Connected Automotive in a 5G World

UNECE: Exploring the technological developments related to V2V and V2I
Feb. 28th 2022

Uwe.Puetzschler@5gaa.org
5GAA Vice Chair

Connected mobility for people, vehicles and transport infrastructure

5GAA bridges the automotive and telecommunication industries in order to address society's connected mobility needs bringing inclusive access to smarter, safer and environmentally sustainable services and solutions, integrated into intelligent road transportation and traffic management.

AUTOMOTIVE INDUSTRY

Vehicle Platform, Hardware and Software Solutions

TELECOMMUNICATIONS

Connectivity and Networking Systems, Devices & Technologies

5GAA: A Global Cross Industry Association

13 of the top 15 OEMs

9 of the top 10 MNOs

3 top smartphone vendors

In September 2016, **8 companies** teamed to create the 5G Automotive Association (5GAA) to help develop, test, and promote 5G standards

SEPT 2016

Today, 5GAA unites **121 members** from around the world working together on all aspects of C-V2X

Q1 2022

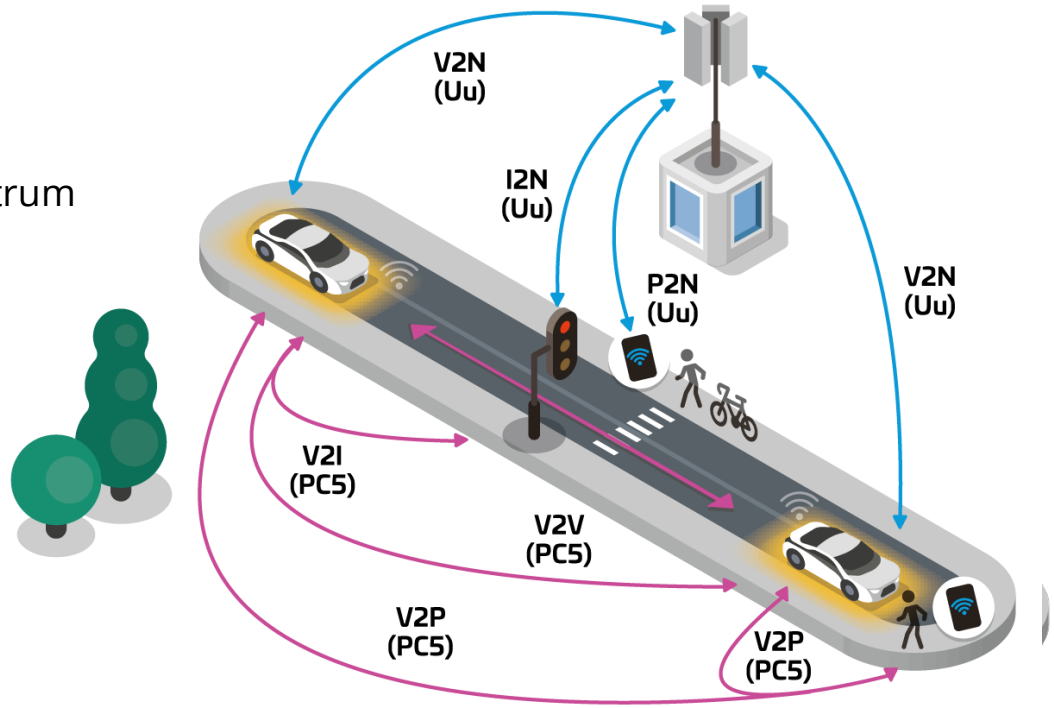
5GAA Organisational Structure

Technology momentum

C-V2X has two complementary communication modes

C-V2X Mobile Network Communications (Uu)

V2N/I2N/P2N in licensed spectrum bands designated for mobile network communication

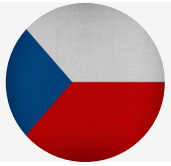


C-V2X Direct Communications (PC5)

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

C-V2X Mobile Network Communications (Uu) + C-V2X Direct Communications (PC5) = Improved mobility ecosystem

5G License obligations – Improved network coverage of roads



Spectrum Tender 2020: Obligations for 700 MHz

Step 1 (within 4 years):

- 100% of core corridors
- 98% of side corridors

of railway and road corridors sections within the Trans-European Transport Network (TEN-T) in the "Core Network" and "Comprehensive Network" categories.

Step 2 (within 6 years):

- 100% of core corridors
- 100% of side corridors

Spectrum Auction 2019: 2GHz & 3,6GHz Coverage Obligations

2019 Step 1 (12/2022):

- All motorways 100 Mbit/s, 10 ms
- Main primary roads 100 Mbit/s, 10 ms
- Primary rail tracks 100 Mbit/s

Step 2 (12/2024)

- Remaining primary roads - 100 Mbit/s, 10 ms
- Secondary and rural roads - 50 Mbit/s
- All rail tracks- 50 Mbit/s
- Harbors and important inner-country waterways - 50 Mbit/s

5G spectrum action 2021: Anatel has approved rules for 5G spectrum auction

Obligation: telecoms must cover all federal highways

Growing momentum:
Connectivity enables many safety use cases

Examples:

C-V2X enabled vehicles

"Intelligent Electric SUV Flagship Hongqi E-HS9 with C-V2X", December,2020

"First 5G enabled car on the road", December, 2020

"BMW iX with 5G connectivity via two network operators", September, 2021

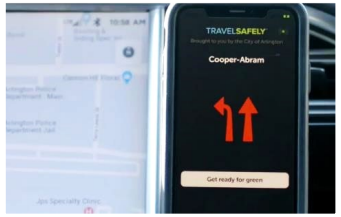
Data for road safety initiative in the EU

Objective:
Create an SRTI Ecosystem to share safety critical data between OEMs, service providers and public authorities …", Data for Road Safety

8 SRTI Use cases:
1. Temporary slippery road
2. Unprotected accident area
3. Short term road works
4. …

Intelligent traffic with smartphone apps

The Netherlands – Talking Traffic:
- 1,8 million users
- 800 Intelligent traffic light in operation
- extra 1000 planned, Source

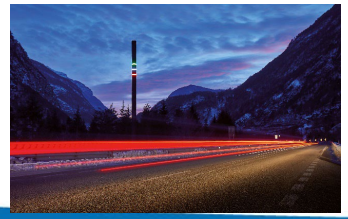


US: Georgia, Texas, .. TravelSafely-App
- 1000+ intersections
- Emergency vehicles
- School zone warning
- Rail crossing warning

… , Source

Deployment of C-V2X RSUs

Italy - ANAS:
Deployment of C-V2X connecting 80Km of Smart Highway 51 to Cortina
Source



China: G5021 Shiyu Highway (Chongqing)
128km highway upgrade with 300+ C-V2X smart RSUs (12 tunnels, 5 dangerous spots), Source1 Source2

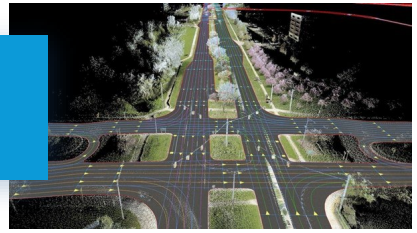
4G/5G based deployment of safety related use cases

Ford cooperates with smart cities to alert driver of traffic jams, road closures and accidents

source: Ford, July 2021

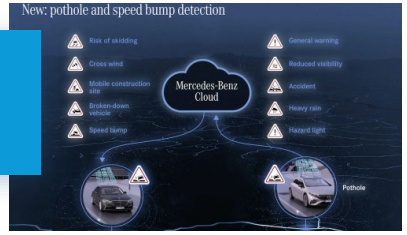
Precise data for greater safety: Audi warns its drivers faster about slippery roads

Source: Volkswagen, Aug 2021



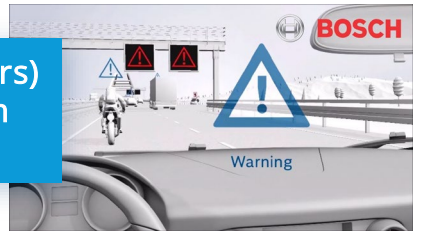
Mercedes-Benz further expands Car-to-X communication; pothole detection

source: Green Car Congress, August 2021



ŠKODA vehicles (and million of other users) receive wrong-way driver warning from BOSCH

Source: Bosch, August 2020 & Bosch, Feb 2021

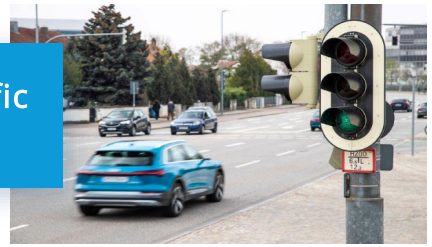


VOLVO warns each other of slippery roads and hazards

Source: VOLVO, Apr 2019

Audi is introducing the V2I service "Traffic Light Information" to Europe.

Source: Audi, 2019 and Audi, 2020



Status in China: At least 13 C-V2X Enabled Vehicles Commercially Launched in 2021

In 2019, 13 OEMs announced mass production of C-V2X cars as of 2020

C-V2X commercial launch time: 2020H2 to 2021H1, OEMs have made the V2X launch plan.

13 C-V2X enabled vehicles already launched in China

OEM	Model	Launch Time
BYD	Han	2020
GAC	V Aion	2020
FAW	E-HS9 Hongqi	2020
GM/SAIC	GL6 BUICK	2020
GM/SAIC	GL8 BUICK	2020
Ford	Mustang Mach-E	2021
Ford	Explorer	2021
Ford	Edge Plus	2021
Ford	EVOS	2021
BJEV	Arcfox	2021
Weltmeister	W6	2021
Great Wall	WEY Mocha	2021
Human Horizons	HiPhi X	2021
NIO	ET7	2022
Audi	A7 L & A6 L	2022

Applications/User Cases standardized in China

Category	Communication type	Service
safety	V2V	Forward Collision Warning
	V2V/V2I	Intersection Collision Warning
	V2V/V2I	Left Turn Assistant
	V2V	Blind Spot Warning
	V2V	Do Not Pass Warning
	V2V-Event	Emergency Brake Warning
	V2V-Event	Abnormal Vehicle Warning
	V2V-Event	Control Loss Warning
	V2I	Hazardous Location Warning
	V2I	Speed Limit Warning
	V2I	Red Light Violation Warning
	V2P/V2I	Vulnerable Road User Collision Warning
efficiency	V2I	Green Light Optimal Speed Advisory
	V2I	In-Vehicle Signage
	V2I	Traffic Jam Warning
	V2I/V2V	Emergency Vehicle Warning
information	V2I	Vehicle Near-Field Payment

Category	Communication type	Service
safety	V2V/V2I	Sensor Data Sharing
	V2V/V2I	Cooperative Lane Change
	P2X	Vulnerable Road User Safe Passing
efficiency	V2I	Cooperative High Priority Vehicle Passing
information	V2I	Guidance Service in Parking Area
	V2I	Differential Data Service
managment	V2I	Probe Data Collection
driving	V2V	Cooperative Platooning Management
safety & efficiency	V2I	Cooperative Vehicle Merge
	V2I	Cooperative Intersection Passing)
information & efficiency	V2I	Vehicle Near-Field Payment
efficiency & management	V2I	Dynamic Lane Management

Day 2

Day 1

Status in the US

Ford commits to deploy C-V2X in all new vehicle models in the US beginning in 2022

source: Ford, Jan 2019

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

source: Audi USA, Jan 2020

Blue Bird join Audi, Applied Information on connected vehicle deployment to boost school bus and school zone safety

source: Blue Bird, March 2021

Auto Industry Unites Behind Safety Technology by Committing at least 5 Million V2X Radios and Devices by the End of 2025

source:
Alliance for Automotive Innovation, April 2020

Qualcomm Spoke Partnership Brings C-V2X to Bicycles, Expands Smart Transportation Safety Ecosystem

"In addition to broadcasting the position of cyclists to other vehicles, the ConnectMe device can also receive messages from C-V2X-equipped vehicles to alert riders to hazards around them."

source: Forbes, August 2021

Verizon & Honda test how 5G enhances safety for connected and autonomous vehicles

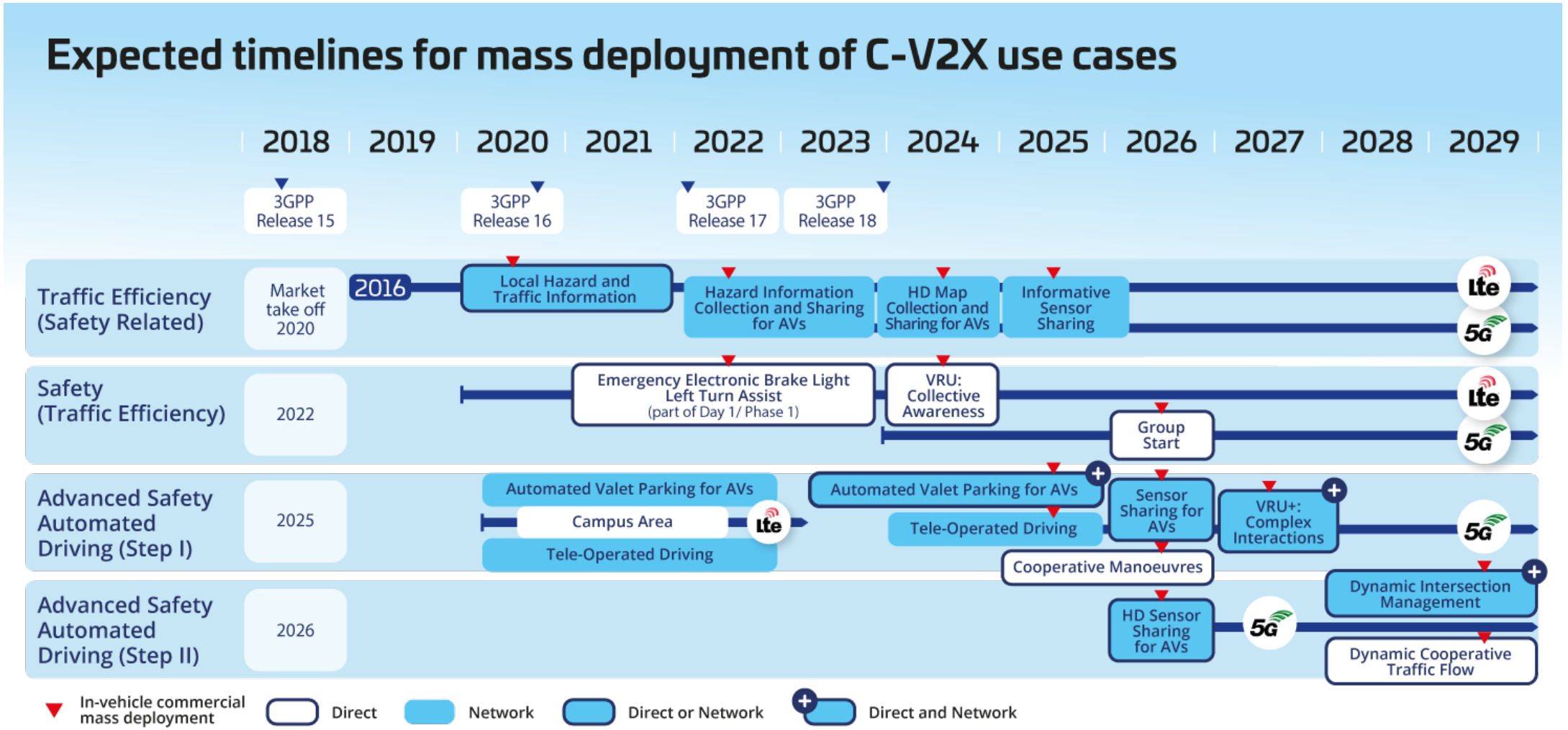
"Using Cellular Vehicle-to-Everything (C-V2X) communication, Honda SAFE SWARM™ enables vehicles to communicate with other road users and share key information such as location, speed, and vehicle sensor data"

Source: Verizon, April 2021

5GAA 2030 Visionary Roadmap

Read the full roadmap here

Expected timelines for C-V2X Use Cases



5GAA Automotive Association

For more information please contact:

secretariat@5gaa.org

www.5GAA.org