IPv6 Neighbor Discovery for IP-Based Vehicular Networks

(draft-xiang-ipwave-vehicular-neighbor-discovery-00)

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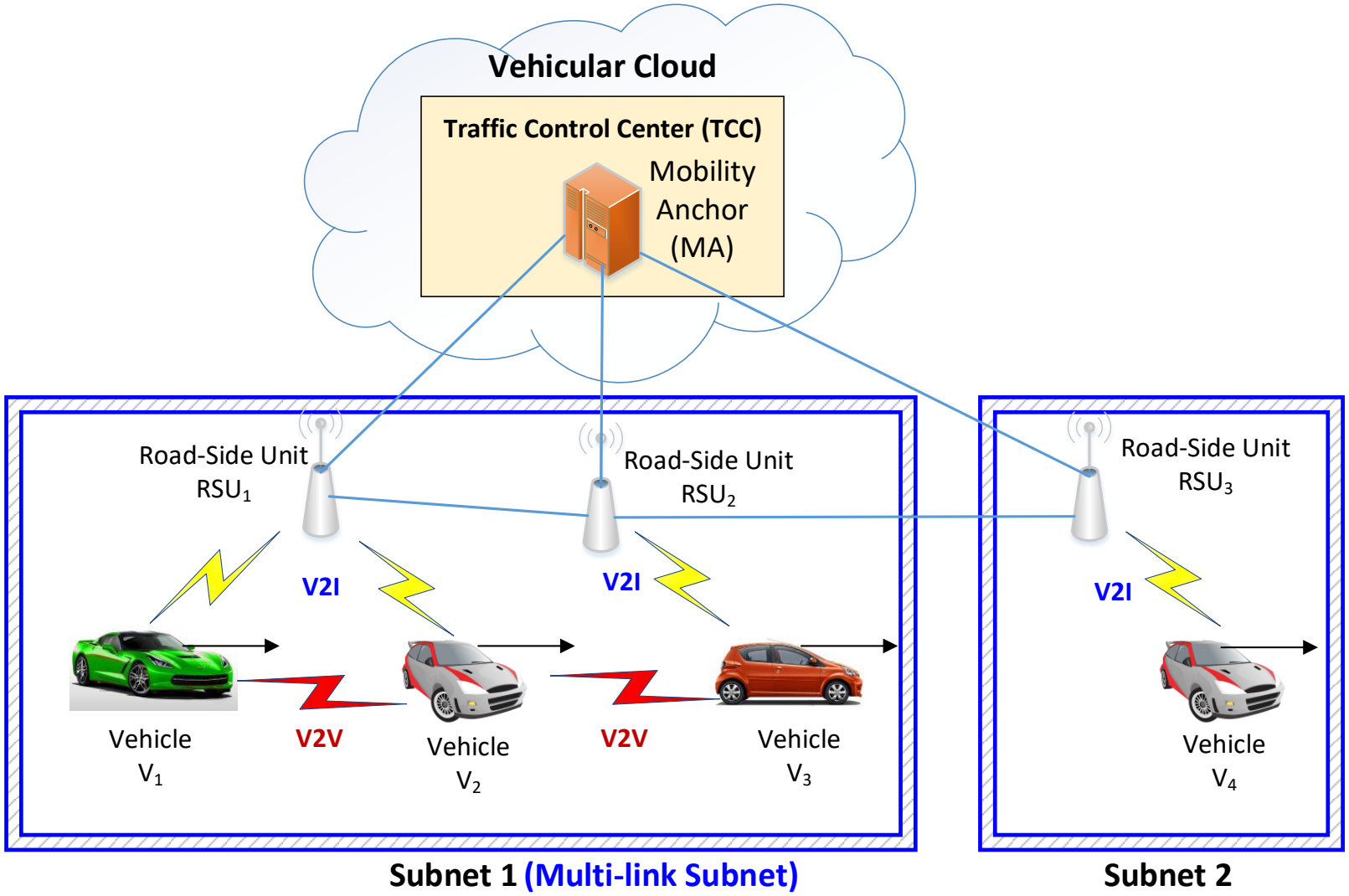
Introduction

- Motivation of Vehicular Neighbor Discovery (VND)
  - This is a candidate for IPv6 ND in IP-based vehicular networks according to IPWAVE Problem Statement Document [draft-ietf-ipwave-vehicular-networking-07]

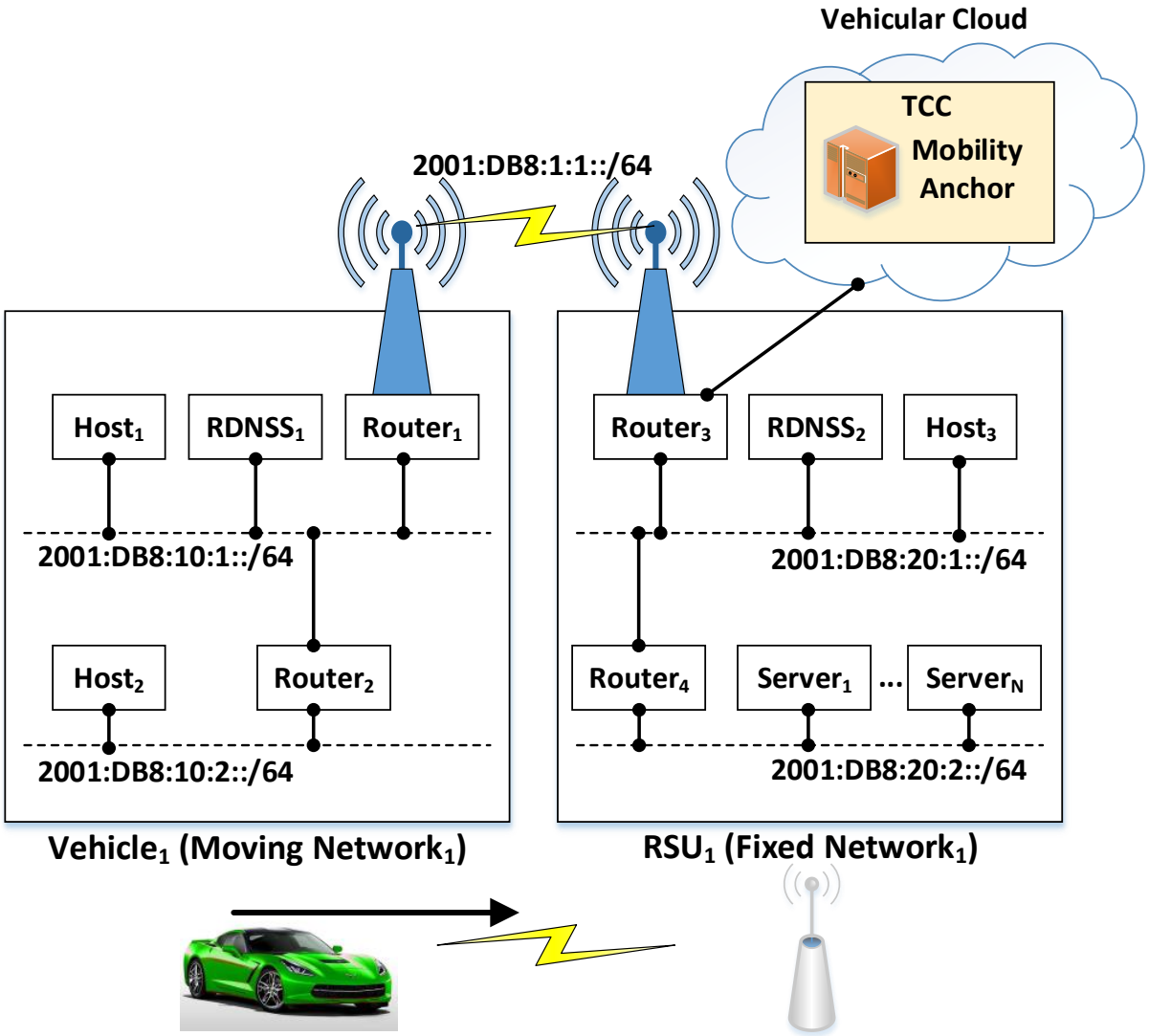
- Subjects of this Draft
  - Definition of Link Model for Vehicular Wireless Links
  - ND Optimization with multihop DAD
  - Proactive Handover with VND in Mobility Management
  - MAC Address Pseudonym Handing with VND

Vehicular Network Architecture



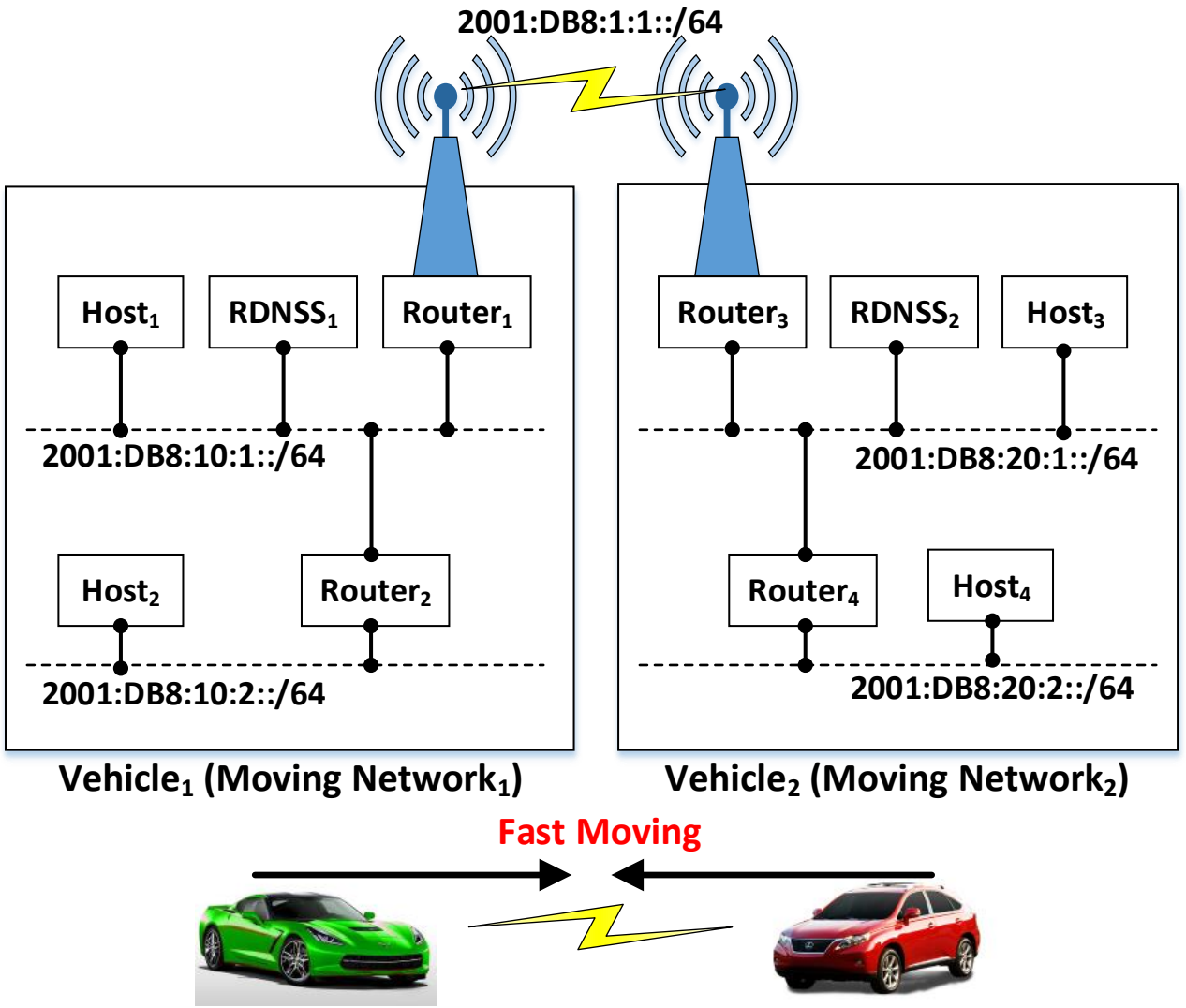
Vehicular Network Architecture
for V2I and V2V Networking

V2I Communication



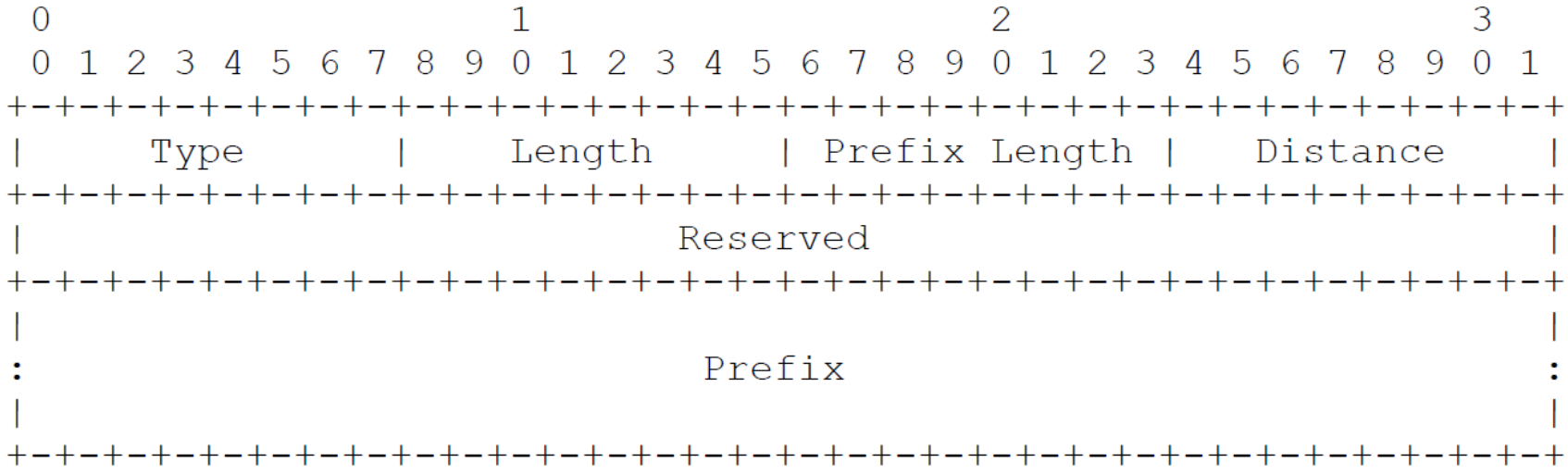
Internetworking between **Vehicle Network** and **RSU Network**

V2V Communication

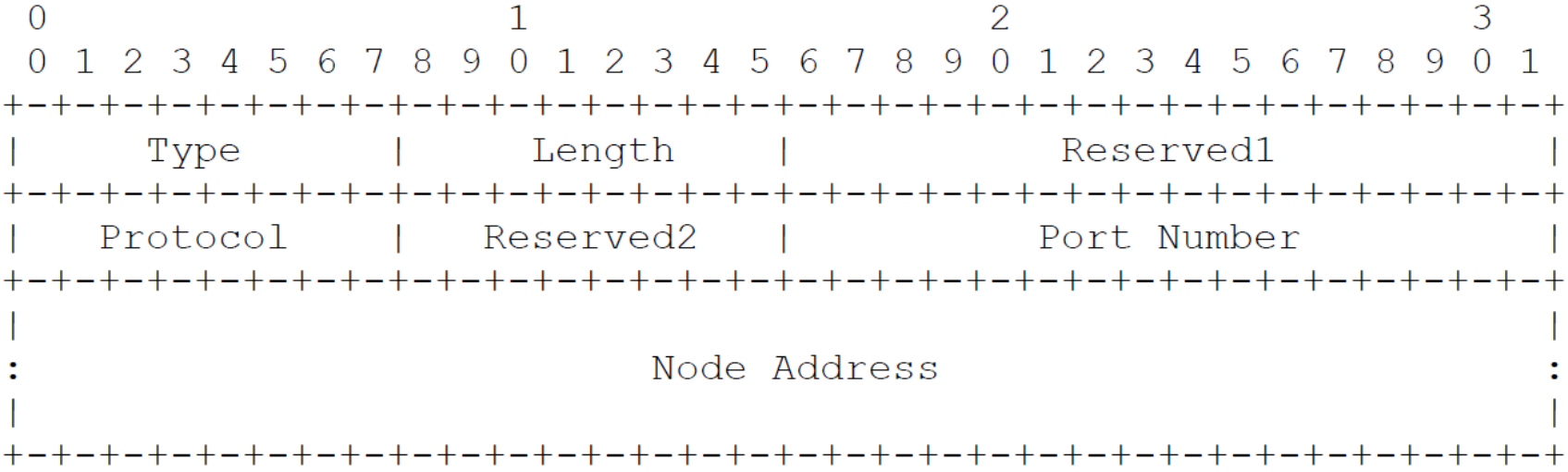


Internetworking between **Two Vehicle Networks**

New Vehicular ND Options



Vehicular Prefix Information (VPI) Option



Vehicular Service Information (VSI) Option

Vehicular Neighbor Discovery (1/2)

- Infrastructure-Based Address Registration
  - It avoids multicast storm for energy and wireless channel conservation.
  - Vehicles create their Neighbor Cache Entry in a serving RSU to maintain registration.

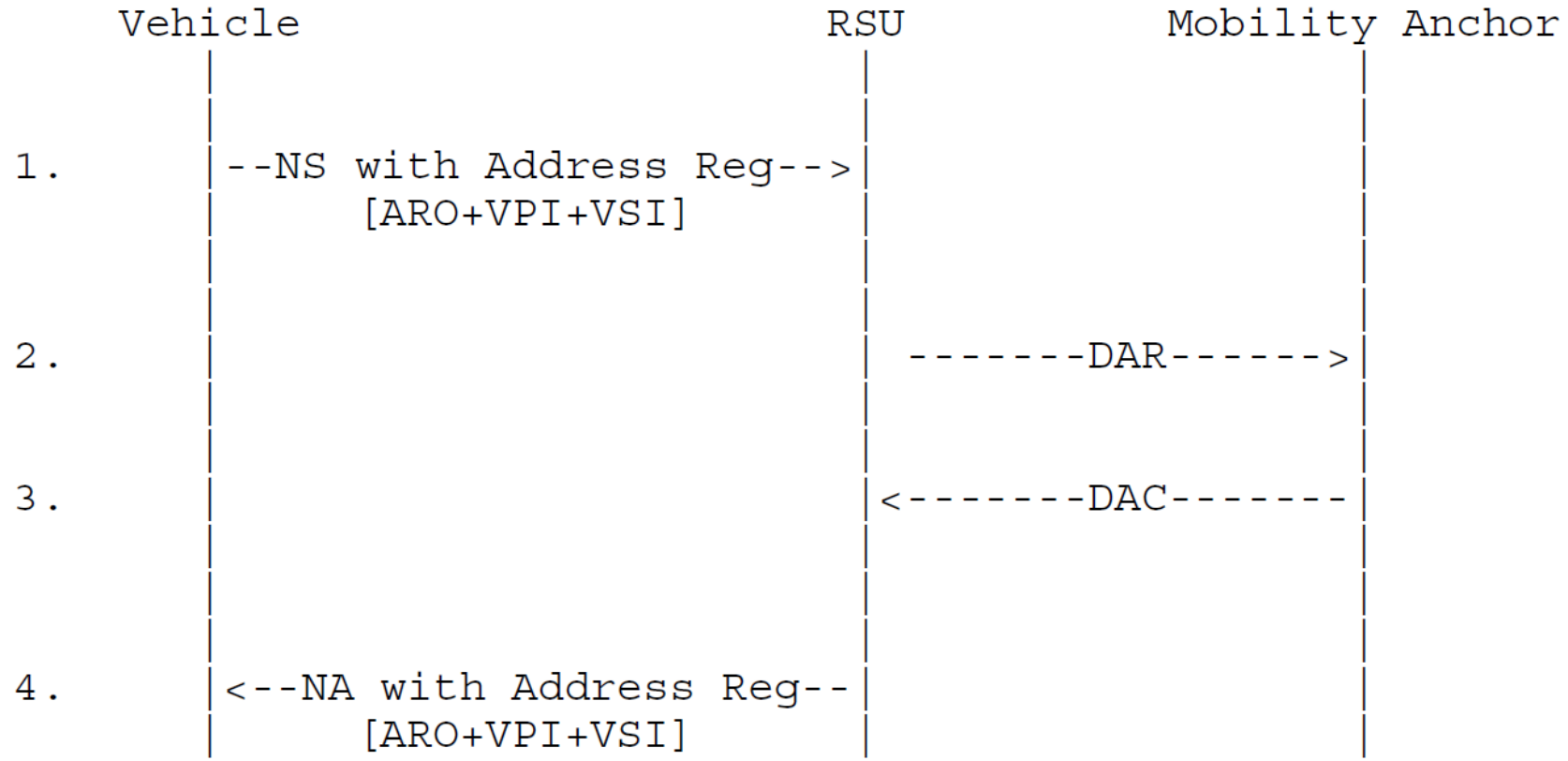
- Multihop Duplicate Address Detection
  - It eliminates redundant ddress configuration when vehicles passing by RSUs belonging to the same multi-link subnet.
  - Neighbor Cache and DAD Table are maintained by each RSU and an MA, respectively.

Vehicular Neighbor Discovery (2/2)

- Prefix Discovery
  - It rapidly finds the prefix information of an internal network in a vehicle or an RSU.
  - Two nodes in two different internal networks can communicate with each other.

- Service Discovery
  - It rapidly finds the service information of an internal network in a vehicle or an RSU.
  - A client in an internal network can contact a required server in another internal network.

Message Procedure of Multihop DAD



ARO: Address Registration Option
VPI: Vehicular Prefix Information Option
VSI: Vehicular Service Information Option

DAR: Duplicate Address Request
DAC: Duplicate Address Confirmation

Pseudonym Handling in VND

- Handling of MAC Address Change for Pseudonym
  - The MAC address of an external interface changes for pseudonym over time.
  - This MAC address change affects the IPv6 address of the interface.
  - The interface's IPv6 address needs to be updated for routing and be notified to the router (i.e. RSU).
  - This IPv6 address change affects on-going TCP (SCTP or UDP) sessions.
  - The IPv6 address change can be notified to the session partner through binding update (e.g., MIPv6 and PMIPv6).

VND for Mobility Management

- Mobility Management for Handover between RSUs
  - It avoids service disruption and reconfiguration of transport-layer session information.
  - Assume that a vehicle moves from the coverage of an RSU to the coverage of another RSU where these RSUs belong to either the same multi-link subnet or different multi-link subsets.
  - The IPv6 address of the vehicle's external interface changes due to the different prefixes.
  - This IPv6 address change affects on-going TCP (or UDP) sessions.
  - The IPv6 address change can be notified to the session partner through binding update (e.g., MIPv6 and PMIPv6).

Next Steps

- WG Adoption Call
  - This Vehicular ND draft is a candidate for IPv6 ND in IP-based vehicular networks according to IPWAVE Problem Statement Document:
    - [draft-ietf-ipwave-vehicular-networking-07]

- Proof-of-Concept
  - We will implement our Vehicular ND in a vehicular network simulator (OMNeT++, VEINS, and SUMO).
  - We have a plan to participate in IETF-104 Hackathon Project (IPWAVE Vehicular ND Project).