Problem Statement for IP in V2V

draft-petrescu-its-problem-01.txt

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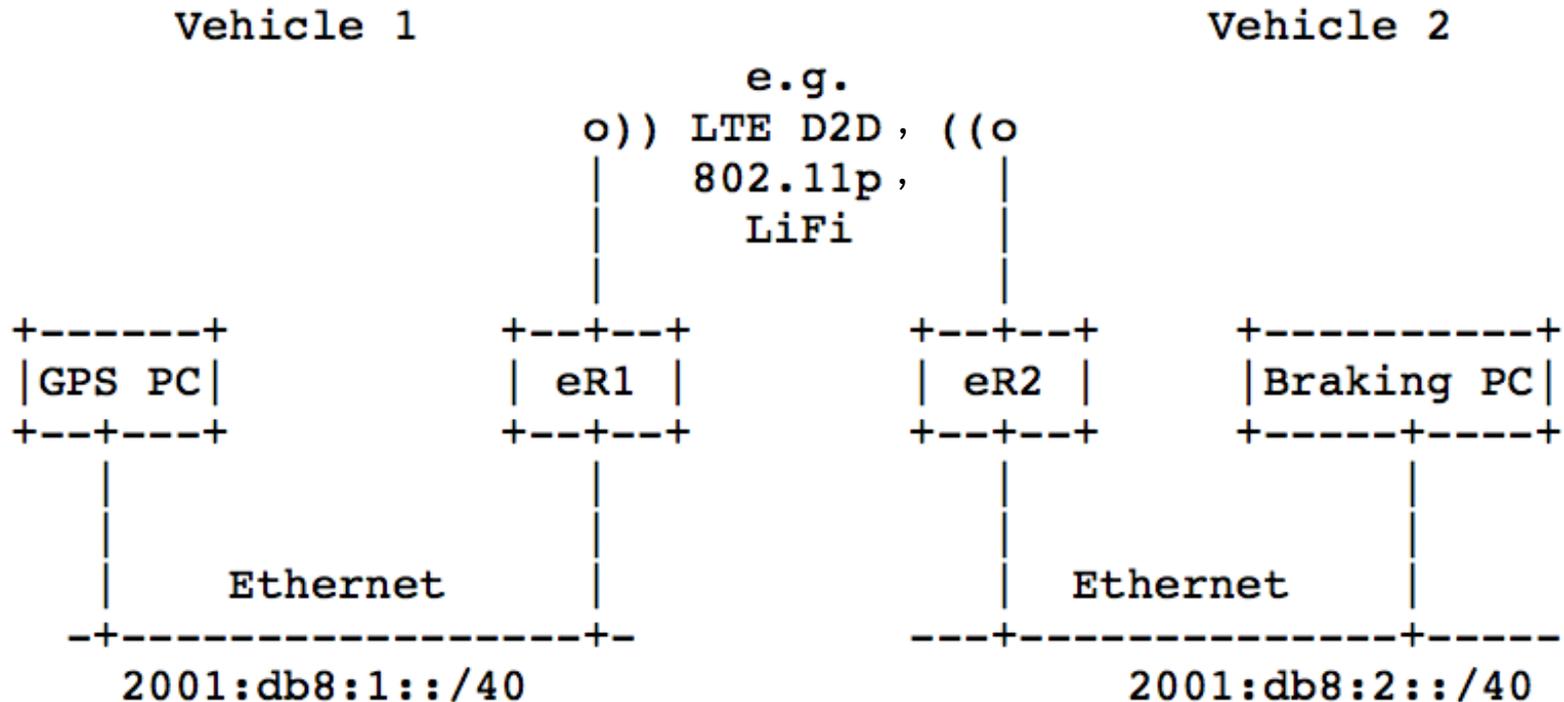# V2V Use Cases: Backgroud

- Use case:
  - Cooperative Adaptive Cruise Control (C-ACC) and Platooning
  - Require IP data exchanges between vehicles
  - Connecting the vehicles through long- range cellular networks typically incurs too much delay. Instead, it is necessary to connect vehicles directly, by using shorter-range communication technologies.

V2V Use Cases: Problem

- A vehicle embeds several IP devices, forming a stable IP network
  - Typically, Ethernet cables are run through a car, together with the CAN networks.
  - Typically one edge router is in charge of wireless communications outside the car, potentially via multiple technologies.
  - The problem is **how to establish direct IP communication paths between the computer on the networks embedded in two or more neighboring and potentially fast-moving vehicles**.

V2V Use Cases: Scenario

```
Vehicle 1                                          Vehicle 2

                           e.g.
                  o)) LTE D2D , ((o
                  |     802.11p ,    |
                  |       LiFi       |
                  |                  |
                  |                  |
+------+        +--+--+            +--+--+        +---------+
|GPS PC|        | eR1 |            | eR2 |        |Braking PC|
+--+---+        +--+--+            +--+--+        +-----+----+
   |               |                  |                 |
   |               |                  |                 |
   |               |                  |                 |
   |   Ethernet    |                  |   Ethernet      |
  -+--------------+-               ---+--------------+-----
   2001:db8:1::/40                     2001:db8:2::/40
```

- As an application example, the "GPS PC" in one vehicle sends IP datagrams containing its coordinates to the Braking PC in the other vehicle, controlling braking.
- The IP datagrams are sent through the respective edge routers
- Problem: The two edge routers need to have forwarding information about their respective subnets: eR1 must learn that prefix 2001:db8:2::/40 is reachable through eR2, and vice-versa. It is thus necessary that they exchange routing information.

V2V Use Cases: Problem Statement

- The problem is divided in:
  - a **discovery sub-problem**
    - how edge routers discover each other.
  - and a **prefix exchange sub-problem**
    - how edge routers exchange routing information.

V2V Use Cases: Problem Statement-Discovery Sub-Problem(1)

- Information needs to be discovered to set up the IP communication between the vehicles:
  - For link layer information, wireless link layer parameters need to be obtained. For example, determining the power level of received wireless frames can be used to determine the distance between two neighboring vehicles.
  - For MAC layer information, the MAC address information of the neighboring edge router needs to be discovered.

V2V Use Cases: Problem Statement-Discovery Sub-Problem(2)

- – For IP layer information, in the above figure, eR1 needs to discover the IP address and IP prefix of eR2 and eR2 also needs to discover the IP address and IP prefix of eR1.
- – Service-related information sometimes is also needed. For example, a vehicle might wish to indicate that it offers video translation etc.

V2V Use Cases: Problem Statement-Prefix Exchange Sub-Problem(1)

- In order for one computer in one vehicle to reach another computer in another vehicle the edge routers in each vehicle have to learn the IPv6 prefix (and/or the IPv6 address) of the other vehicles.

- A prefix-exchange mechanism is needed, otherwise the IP communication cannot be established.

- After each vehicle has informed the other vehicles nearby about its prefix, the forwarding tables of each vehicle must be updated to contain the tuple [prefix; IP address] of the other vehicles.

- The updating has to deal with situations when vehicles leave the network.

Thanks!