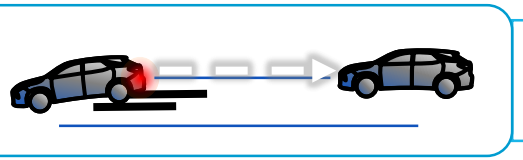
Virtual Road Side Units Architecture

Stefano Sorrentino, Master Researcher, Ericsson

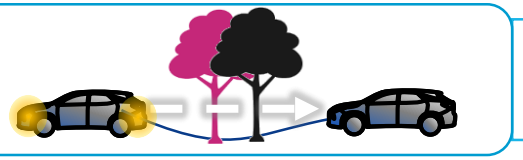
Todd Essery, General Manager - Wireless (5G & IoT), Telstra

Australia's First C-V2X Project

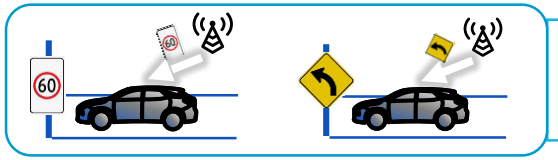
- All use-cases implemented over PC5 (Sidelink) and Uu (Network) interfaces
  - PC5 for Vehicle to Vehicle (V2V)
  - Uu for I2N2V / V2N2I & V2N2V
- No Road Side Units (RSUs)
- Uu optimized for V2X low-latency on commercial public network
- Project run with VicRoads and TAC under "Towards Zero" road safety initiative (Victorian State Government)



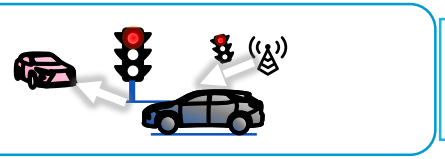
- Electronic Emergency Brake Light
- (V2V, V2N2V)



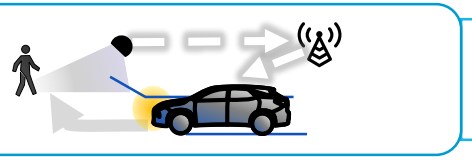
- Slow / Stopped Vehicle Warning
- (V2V, V2N2V)



- In-vehicle Speed Advisory (I2N2V)
- Curve-Speed Warning (I2N2V)

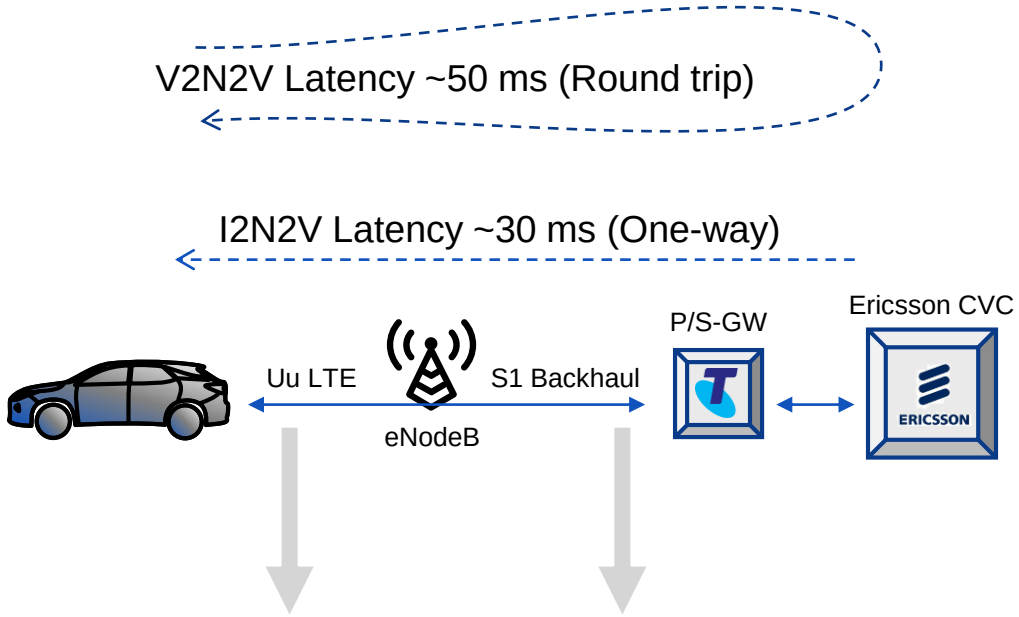


- Red-Light Violation Warning
- (I2N2V, V2V, V2N2V)



- Pedestrian Warning / Right Turn Assist
- (I2N2V)

Uu Optimized for V2X



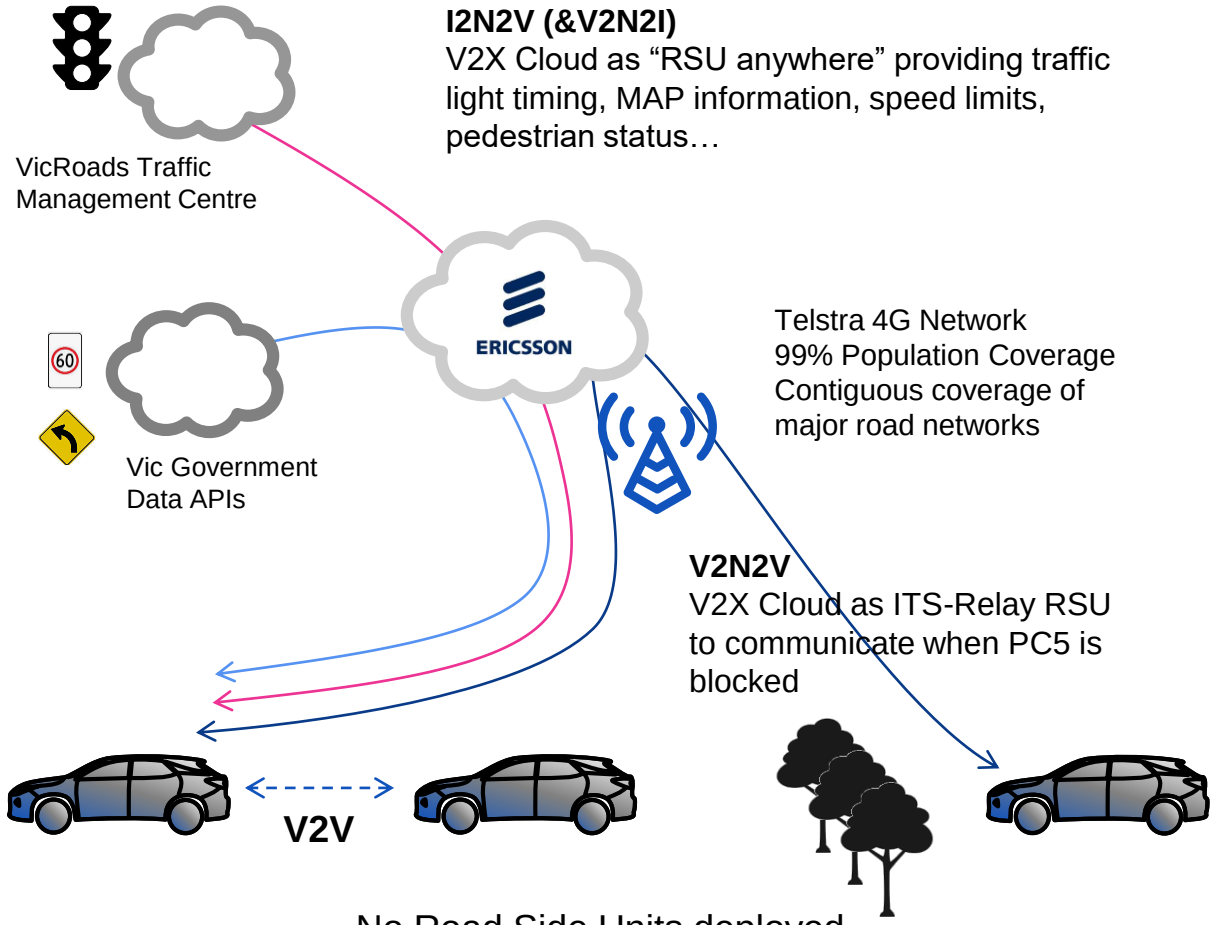
V2X latency on Uu

- **Deterministic scheduling** for V2X users
- **Idle-Mode** and **DRX** modifications
- **Minimum rate** for V2X users to sustain CAMs/DENMs
- **Partial priority** over general internet users, (lower than emergency services etc).

E2E QoS across entire Telstra Network

- **3GPP QCI 79** (Non GBR V2X)
- **Same Quality of Service (QoS)** system that exists for Voice over LTE (VoLTE)

"Virtual RSU" Architecture



I2N2V (&V2N2I)
V2X Cloud as "RSU anywhere" providing traffic light timing, MAP information, speed limits, pedestrian status…

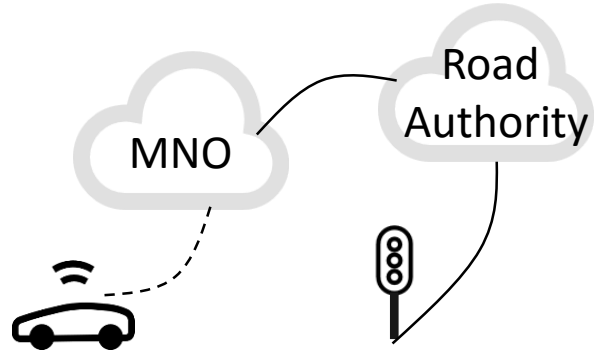
Telstra 4G Network
99% Population Coverage
Contiguous coverage of major road networks

V2N2V
V2X Cloud as ITS-Relay RSU to communicate when PC5 is blocked

No Road Side Units deployed

A ”virtual” Roadside Unit – why?

- Connecting road infrastructure and vehicles using a C-ITS backend is the most efficient solution
  - 10-100x cost saving for public sector (compared to deploying Roadside Units)[1]
  - Fastest service penetration by leveraging vehicular cellular connectivity[2]
  - Low, controlled latency with 4G, further improved with 5G
- Flexible deployment and interoperability
- Future/backwards compatibility
- Road infrastructure as part of the larger IoT ecosystem



- ..despite European Commission’s ”Delegated Act”, which currently excludes cellular networks from providing C-ITS services

1) 5gaa.org/wp-content/uploads/2019/01/5GAA-BMAC-White-Paper_final2.pdf
2) 5gaa.org/news/5gaa-safety-of-life-study/

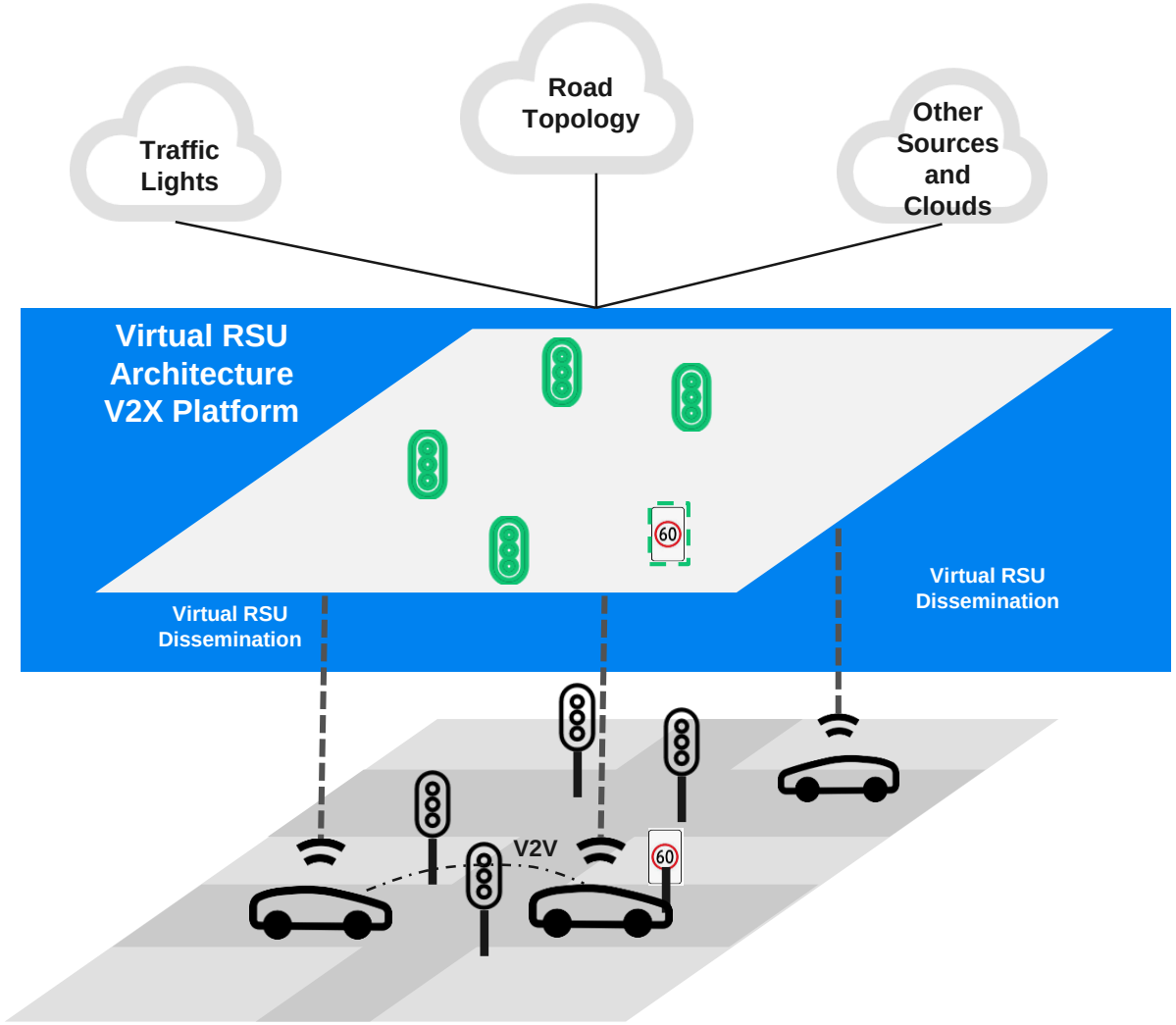
C-ITS and Virtual Roadside Unit

Modular and Harmonized architecture scales for providing cellular communication, from basic to advanced services.

Flexible models for the Virtual RSU, follow the vehicle or a digital twin

Re-use of C-ITS message sets for vehicular communication provides necessary foundation for harmonization

Data Relay from the data sources like Road Authorities prevents threats to critical asset information, like hacking, as the critical asset information will still remain at the data sources and not reside in the platform.



C-ITS and Virtual Roadside Unit

Security & Privacy on different layers and different interfaces

Flexible deployment models enables realization of latency critical use-cases using Operator's infrastructure apart from Public/Private Cloud deployments

Accelerates C-V2X deployments with a hybrid architecture providing vehicular communications as well as backend communication with Road Authorities, OEMs and other cloud backend systems.