IP Wireless Access in Vehicular Environments (IPWAVE): Problem Statement and Use Cases (draft-ietf-ipwave-vehicular-networking-08)

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Update from -07 Version (1/2)

- This document (-08) is updated from
  - draft-ietf-ipwave-vehicular-networking-07

- Major Updates
  - Review of Volunteer Reviewers
    - Charlie Perkins (Done)
    - Sri Gundavelli (Done)

  - Key Work Items for IPWAVE Problem Statement
    - Neighbor Discovery (with Vehicular Link Model)
    - Mobility Management
    - Security and Privacy

Update from -07 Version (2/2)

- **Major Updates**
  - **Reflection** of the Comments from Charlie Perkins and Sri Gundavelli on This Version.
  - **Section 4.1: Existing Protocols**
    - The existing protocols for IP vehicular networking are summarized and analyzed through a **gap analysis**.
  - **Figure 1: Vehicular Network Architecture**
    - A vehicular network architecture is modified to clarify the **concept of a multi-link subnet**.
  - **Problem Statement**
    - The statement of **Vehicular Neighbor Discovery** and **Vehicular Mobility Management** is clarified.

Vehicular Network Architecture

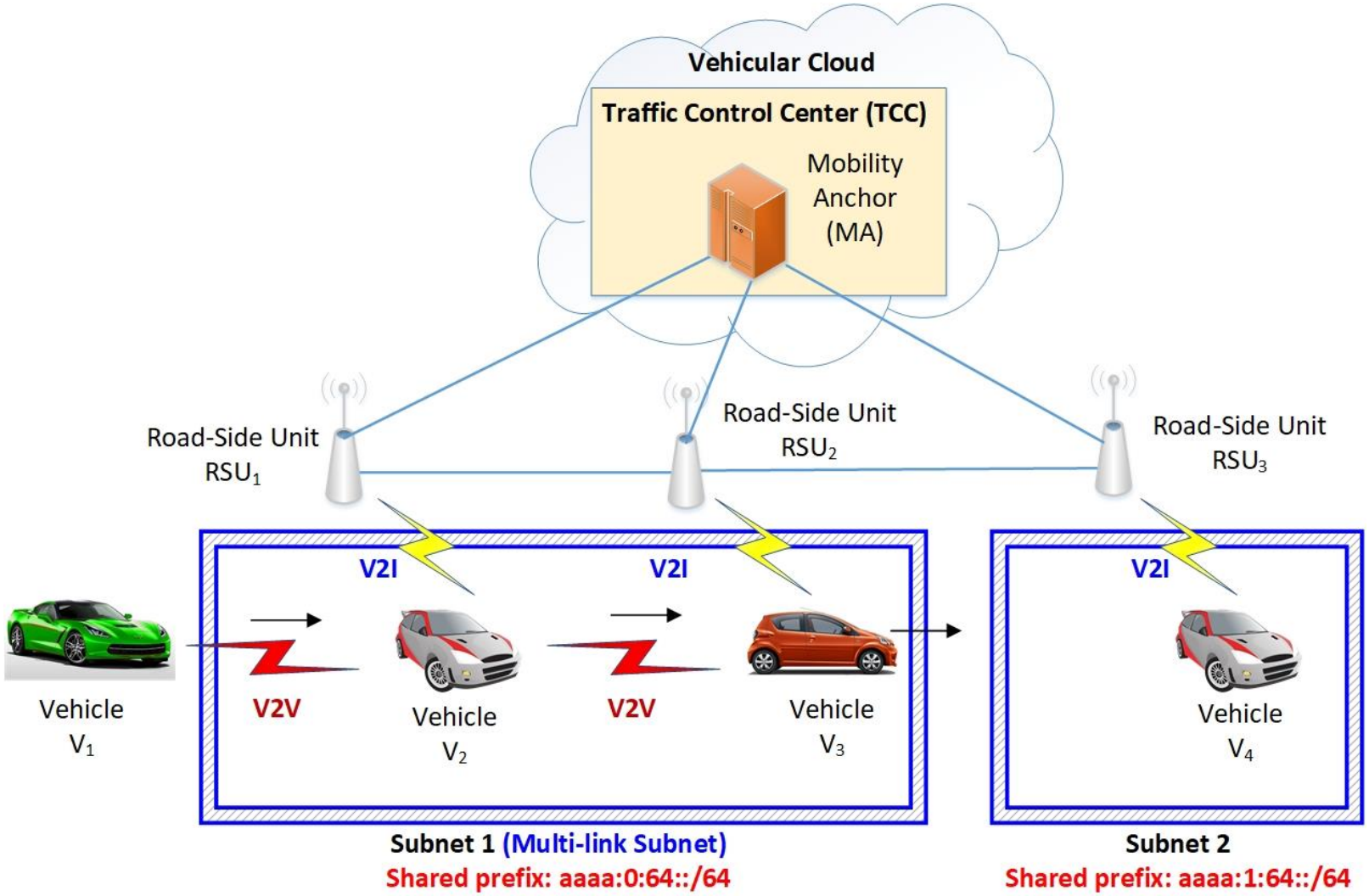


Figure 1: A **Vehicular Network Architecture** for V2I and V2V Networking

Neighbor Discovery (ND) (1/3)

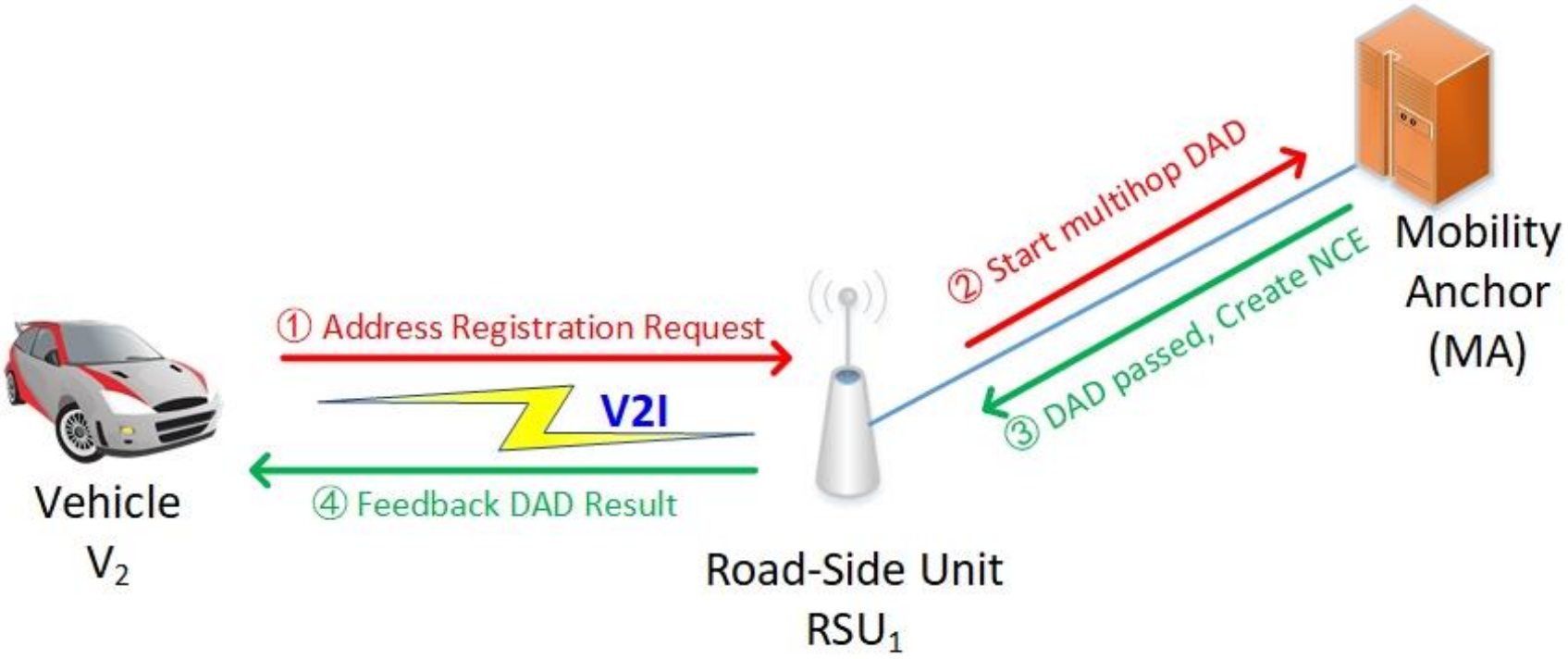
- **Link Model**
  - The legacy IPv6 ND protocol is not suitable for vehicular wireless links.
    - The existence of unidirectional links due to interference and different Tx power levels.
    - Unreachability between two nodes with the same prefix due to node mobility and highly dynamic topology.
    - Reachability between two nodes in a multi-link subnet having multiple wireless links with the same prefix.
  - IPv6 ND should be extended to support the concept of a Vehicular Link Model in a multi-link subnet.
    - Vehicles communicate with each other via V2V and also communicate with an RSU via V2I with a wireless interface configured with a global IPv6 address.

Neighbor Discovery (ND) (2/3)

- **New Features for Vehicular ND (VND)**
  - Lightweight Duplicate Address Detection (DAD)
    - ND Optimization for 6LoWPAN [RFC 6775]
      - RS-trigger-unicast RA for ND control traffic reduction
      - Unicast-based **Multihop DAD** with a router
    - RSU and MA can perform the **Multihop DAD** for a vehicle.
  - A single address configuration in a multi-link subnet
    - A vehicle does not change its IP address while its handover in a multi-link subnet is performed between RSUs.
  - VANET-based multihop forwarding in a multi-link subnet
    - **VND** can play the role of routing in a connected VANET.

Neighbor Discovery (ND) (3/3)

- **Vehicular Neighbor Discovery (VND)**
  - **Example: IP Address Registration** through **Multihop DAD** [draft-jeong-ipwave-vehicular-neighbor-discovery-06].



Mobility Management (MM) (1/3)

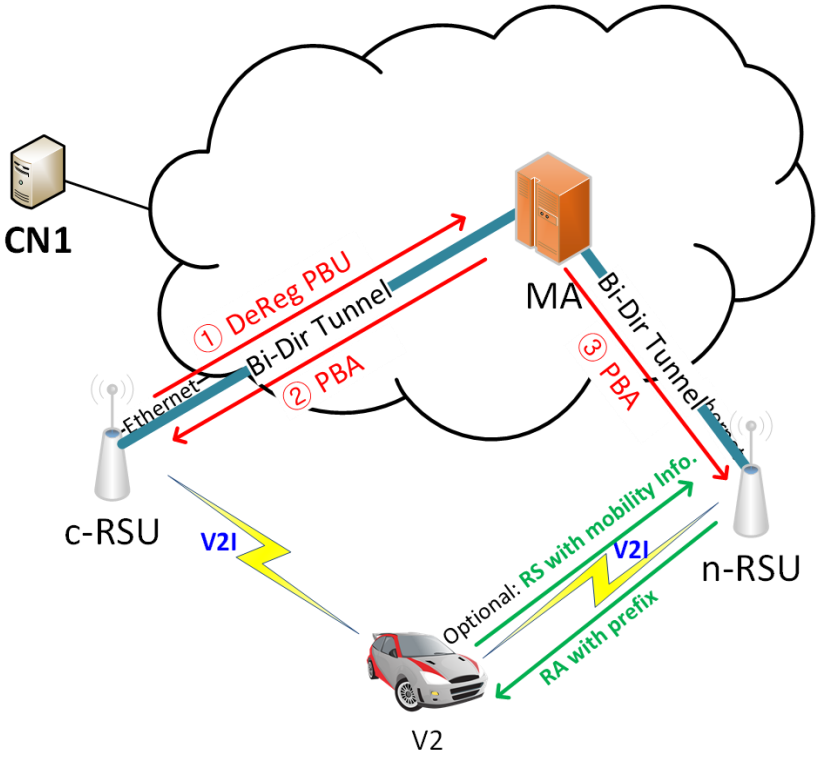
- **Requirements**
  - Seamless Connectivity during Movement
  - Timely Data Exchange between Two End Points
- **Design Principles (1/2)**
  - **Proactive Mobility Management**
    - A vehicle's **mobility information** can be shared with RSUs and MA.
      - Mobility information (e.g., position, speed, direction, and trajectory) by a GPS receiver and motion sensors is available.
    - **Proactive handover** can be performed with the mobility information.
      - Handover operations are performed in advance along the vehicle's trajectory (i.e., navigation path).

Mobility Management (MM) (2/3)

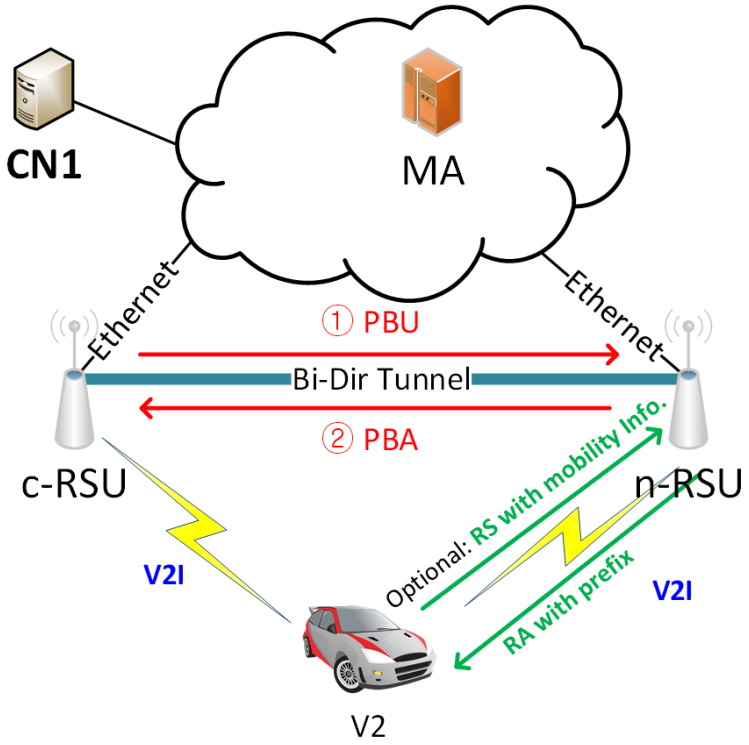
- **Design Principles (2/2)**
  - **Network-Based Mobility Management**
    - **Network infrastructure** (e.g., RSUs and MA) can handle a vehicle's handover along its trajectory.
      - It performs DAD, data packet routing, and horizontal/vertical handover for the sake of vehicles.
    - **A vehicle's address configuration** through network infrastructure can reduce configuration traffic with multihop DAD and unicasted RA.

Mobility Management (MM) (3/3)

- **Vehicular Mobility Management (VMM)**
  - **Example: Network-Based Proactive VMM** [draft-jeong-ipwave-vehicular-mobility-management-00].



Proxy MIPv6-Based Handover



DMM-Based Handover

Next Steps

- **WG Last Call**
  - This version is good enough for WGLC.
- **IESG Submission and RFC Publication**
  - We aim at submitting it to IESG this April so that it can be published as an RFC before the IETF-105 Montreal meeting.
- **Rechartering of IPWAVE WG**
  - After the RFC approval of IESG, IPWAVE WG can start the **Rechartering for IPWAVE Basic Protocols:**
    - Vehicular Neighbor Discovery
    - Vehicular Mobility Management
    - Vehicular Security and Privacy Management.