



Cellular-Vehicle-to-Everything (C-V2X): today and next steps

Maxime Flament,
5GAA Chief Technology Officer

Connected mobility for people, vehicles and transport infrastructure

5GAA bridges the automotive and telecommunication industries in order to address society's connected mobility and road safety needs



AUTOMOTIVE INDUSTRY

Vehicle Platform, Hardware
and Software Solutions



TELECOMMUNICATIONS

Connectivity and Networking
Systems, Devices and Technologies

5GAA unites today 133 members from around the world working together on all aspects of C-V2X including technology, standards, spectrum, policy, regulations, testing, security, business models and go-to-market

5GAA Members*



*28 May 2020

5GAA Priority Areas

Trust

Implement state-of-the-art **security and privacy** by design in the V2X ecosystem



Digital Roads

Engage with road operators to **fully integrate the road infrastructure**



Vulnerable Road Users

Enable **smart devices** to deliver services protecting pedestrians, cyclists, ...

Interoperable, deployable & secure



Connected mobility for people, vehicles and transport infrastructure

end-to-end connectivity solutions

Mobile Networks

Build upon **cellular network deployments** to fast track new mobility services



Precise Positioning

Foster advanced **positioning solutions** for all road users



Flexible Service Architectures

Leverage **distributed cloud and edge computing** capabilities



Interoperable Ecosystem

Satisfy **business needs** for interoperation between devices and services across ecosystem partners



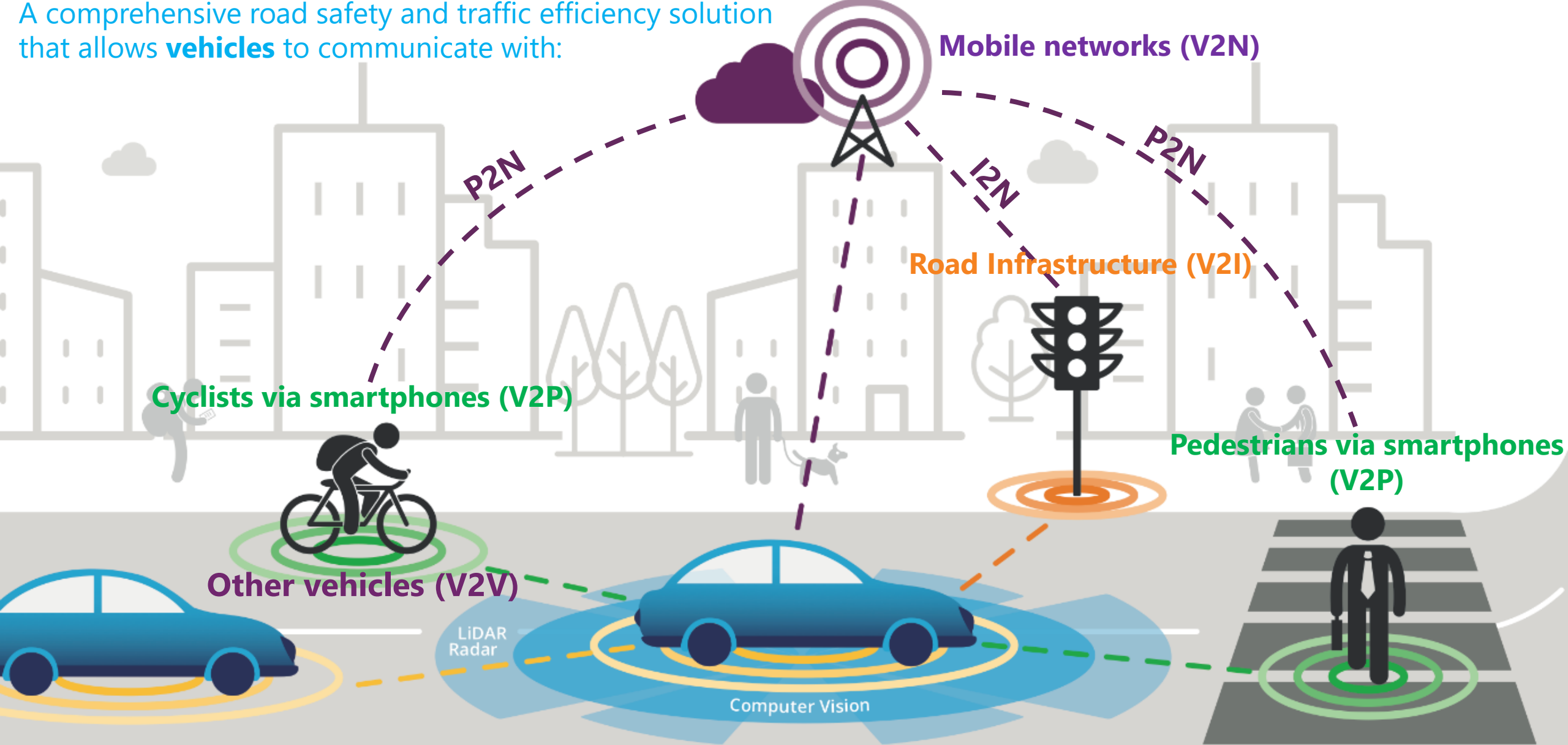
Sustained Technology Evolution

Accelerate evolution of cellular technologies towards **5G V2X**



What is C-V2X (Cellular-Vehicle to Everything)?

A comprehensive road safety and traffic efficiency solution that allows **vehicles** to communicate with:



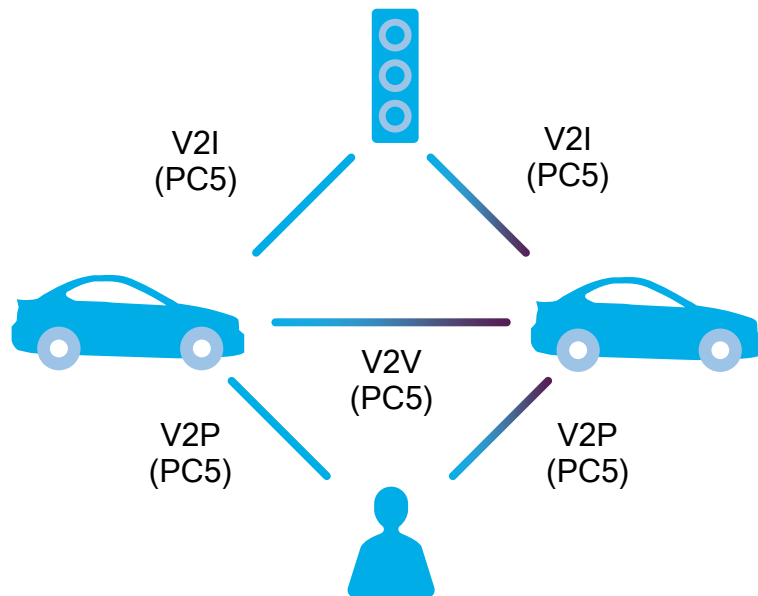


Cellular Veh rything

C-V2X has two complementary communication modes

Direct short-range (= Sidelink)

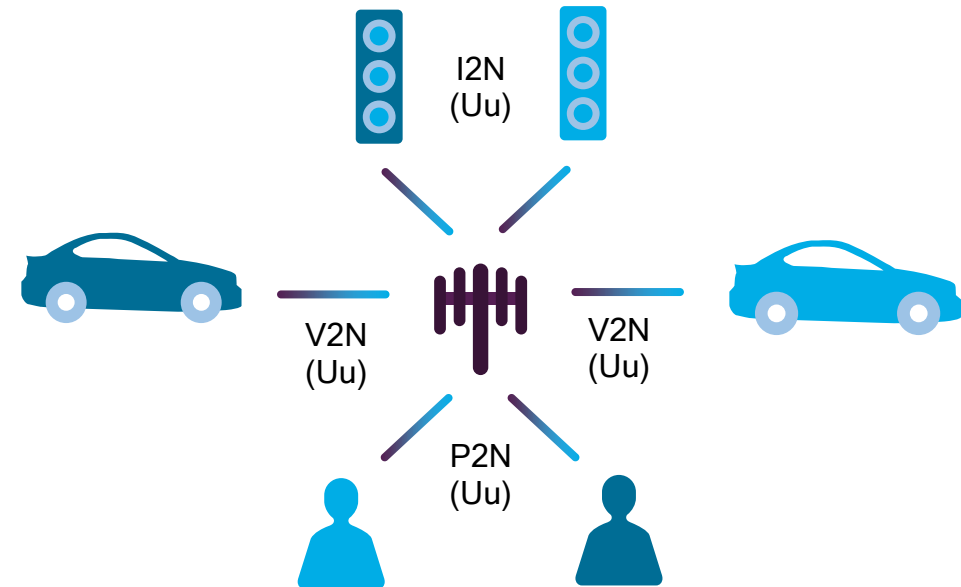
V2V, V2I, and V2P operating in ITS bands (e.g. ITS 5.9 GHz) independent of cellular network



Short range (<1 kilometer), location, speed
Implemented over “**PC5 interface**”

Network (= Up/Downlink)

V2N operates in traditional mobile broadband licensed spectrum



Long range (>1 kilometers). e.g. accident ahead
Implemented over “**Uu interface**”

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It's ONE cellular technology based on 3GPP

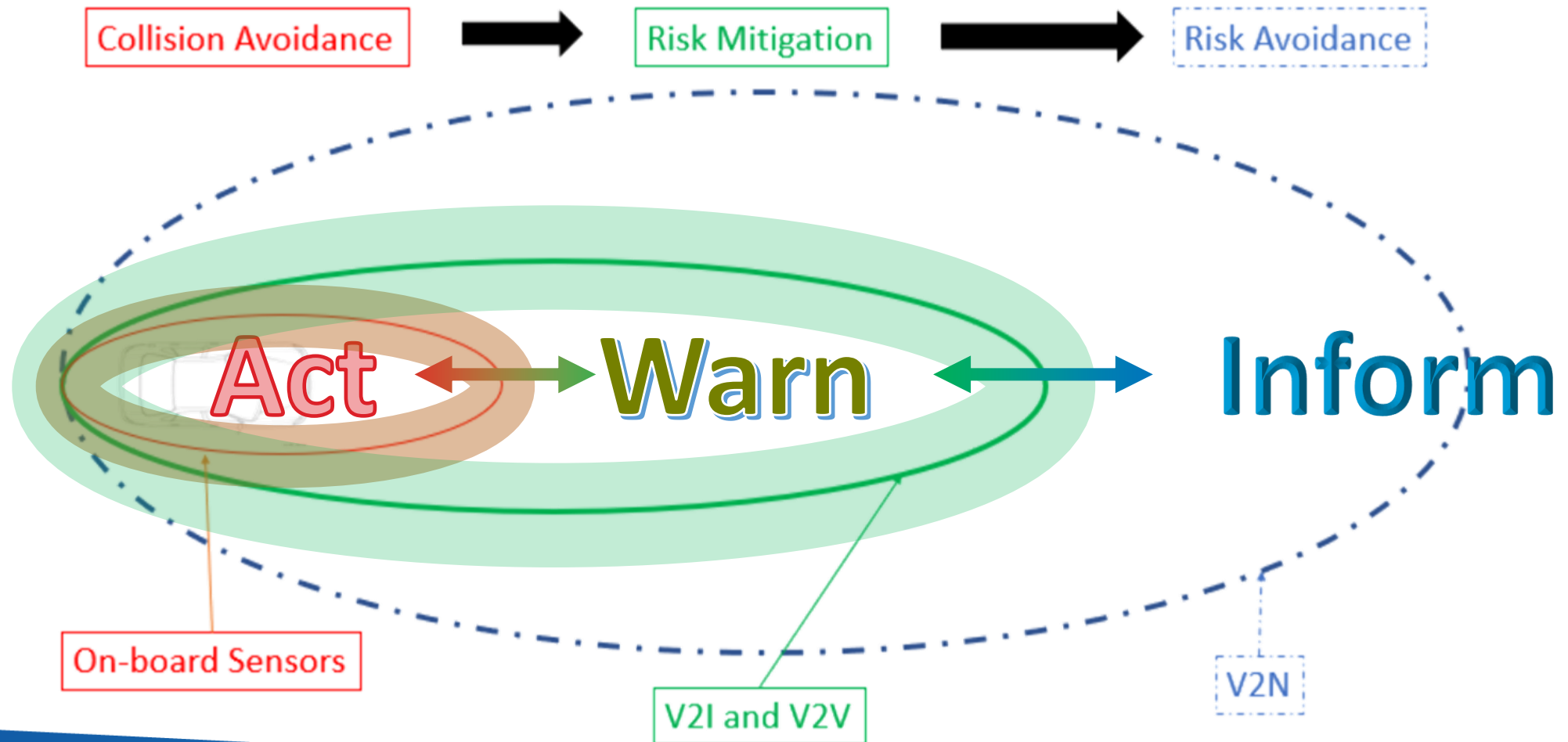
- fully integrated chipset solution
 - single radio solution
 - one antenna system
- reduced complexity and cost (on-board & infrastructure)

Short range (<1 kilometer), location, speed
Implemented over “**PC5 interface**”

Long range (>1 kilometers). e.g. accident ahead
Implemented over “**Uu interface**”

Understanding vehicle safety needs: Inform, Warn, Act

Yesterday, Today and Tomorrow



C-V2X evolution roadmap towards 5G

Since 2016

As of 2020/2021

As of 2024/2025

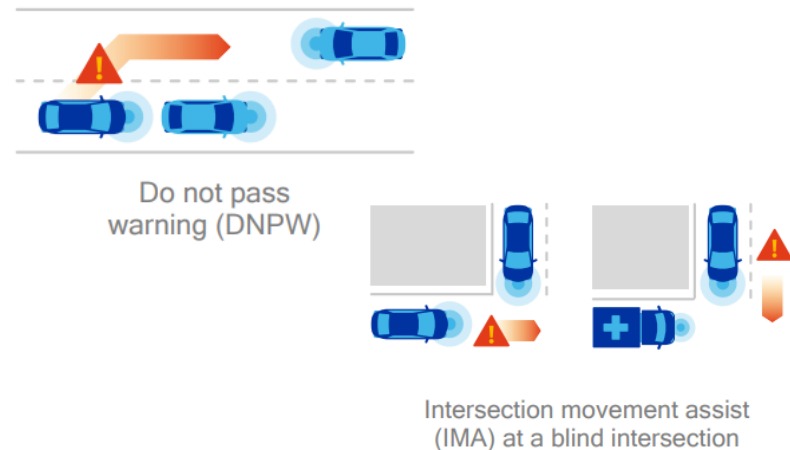
Traffic Efficiency 4G/LTE (network-only)

- Only using mobile networks (V2N)
- +20 million EU connected cars*
 - Local Hazard Warning
 - Traffic Info (in some markets)



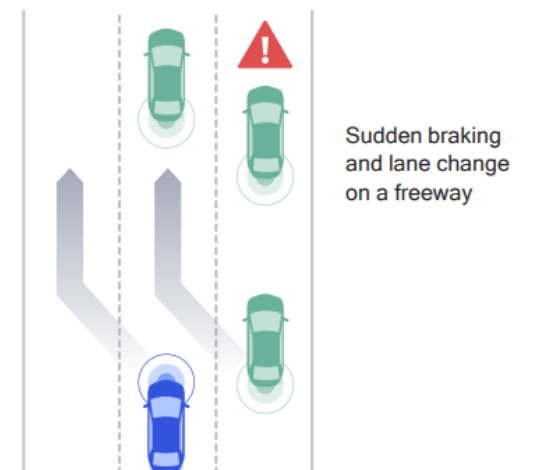
Basic & Enhanced Safety LTE-V2X (+ direct short-range)

- Short-range communications (V2V/V2I)
- China first-mover: 13 OEMs (2020/2021)
- US deployment announced 2022 (Ford)
- Audi US initial deployment Q3/2020



Advanced Driving 5G-V2X enhancing Advanced Driver-Assistance Systems (ADAS)

- Direct short-range + network communications
- Backward compatible with LTE-V2X
- Ultra-reliable at low latency (<1 millisecond)
- Almost unlimited data exchange



* Services provided depend on the OEM

5G-V2X services combine 3GPP standards: NR-V2X for advanced driving on top of LTE-V2X for basic safety

Basic Safety use cases

LTE-V2X sidelink
Rel. 14/15
Basic messages with
Broadcast

Advanced Driving use cases

NR-V2X sidelink
Rel. 16 and beyond
QoS with Groupcast

Upper layers
Mapping use cases
to transport profile



5G-V2X sidelink

C-V2X deployments announced for 2020-2022

13 Chinese Carmakers Jointly Published Commercial Roadmap: Launching Mass Production C-V2X Car from 2020



Source: [Huawei](#)

Audi Newsroom

[Press releases](#) | [Models](#) | [Gallery](#) | [Corpo](#)

Audi of America, Virginia DOT and Qualcomm Announce Initial C-V2X Deployment in Virginia

Source: [Audi USA, 22 Jan 2020](#)

Ford to deploy C-V2X tech in all new vehicles in 2022



Credit: Ford

Source: [Ford Motor Press Release @ CES, Jan 2019](#)

BMW and Samsung to offer 5G in the iNEXT as soon as 2021

Auto Shows. News | January 7th, 2020 by [Horetu Boeriu](#) | [2 comments](#) | [Like 8](#) | [Tweet](#) | [Save](#)



Source: [BMW Group Press Release @ CES, Jan 2020](#)



Thank you for joining!

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