



# 5G Automotive Association, pioneering digital transformation in the automotive industry

Learn more at  
[WWW.5GAA.ORG](http://WWW.5GAA.ORG)

# Connected mobility for vehicles, people and transport infrastructure

**5GAA brings together the automotive and telecommunications industries to accelerate the global deployment of Cellular Vehicle-To-Everything (C-V2X) as a first step towards a fully integrated intelligent transport system with 5G**



## **AUTOMOTIVE INDUSTRY**

Vehicle Platform, Hardware  
and Software Solutions



## **TELECOMMUNICATIONS**

Connectivity and Networking  
Systems, Devices and Technologies

**5GAA unites 110+ members\* from around the world working together on all aspects of C-V2X including technology, standards, spectrum, policy, regulations, testing, business models and go-to-market**



# 5GAA Priority Areas



## New Radio

“Define the next step” -  
accelerate definition of **5G-V2X** based on 5G New  
Radio



## Push V2N

Ensure functional rollout of  
**V2N based applications**  
in order to reach broad  
penetration fast



## Joint Ecosystem

Create a joint eco  
system between  
**car – smartphone -  
home**



## Vehicle to Smart Device

**V2X-based vehicle  
interface** for  
smartphone controlled  
functions



## Edge Computing

Undertline Edge  
Computing as one of the  
**key elements of the  
connected future**



## Interoperability

Ensure **cross OEM** cars  
and **cross operator**  
networks can „speak“ with  
**each other**





**EATA**



**VDT  
Alliance**

*Ecosystem Cooperation*

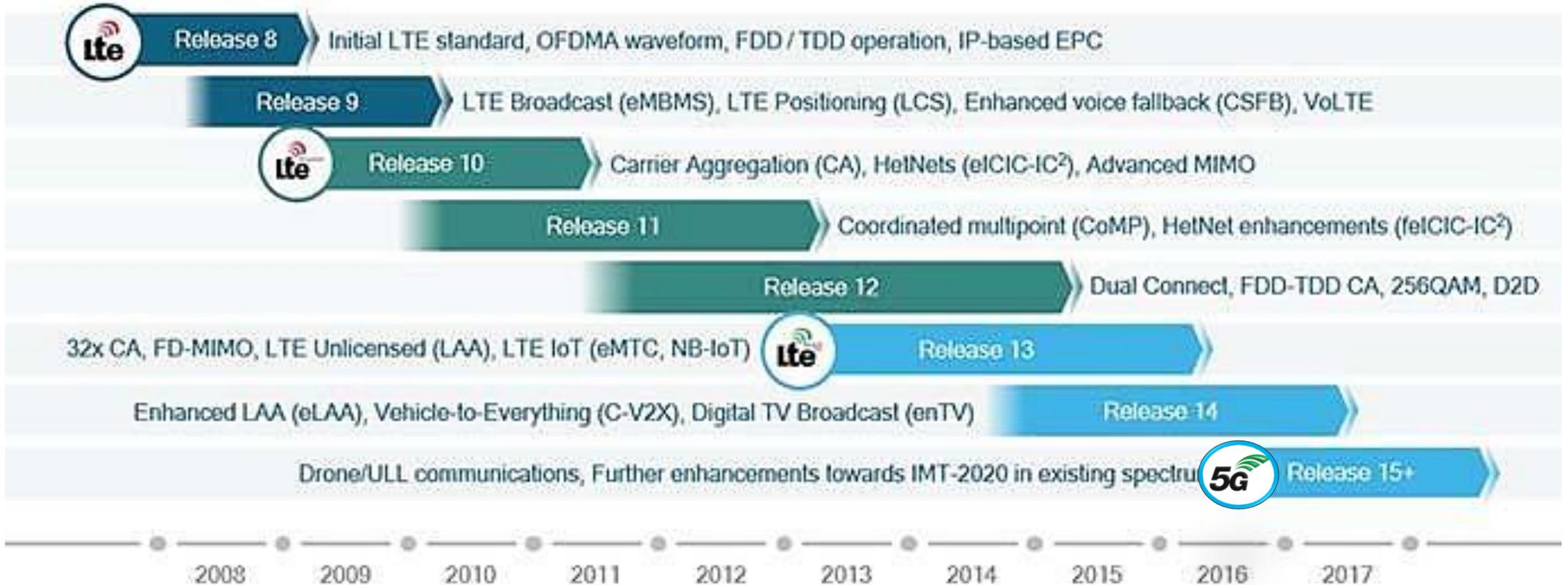




# Working with 3GPP towards 5G for automotive industry



# - A journey towards 5G

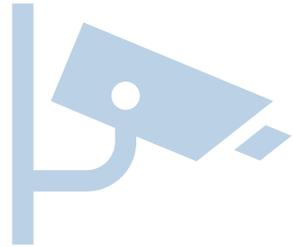


3GPP is steadily building the blocks towards a family of air interfaces embedded in 5G

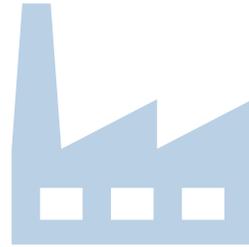
# 5G Vision: a swiss army knife for all industries



Automotive



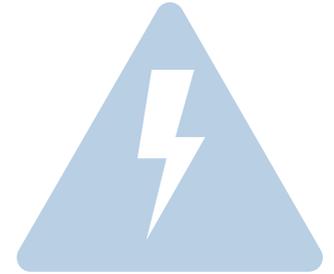
Public safety



Manufacturing



Multimedia &  
gaming



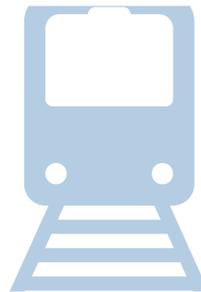
Energy



Health



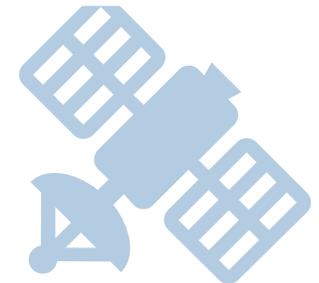
Smart cities



Public Transport



Farming & food

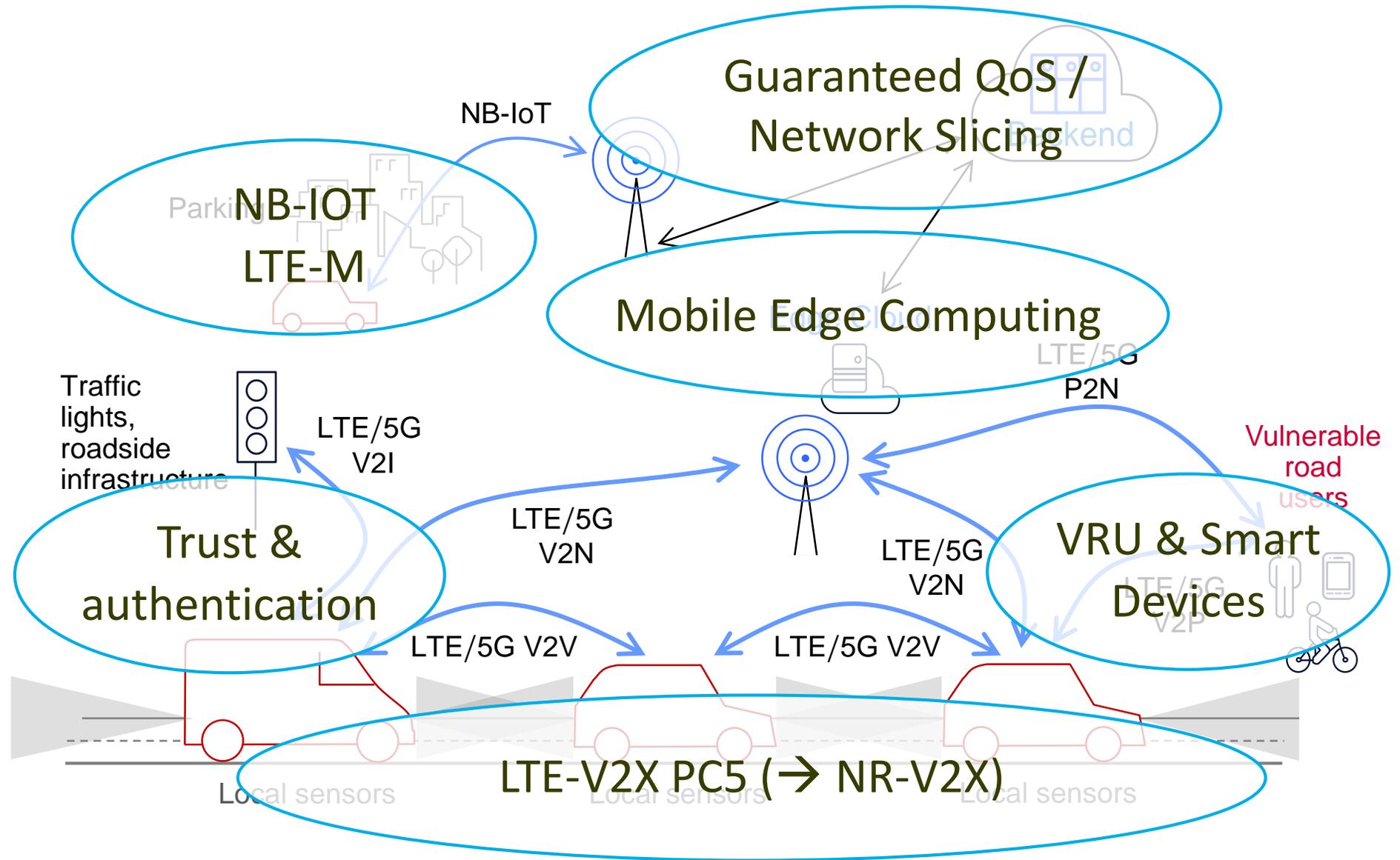


Aerospace

# Automotive Connectivity Landscape

C-V2X is a unified technology platform which integrates:

- **Short-range**, network-less, direct communications (LTE-V2X **PC5** today)
- **Long-range** cellular network communications (LTE-V2X **Uu** today)





# 3GPP: Cellular-V2X (C-V2X)



# C-V2X has two complementary communication modes

## Direct (= Sidelink)

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

## Network (= Up/Downlink)

V2N operates in traditional mobile broadband licensed spectrum

### It's ONE cellular technology

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

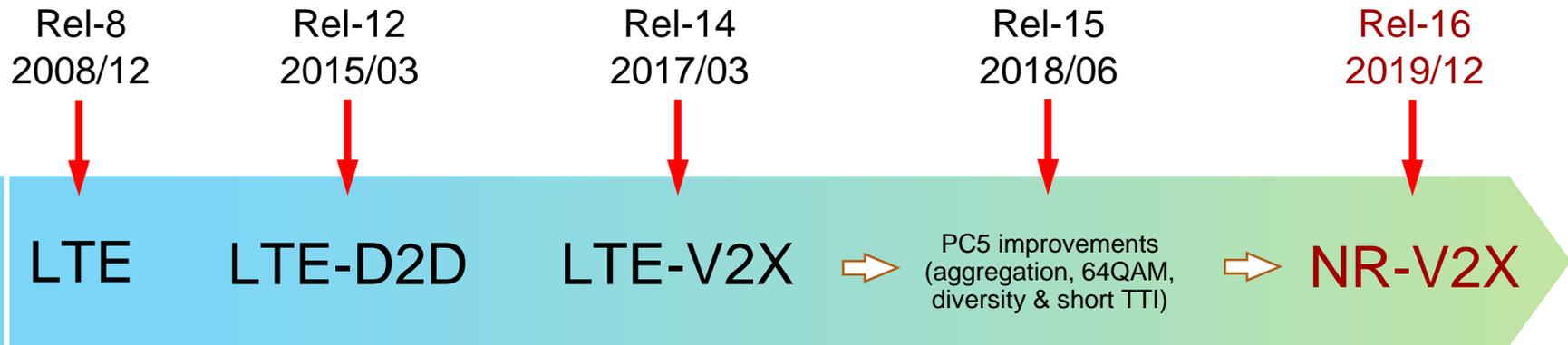
**Short range** (<1 kilometer), location, speed  
Implemented over 3GPP's "PC5 interface"

**Long range** (>1 kilometers). e.g. accident ahead  
Implemented over 3GPP's "Uu interface"

# 3GPP time plan: from LTE-V2X to 5G NR-V2X

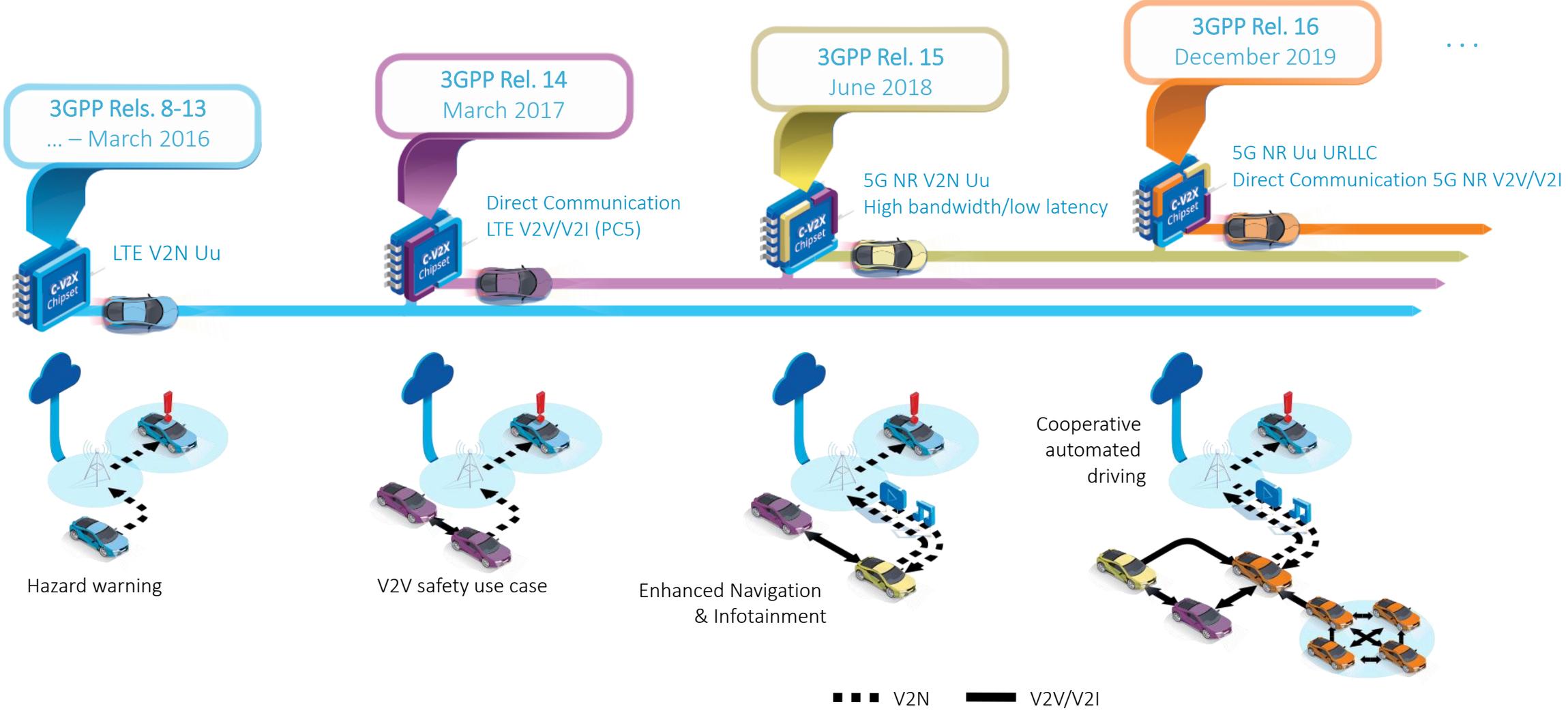


- ❑ Current version of C-V2X is called **LTE-V2X** as part of 3GPP Rel-14 & 15.
- ❑ **NR-V2X** as part of Rel-16 comes as an improvement to support automated driving.
- ❑ NR-V2X will **complement, co-exist** and **support interworking** with LTE-V2X i.e. operation of NR-V2X alone is not considered.



- ❑ NR-V2X **study item** started in **June 2018**.
- ❑ Subsequent NR-V2X work item by **December 2019**.

# C-V2X: Evolution to 5G maintains backward compatibility



# Successful 5GAA C-V2X stories thanks to 3GPP cooperation

- 5GAA use cases submitted to SA1 via 3GPP members
- LTE-sidelink as part of R14 (& improvements in R15) in RAN/RAN1
- NR-Sidelink as part of R16 in RAN/RAN1
- Option to have two Rx antennas for 5G in cars in RAN4
- Launch of QoS notification (prediction) in SA2
- Kickoff of interoperability and compliance test framework for LTE-V2X (R14) thanks to RAN5/GCF
- LTE-V2X product roadmap with R14 automotive-grade mass market readiness in vehicles as of mid-2020
- Inclusion of PC5-based V2P in the smartphone product roadmap (202x)

# Future 5GAA topics which may need 3GPP cooperation

- VRU protection by smart phone incl power reduction mechanisms, V2X PC5 positioning, etc.
- 5G positioning improvement for V2X
- Optimized V2X RAN+CN protocol stack (V2X slice?) including flexible encryption, xCast reliability, etc.
- Multi-MNO mode 3 PC5
- Multi-MNO MEC solutions
- Support of Functional Safety by 5G



Thank you!