

# C-V2X: on the way to 5G

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## Vision or reality?



Source: <https://clickamericana.com/topics/science-technology/future-electric-driverless-cars-1956>



<https://www.stuttgarter-zeitung.de/inhalt.autonomes-fahren-technisch-ausgereift-aber-verboden.dcb6d764-6c23-4bbe-94ef-c558890e2922.html?reduced=true>, 29.12.2017

# Vehicles need communication



Traffic safety and  
automated driving



Traffic efficiency



Infotainment



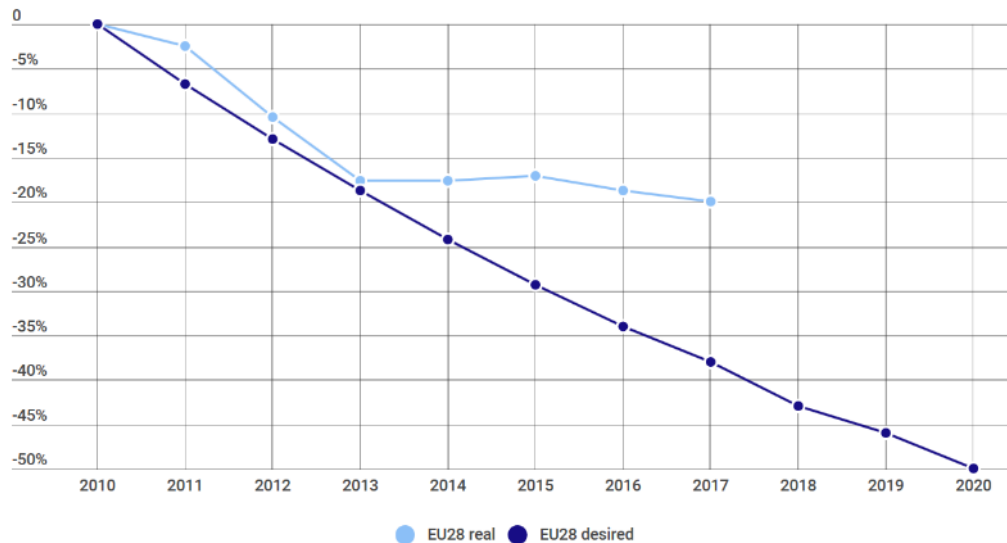
“ ... the Commission will follow an integrated approach between automation and connectivity in vehicles ...”

On the road to automated mobility: A  
EU strategy for mobility of the future

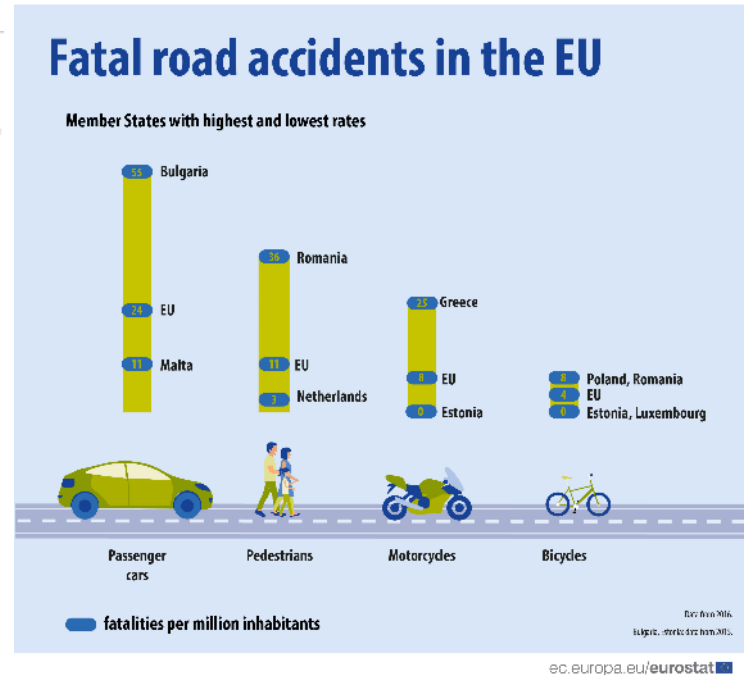
# Road fatalities in the EU

## Desired progress not achieved

### Widening gap between the actual and desired progress towards the EU 2020 target



Source: <https://etsc.eu/euroadsafetydata/>



In the mean time, technology has started transforming road safety, business models and driver experience

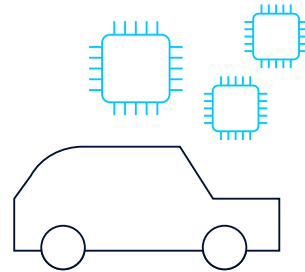


Connectivity

4 of 5 vehicles built in 2020 will connect to the internet.

4/5

Source: Gartner

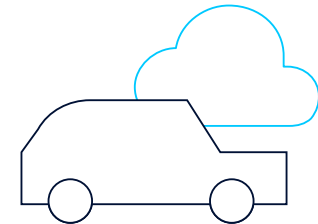


Software & sensors

50% of a vehicle's value will be in software by 2020.

50%

Source: Volkswagen



Services

150% increase in demand for contextual information from 2016 through 2020.

150%

Source: Gartner

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

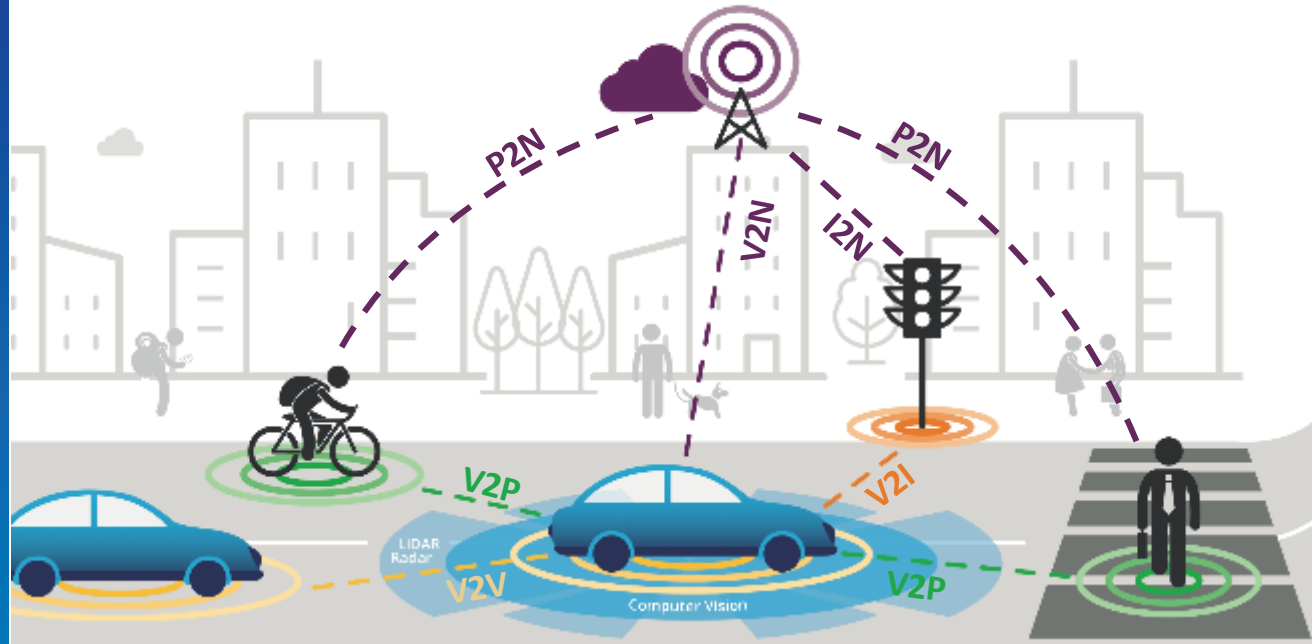
C-V2X is a comprehensive road safety and traffic efficiency solution that allows **vehicles** to communicate with

- **Other vehicles (V2V),**
- **Pedestrians and Cyclists via smartphones (V2P),**
- **Road Infrastructure (V2I),**

supported by the

- **Mobile network (V2N, P2N, I2N)**

to guarantee **full coverage** and **continuity of services**.

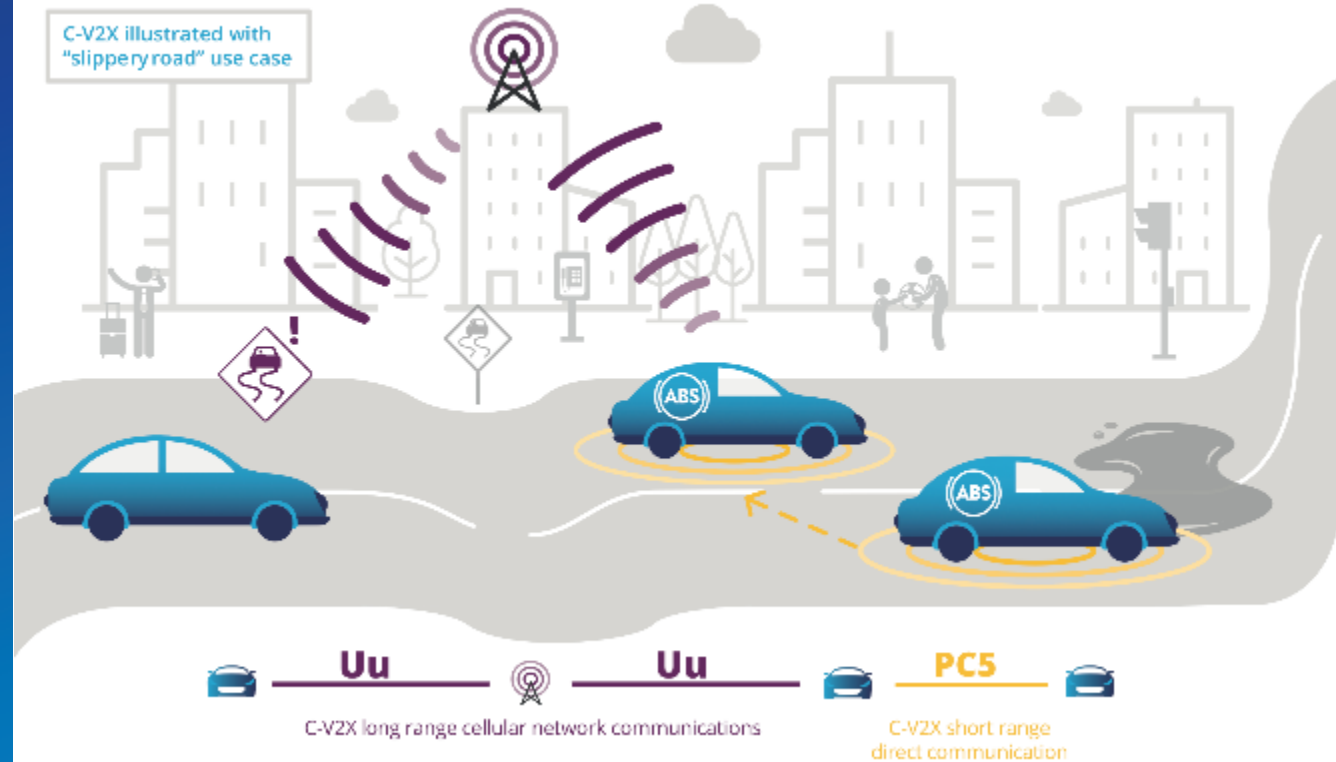


C-V2X is a unified technology platform including both:

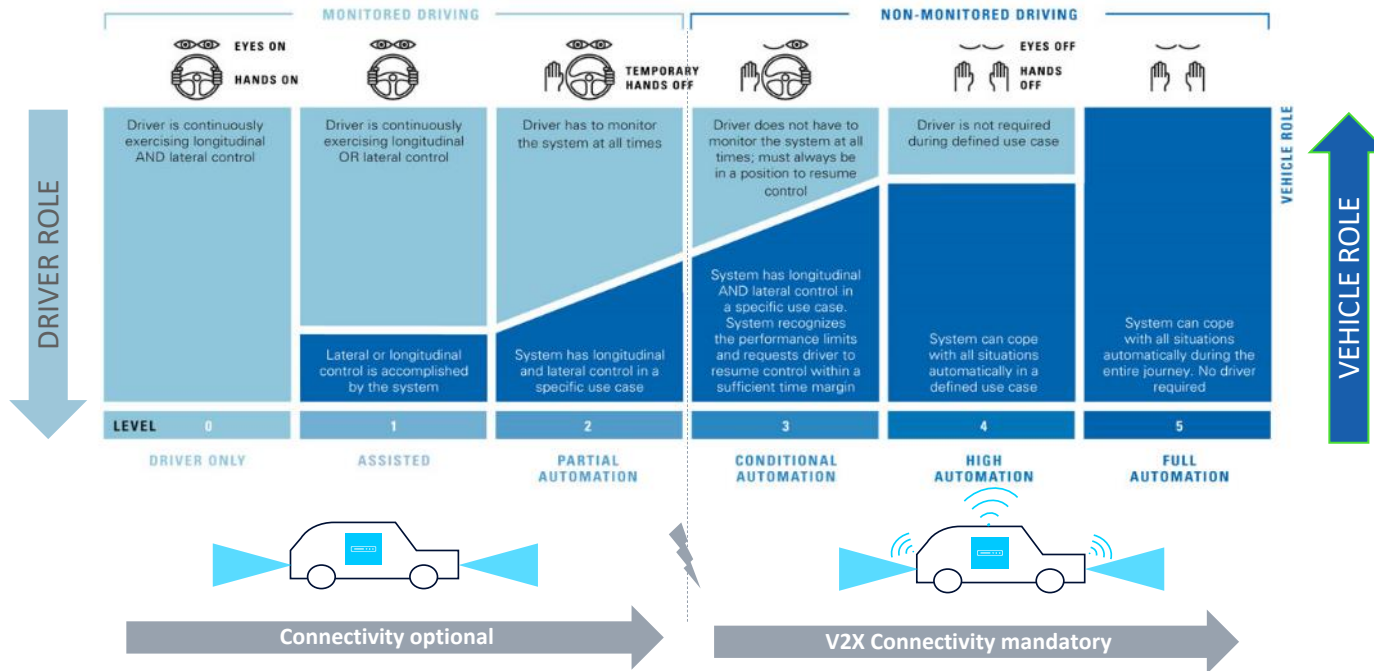
- Short range direct communications (LTE-V2X PC5 and 5G-V2X PC5)
- Long range cellular network communications (LTE-V2X Uu)

Provides clear evolution path to 5G, with technology backwards compatibility safeguard

## Why Cellular V2X (C-V2X)?



# Common consensus in car industry: Highly reliable and predictable connectivity with low latency is mandatory for highly automated driving (HAD)

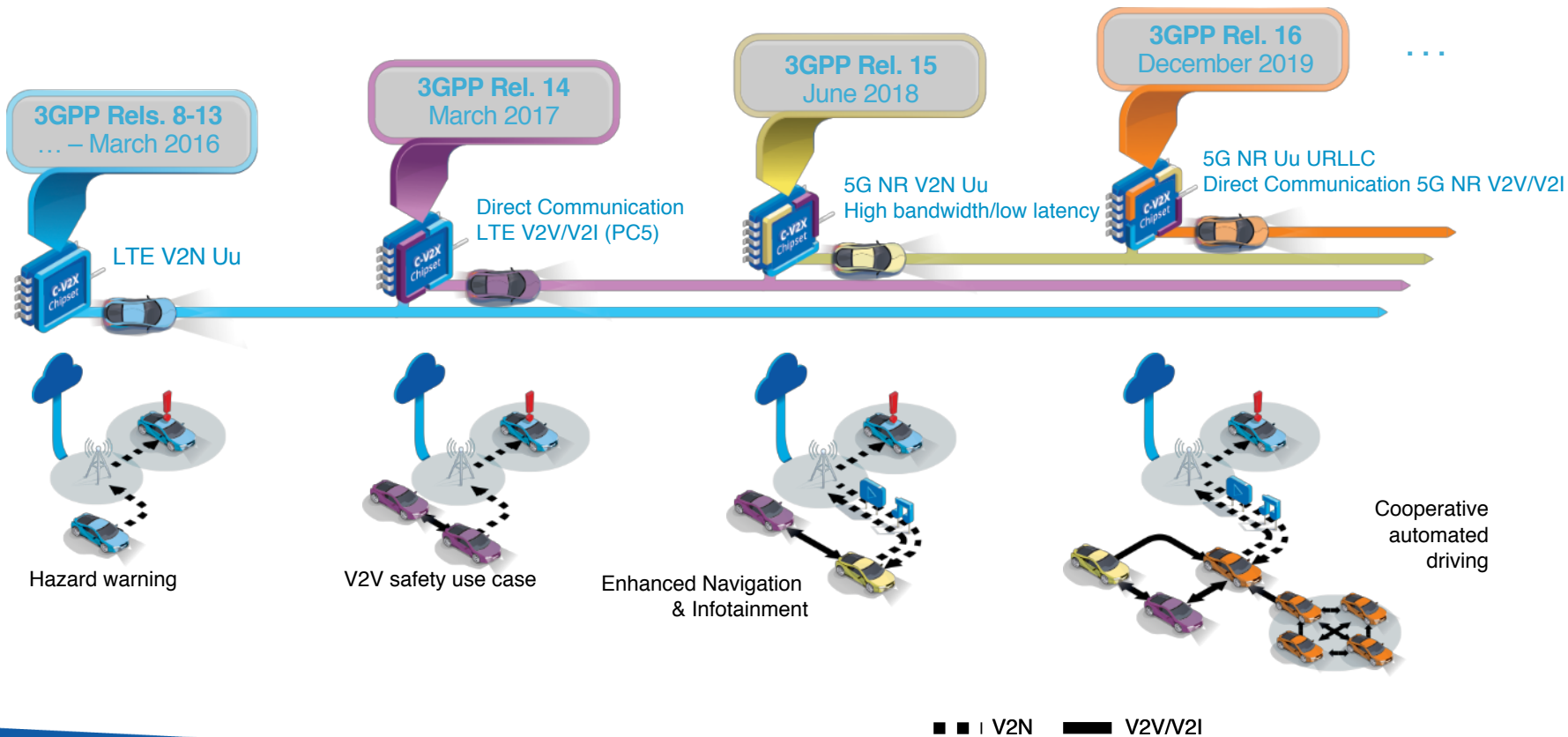


  
 On the road to automated mobility: An EU strategy for mobility of the future  
 17.5.2018  
**“ ... the Commission will follow an integrated approach between automation and connectivity in vehicles ... ”**

Source of 5 levels graphic: EU commission: On the road to automated mobility: An EU strategy for mobility of the future, 17.5.2018, [https://ec.europa.eu/transport/sites/transport/files/3rd-mobility-pack/com20180283\\_en.pdf](https://ec.europa.eu/transport/sites/transport/files/3rd-mobility-pack/com20180283_en.pdf)



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



# Reflections of the situation in Europe

## Different motivations, needs and concerns?

### Automotive

- Wants 5G coverage along roads
- Aware, that traffic safety and HAD do not make the business case
- Need 5G for infotainment, too
- Naturally, do not want to invest into comms infrastructure

### Road operators

- Uncertainty about technology evolution
- Focus on safety and efficiency – not on business
- Unclear relationship with MNOs with respect to responsibility sharing in context of functional safety thinking

**Convergence  
of views??**

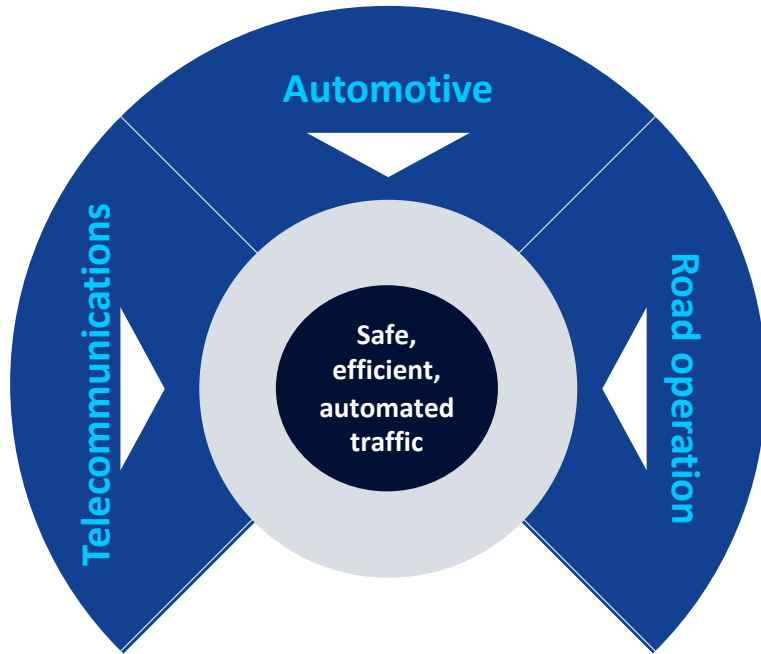
### Network operators (EU):

- See long coexistence (complementary unified approach) of 4G and 5G
- See very challenging business case for 5G full road coverage (3.x GHz technology is not a coverage technology)
- Focus on improving 4G coverage

### Others

- Want to see focus on inter-modal mobility
- Want to see focus on safety for VRUs
- Urban and rural are more important than motorways (see number of fatalities) ...

# A new ecosystem needs to address the challenges together



## Key elements:

- New business relationships as well as business and financing models
- Collection, processing, correlation and exchange of data
- Use of new technologies
  - Sensors & HD maps
  - 5G & C-V2X
  - Machine learning and AI
- Global cross-all interoperability

**NOKIA**