Basic Support for IPv6 Networks Operating over 5G Vehicle-to-Everything Communications

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IPv6-Over-5G-V2X Networks

- Wireless Communications based on 3GPP 5G-V2X.
- V2V over PC5 Reference Point (RP) or Interface
- V2I over Uu RP or Interface
IPv6 Vehicular Networks with 5G V2X

Traffic Control Center (TCC) in Vehicular Cloud

Correspondent Node

Mobility Anchor

gNodeB1

Vehicle1

Vehicle2

Vehicle3

Vehicle4

Subnet1 (Prefix1)

Subnet2 (Prefix2)

Subnet3 (Prefix3)

Wired Link

Wireless Link

Moving Direction
IPv6 Networking over 5G V2X Links

• Maximum Transmission Unit (MTU)

• Frame Format

• Link-Local Addresses

• Subnet Structure

• Stateless Address Autoconfiguration (SLAAC)
IPv6 Networking over 5G V2X Links

• Maximum Transmission Unit (MTU)
  • The default MTU for IP packets on 5G V2X links over both PC5 and Uu RPs is inherited from [RFC2464], which is 1500 octets.
  • As defined in [RFC8200], the 5G V2X links must offer a minimum MTU of 1280 octets to the IPv6 layer.

• Frame Format
  • IPv6 packets over 5G V2X links follow the general frame format according to the protocol stack defined by 3GPP.
IPv6 Networking over 5G V2X Links

• Link-Local Addresses
  - IPv6-based 5G V2X uses link-local addresses for IPv6 packets.
  - To avoid conflicts between link-local address in wireless vehicle networks, the interface identifier used by each IP-VehUE is ensured to be unique through addressing [RFC4291] [RFC4193] [RFC7136].

• Subnet Structure
  - The 5G-V2X subnet structure supports multi-link subnets for efficient V2V and V2I communications [I-D.jeong-ipwave-vehicular-neighbor-discovery].
When using IPv6 link-local addresses, an IP-VehUE forms the link-local addresses locally without Duplicate Address Detection (DAD) [3GPP TS23287].

When using SLAAC, an IP-VehUE uses an IPv6 prefix sent by another IP-VehUE acting as an IPv6 default router.
IPv6 Stateless Address Autoconfiguration (SLAAC) (2/2)

• Issues to solve for IPv6 SLAAC are as follows:
  • Which VehUE shall be the IPv6 router for the role to assign IPv6 addresses/prefixes if multiple VehUEs can be or want to be an IPv6 router?

  • For a VehUE acting as an IPv6 router, how many IPv6 addresses/prefixes will it assign? How much will the role of an IPv6 router burden the IPv6 router VehUE?

  • For a VehUE receiving IPv6 addresses/prefixes from an IPv6 router VehUE, how many IPv6 addresses/prefixes will it have on the movement?

  • If a VehUE (e.g., Car D) does not have any connection with an IPv6 router VehUE, it will only use an IPv6 link-local address for communications. In this case, multihop routing is triggered to forward IPv6 packets. How will this scenario affect the IPv6 networking among VehUEs?
Next Steps

• Is this draft valuable to work on it in 6MAN WG?

• If so, may this draft be adopted as a WG item now? Or is it needed to develop this draft more?

• In this IETF-118 IPMON hackathon project, we showed the feasibility for Drones’ Safe Flying with IPv4-Over-5G-V2X.
  • We will work on IPv6-Over-5G-V2X for Drones’ Safe Flying for IETF 119.

• We welcome your comments and feedback 😊