Panel on Information Processing

Topic: Processing Sensing Data

Moderator

Wael Bazzi, American University in Dubai, United Arab Emirates

Panelists

Thomas Jell, Siemens Mobility GmbH, Germany
Hamid Menouar, QMIC - Qatar Mobility Innovations Center, Qatar
Paris Kaimakis, University of Central Lancashire Cyprus, Cyprus

Thomas Jell, Siemens Mobility GmbH, Germany

IoT and IoT interoperability

Hamid Menouar, QMIC - Qatar Mobility Innovations Center, Qatar

Connected Vehicles, an enabler of Big Data

Paris Kaimakis, University of Central Lancashire Cyprus, Cyprus

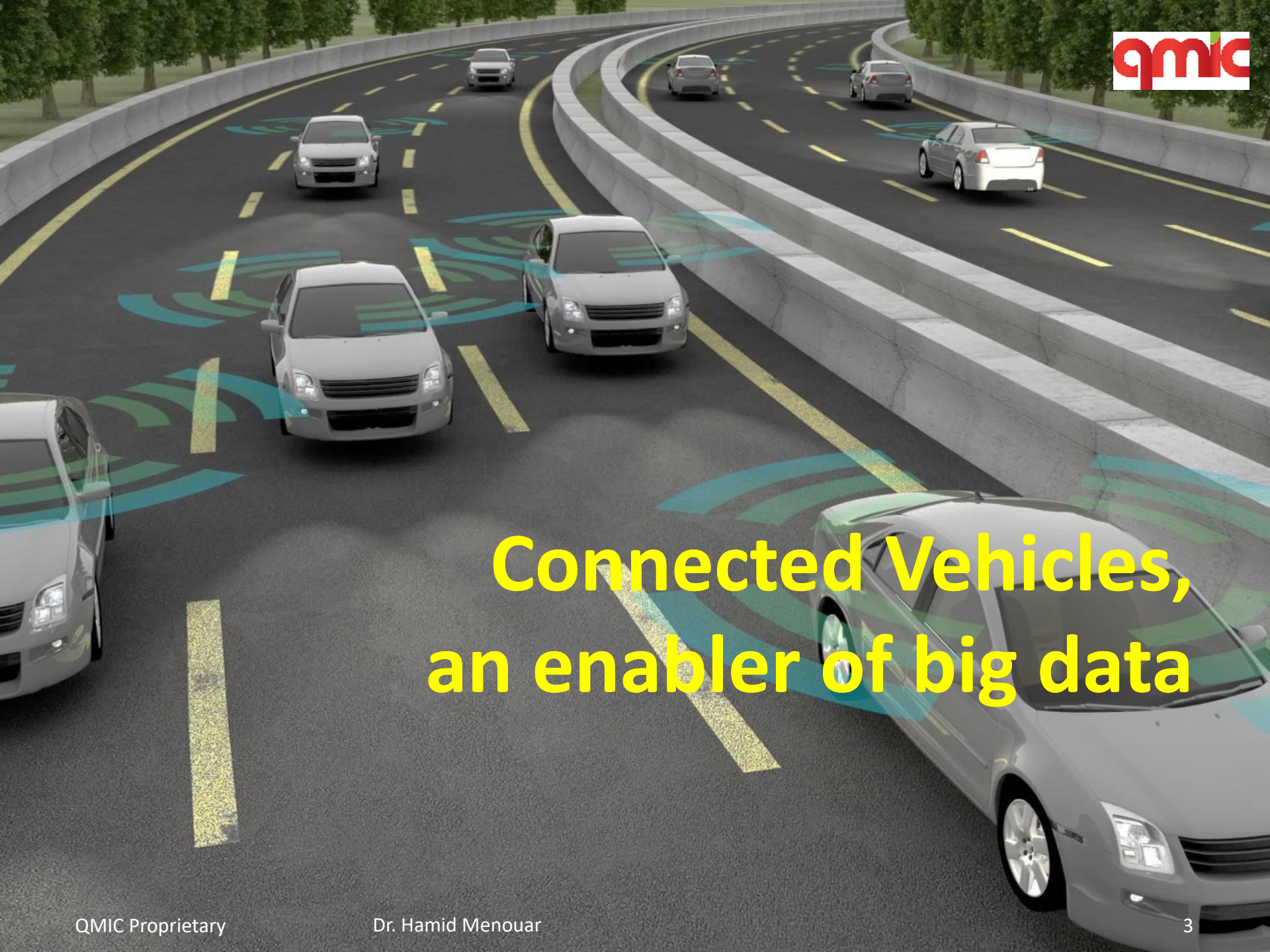
Computer Vision vs. Privacy

Connected Vehicles, an enabler of **Big Data**

Dr. Hamid Menouar (www.menouar.com)
Senior R&D Expert and Product Manager,
Qatar Mobility Innovations Center

InfoWare 2019, July 2nd, 2019, Rome, Italy

Vehicles do already generate business-profitable data


Connected Vehicles,
an enabler of big data

Connected Vehicles **a Reality**

Forbes

Toyota Has Big Plans To Get Cars Talking To Each Other And Infrastructure In The U.S.

APR 16, 2018

After well over a decade of development a tentative step by General Motors in 2017, vehicle-to-vehicle (V2V) communications might finally get some market momentum with a push from Toyota. The Japanese automaker has announced plans to begin a broad deployment of V2V and vehicle to infrastructure (V2I) technology in the U.S. market from 2021 with the goal of having it across almost its entire lineup by mid-decade.

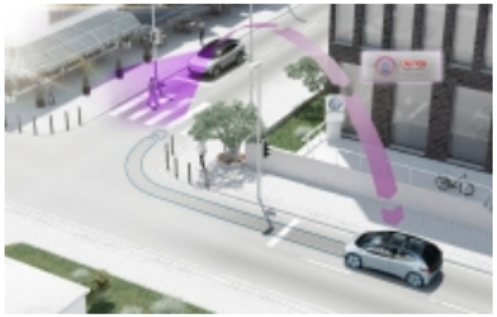
The combination of V2I, V2V and communication with other road users such as pedestrians and cyclists is known as V2X. Like GM, Toyota is planning to use dedicated short-range communication (DSRC) technology which is based on WiFi. In the U.S. the federal communications commission has set aside spectrum in the 5.9 GHz band for connected transportation.

Source: https://www.forbes.com/sites/samabuelsamid/2018/04/16/toyota-launches-aggressive-v2x-communications-roll-out-from-2021/#193a867a146c

Connected Vehicles **a Reality**

With the aim of increasing safety in road traffic, Volkswagen will enable vehicles to communicate with each other as from 2019

JUNE 28, 2017



The first Volkswagen models will be fitted with pWLAN in 2019

Connectivity between different vehicles as well as between vehicles and transport infrastructure in the vicinity is another important step towards connected motoring that aims to reduce road accidents or minimise their consequences. As from 2019, Volkswagen will therefore start fitting its first models with pWLAN as standard in order to serve as an additional communication technology for the exchange selected information relevant to traffic between cars made by different manufacturers. This will involve information being exchanged both between vehicles (car-to-car), as well as between vehicles and the transport infrastructure (car-to-X)*. This will, for example, enable information about the current traffic situation, accidents and other situations relating to traffic conditions to be shared with the local environment, within a radius of approx. 500 m, even faster than has been possible in the past.

The technology used by Volkswagen is based on the IEEE 802.11p (pWLAN) standard, which the automotive industry has standardised and tested for direct, non-proprietary inter-vehicle communication as well as between vehicles and transport infrastructure and in international markets.

Source: https://www.volkswagen-media-services.com/en/detailpage/-/detail/With-the-aim-of-increasing-safety-in-road-traffic-Volkswagen-will-enable-vehicles-to-communicate-with-each-other-as-from-2019/view/5234247/6e1e015af7bda8f2a4b42b43d2dcc9b5?p_auth=pff9weqT

Connected Vehicles **a Reality**

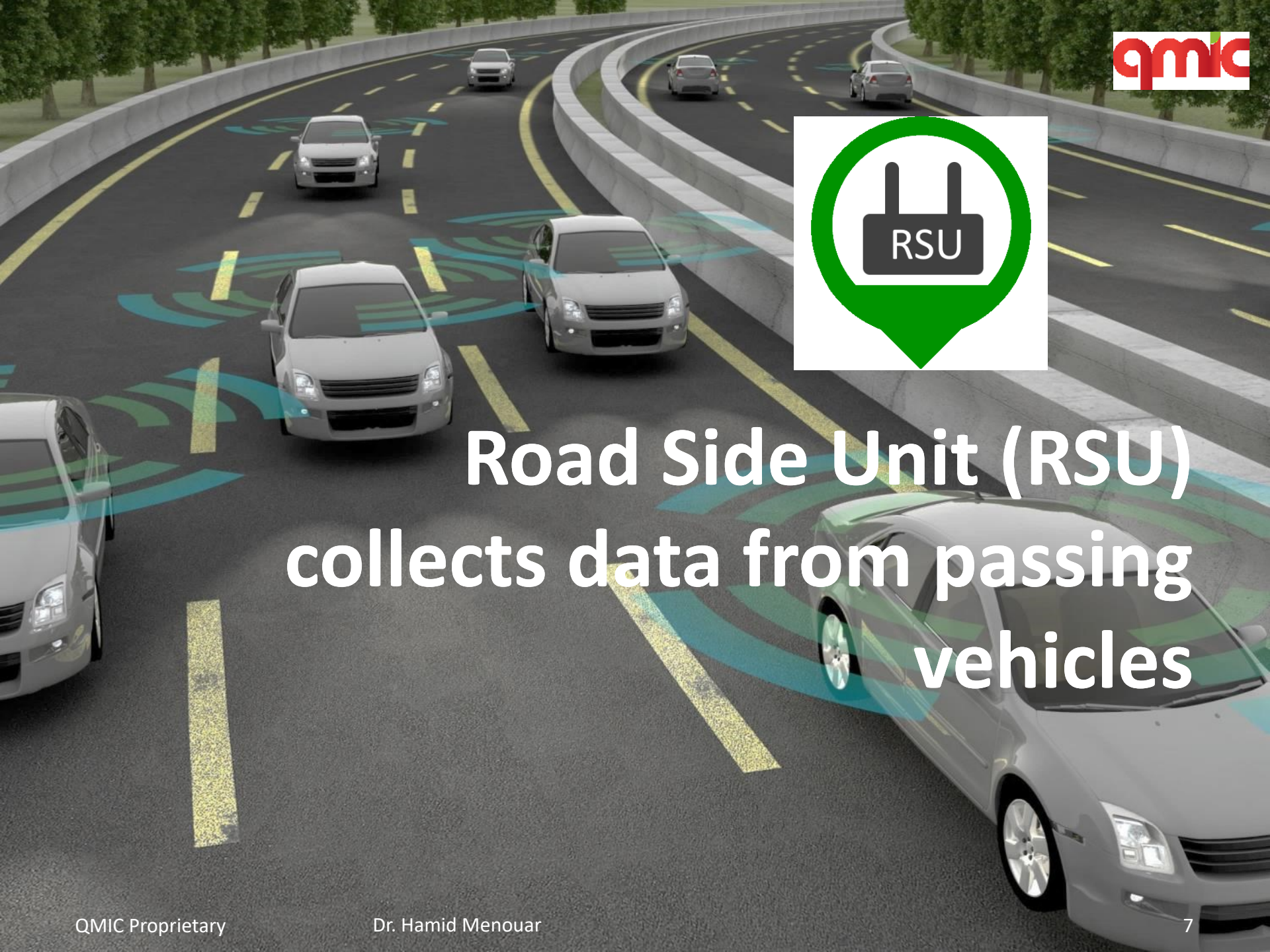
Forbes

Every Cadillac To Soon Get Hands-Off Super Cruise Automated Driving System For Highways

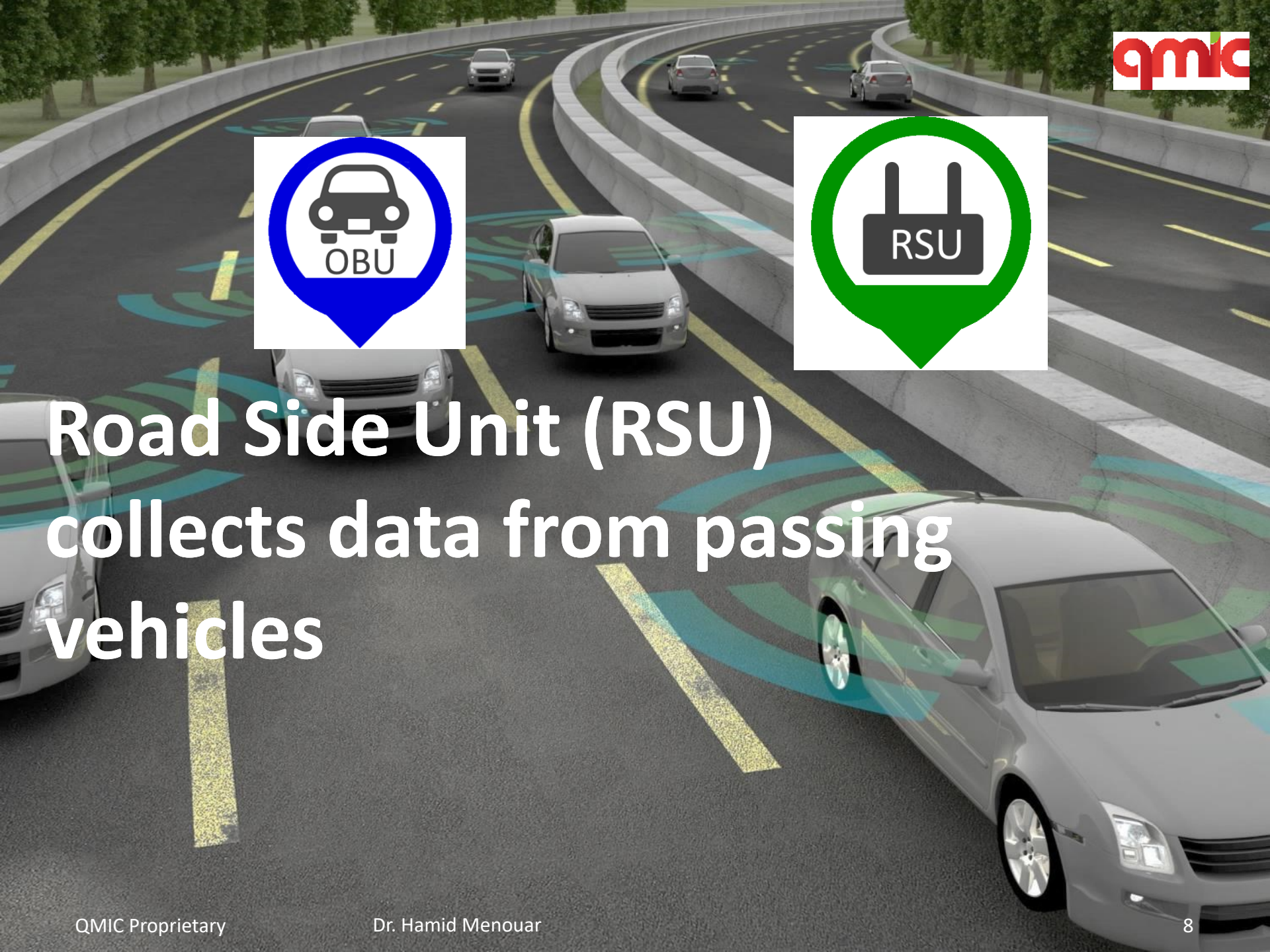
JUNE 06, 2018

Cadillac's Super Cruise partially automated driving system is widely considered to be the best such system currently available in production but it's only available on a single model, the slow-selling CT6 sedan. That changes in 2020 as it will be rolled out to the entire Cadillac line and then to other GM vehicles as well. Another feature currently limited to a single Cadillac right now is vehicle-to-vehicle (V2V) communications and that to will become more available but not until 2023.

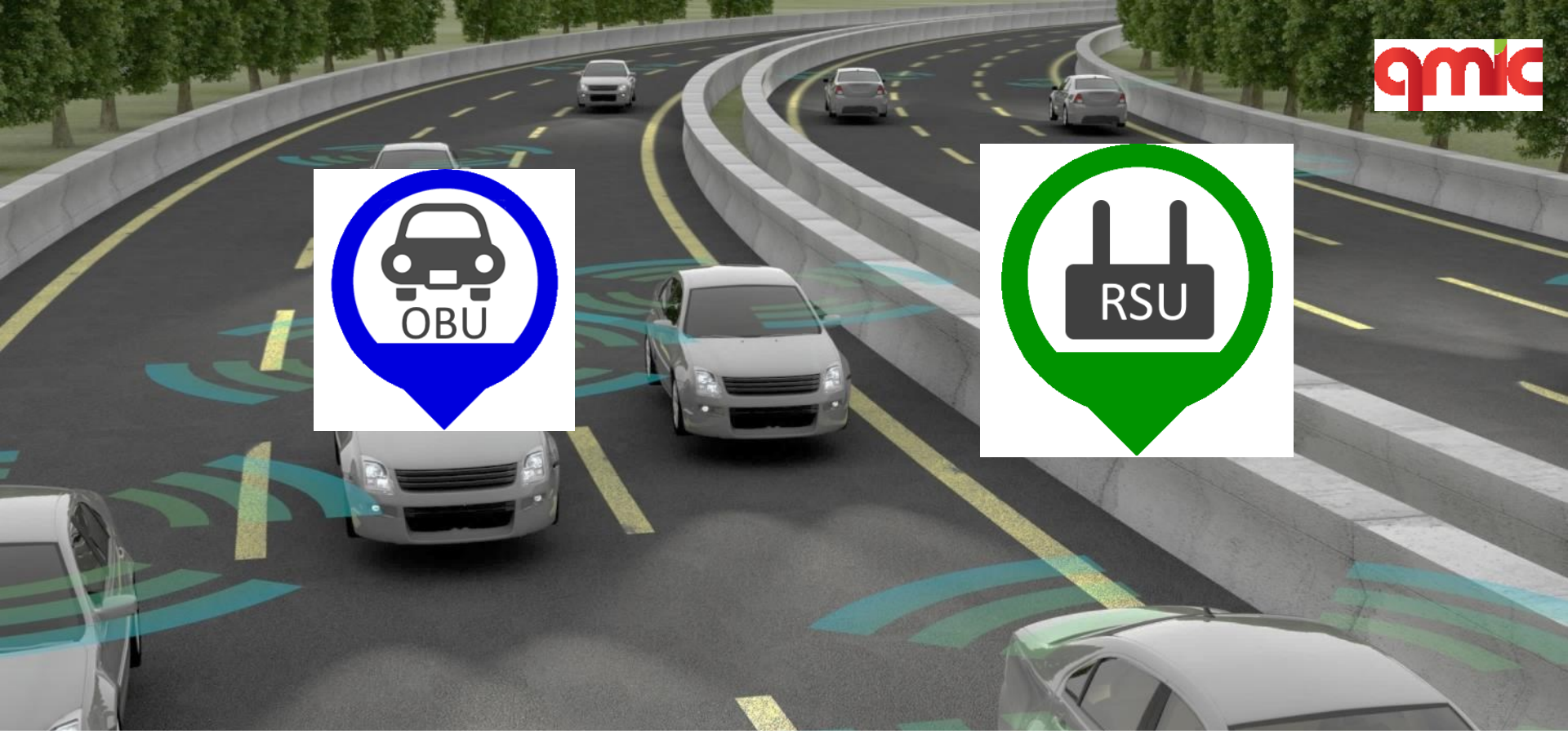
Source: https://www.forbes.com/sites/samabuelsamid/2018/06/06/cadillac-to-expand-super-cruise-and-v2x-availability-starting-in-2020-and-2023/#4365a92a4681



Road Side Unit (RSU) collects data from passing vehicles



Road Side Unit (RSU) collects data from passing vehicles



Data Cleaning

Remove Duplicates

Edge Computing

Data Privacy

Thank you

Dr. Hamid Menouar
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QMIC Proprietary

Computer Vision *vs* Our Privacy

Paris Kaimakis

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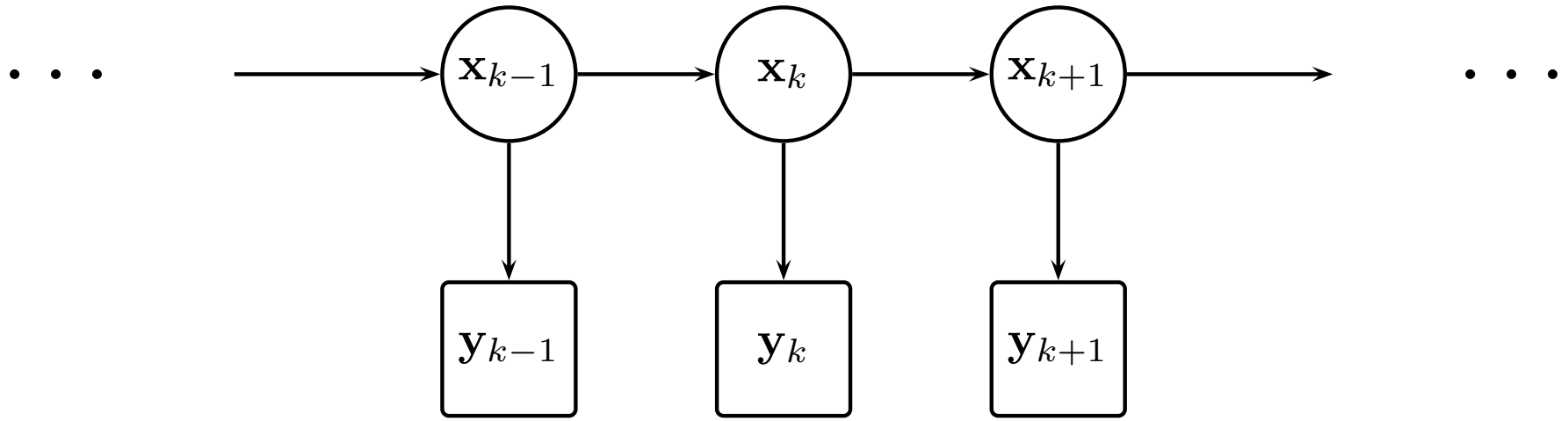
July 2, 2019

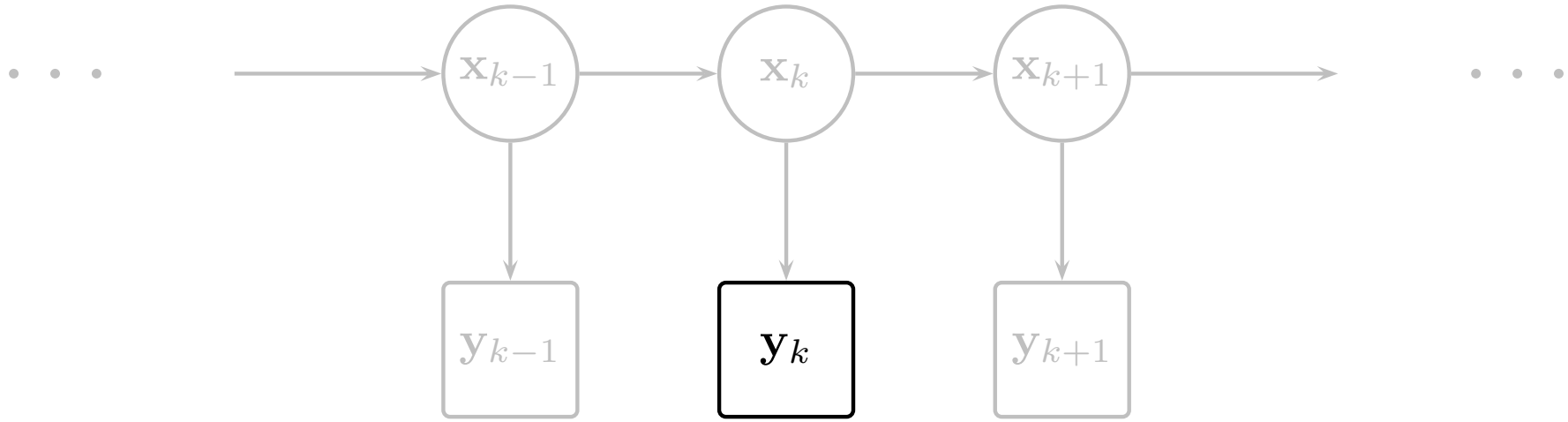
Case Study: A Surveillance Application

Consider the application of road-traffic monitoring:



- Visual data $\mathbf{y} \in \mathbb{R}^P$ with $P = \mathcal{O}(10^6)$
- Inferred state of cars $\mathbf{x} \in \mathbb{R}^S$ with $S = \mathcal{O}(10^2)$

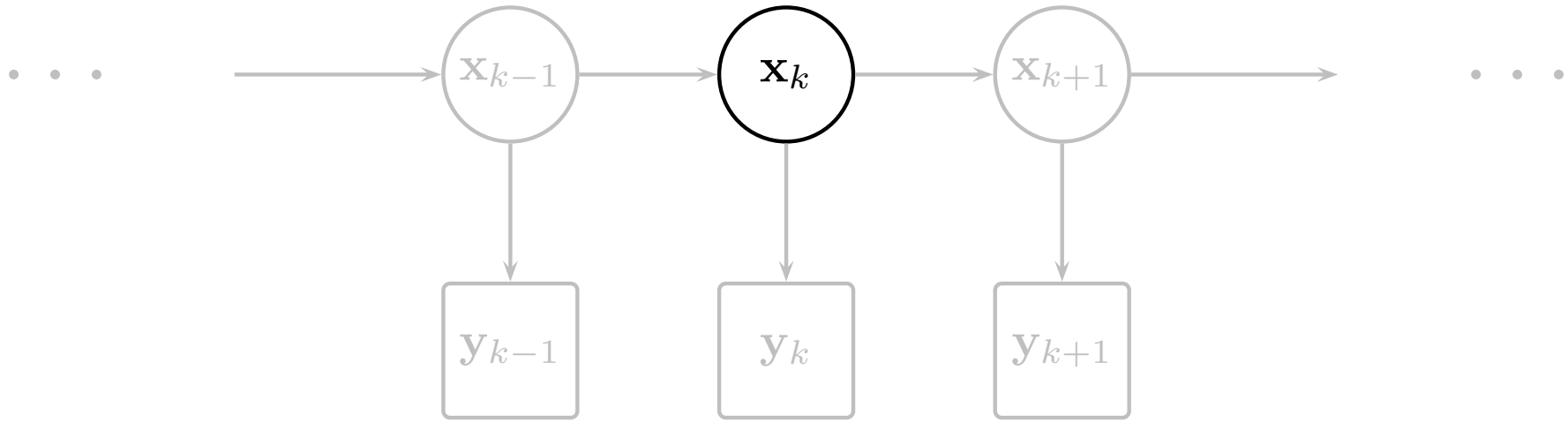
What's inside $\mathbf{y}_k$?



- A huge amount of information — hard to store and transmit
- Mostly useless information
- A tiny amount of useful information
- Some information related to our identity and privacy

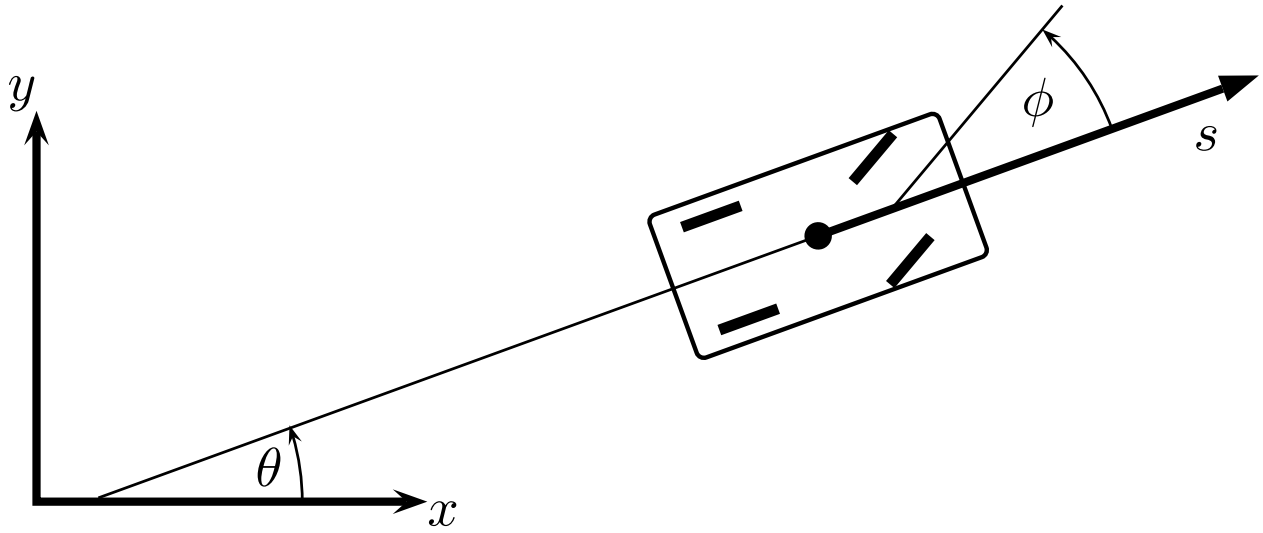

THERMO
DAF
AV03 HBU
R209 LTT
EU55 FLV

What's inside $\mathbf{x}_k$?



- Small amount of information — easy to store and to transmit
- No useless information
- No redundancy
- No information related to our privacy

What's inside $\mathbf{x}_k$?



$$\mathbf{x} = \begin{bmatrix} \mathbf{x}_{(1)}^{\mathrm{T}} & \dots & \mathbf{x}_{(n)}^{\mathrm{T}} & \dots & \mathbf{x}_{(N)}^{\mathrm{T}} \end{bmatrix}^{\mathrm{T}}$$

where $N = \mathcal{O}(10)$ is the number of cars detected, and where

$$\mathbf{x}_{(n)} = \begin{bmatrix} x & y & \theta & s & \phi \end{bmatrix}^{\mathrm{T}}$$

How can we achieve road-traffic monitoring without violating citizens' privacy?

- We encourage the computer vision community to develop lightweight, decentralised algorithms which can infer car states $\mathbf{x}$ **locally** on surveillance camera chips
- We call for policy makers to **ban** the transmission of captured images $\mathbf{y}$ to centralised servers – whether for processing or for storing
- We call for legislation that ensures **low-bandwidth connection** on surveillance camera equipment
- We call for more **transparency** on the handling of data captured by surveillance cameras

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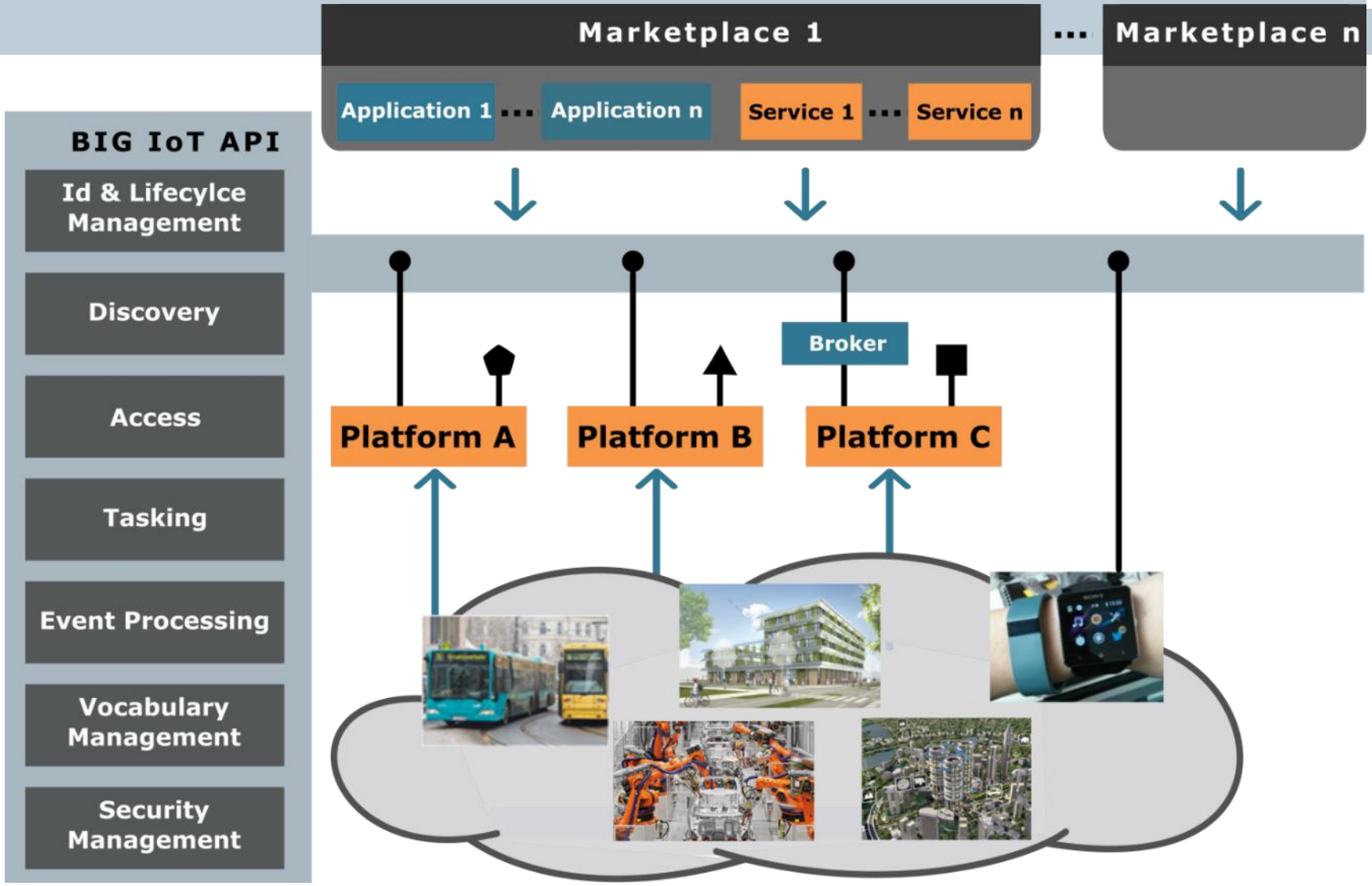
Ingenuity for life

Advanced Parking Management – a multifunctional lever in effective city management

Thomas Jell Innovative Mobility Solutions, Siemens-Mobility

Approach



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City2Share

sozial. urban. mobil

5 Mobilitätstationen in München
- Münchner Freiheit
- Goetheplatz
- Am Glockenbach
- Kidlerplatz
- Zenettiplatz

2 Mobilitätsstationen in Hamburg (switchh)
- Schlump
- Barmbek

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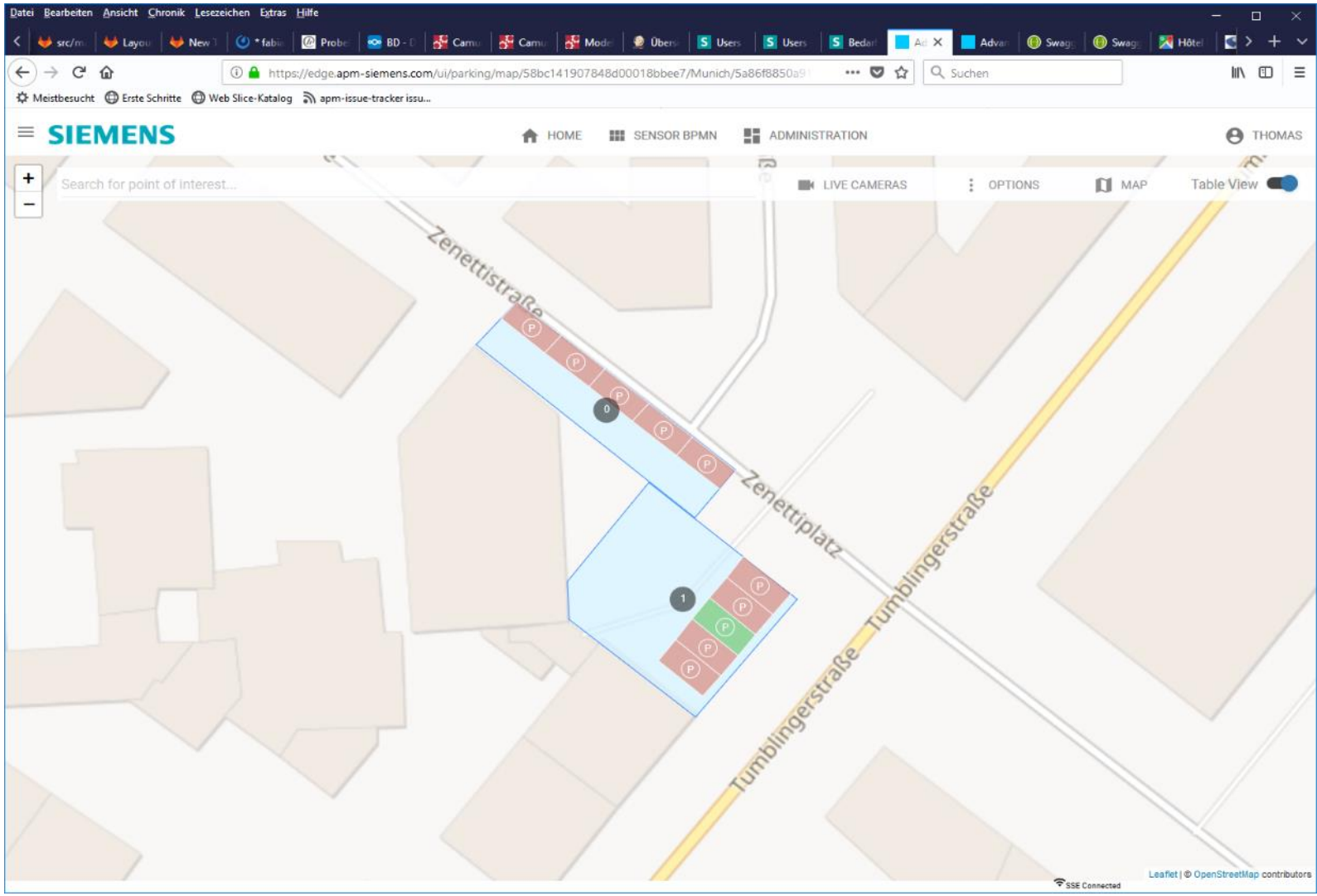
Integration Siemens -> DriveNow



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Live Demo

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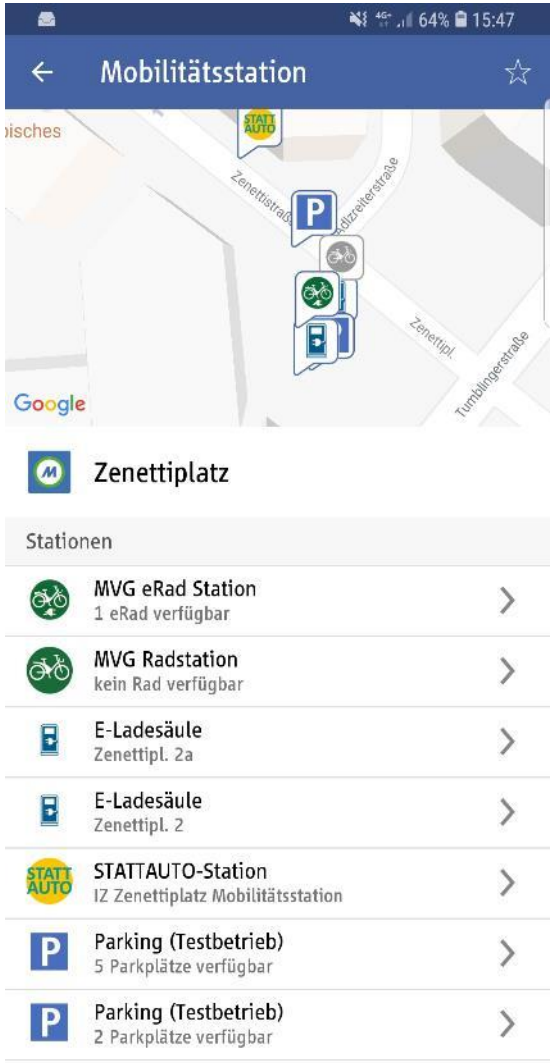
[APM Prod Cluster]
[APM Development Cluster]

MVG More



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Next Use Case: Infrastructure for selfdriving vehicles

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Infrastructure enhances driving abilities of self-driving vehicles in traffic critical situations

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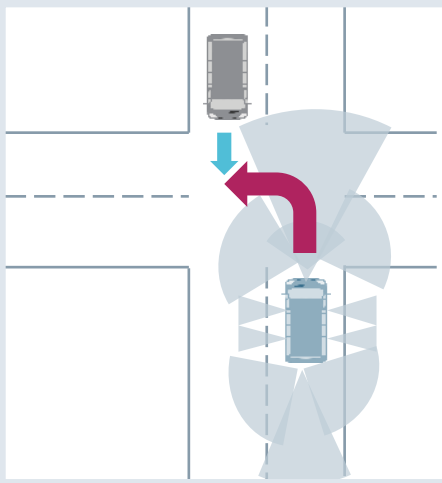
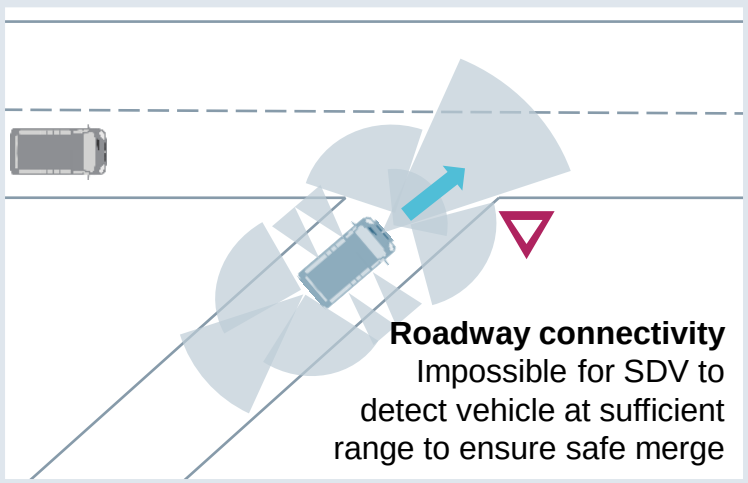
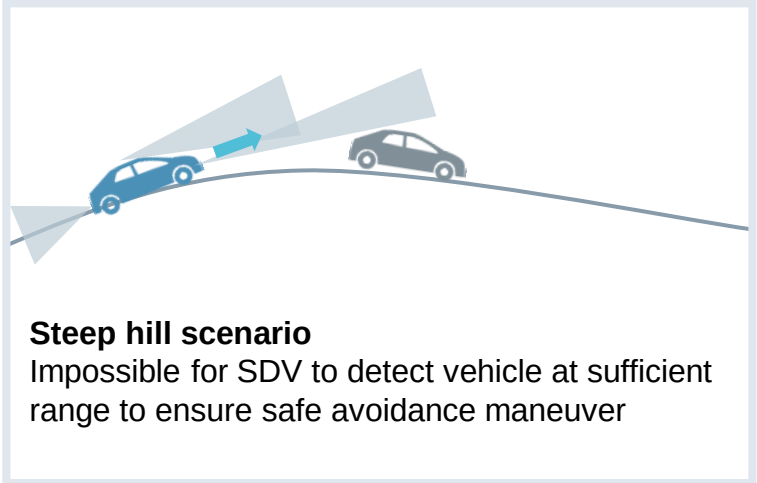


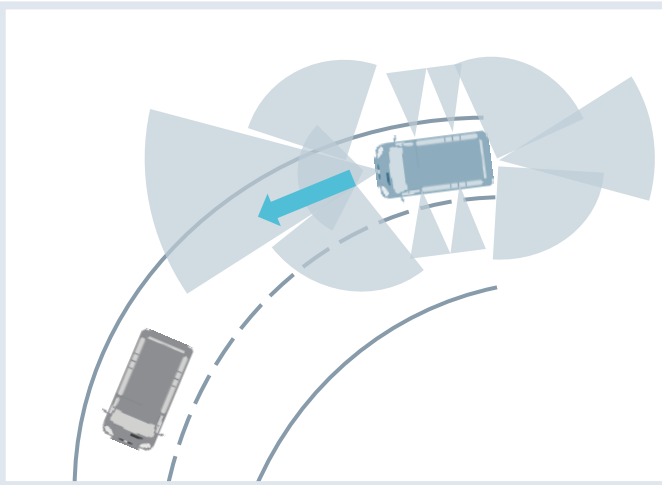
Roadway junction
Impossible for SDV to detect vehicle at sufficient range to ensure safe left turn



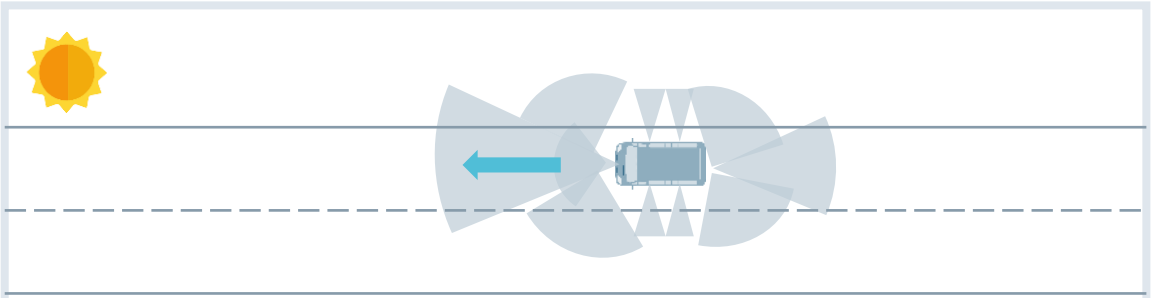
Roadway connectivity
Impossible for SDV to detect vehicle at sufficient range to ensure safe merge



Steep hill scenario
Impossible for SDV to detect vehicle at sufficient range to ensure safe avoidance maneuver



Hairpin turn
Impossible for the SDV to detect vehicle at sufficient range to ensure safe avoidance maneuver



“Sun blinding” of sensors
Degraded sensor performance

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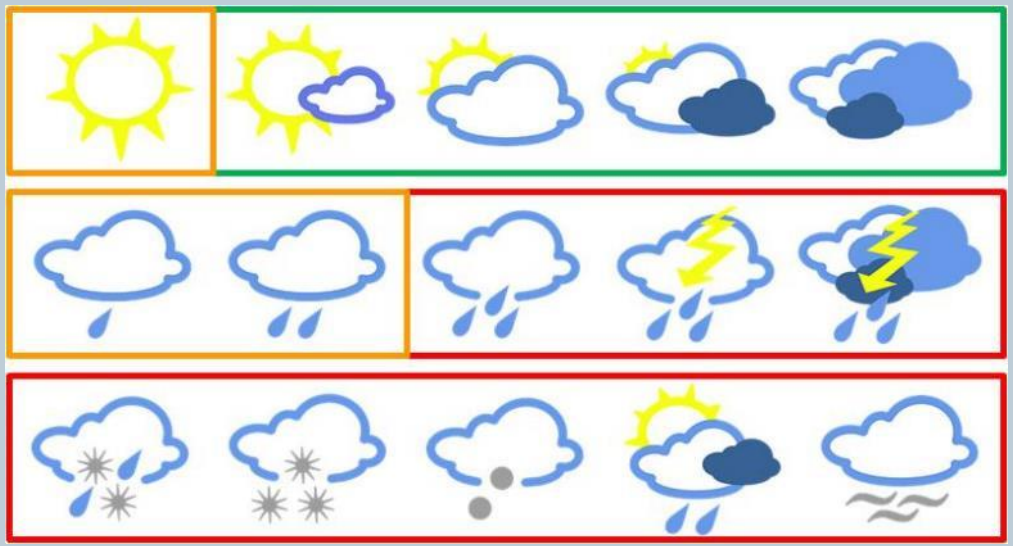
We ensure safe and fluent traffic (ease of traffic) for self-driving PT vehicles



in all weather conditions

and complex traffic situations

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We will demonstrate multitude of use cases for self-driving vehicles

Infrastructure works reliably, even in the case of changing weather and light conditions (rain, snow, fog or glaring sunlight)

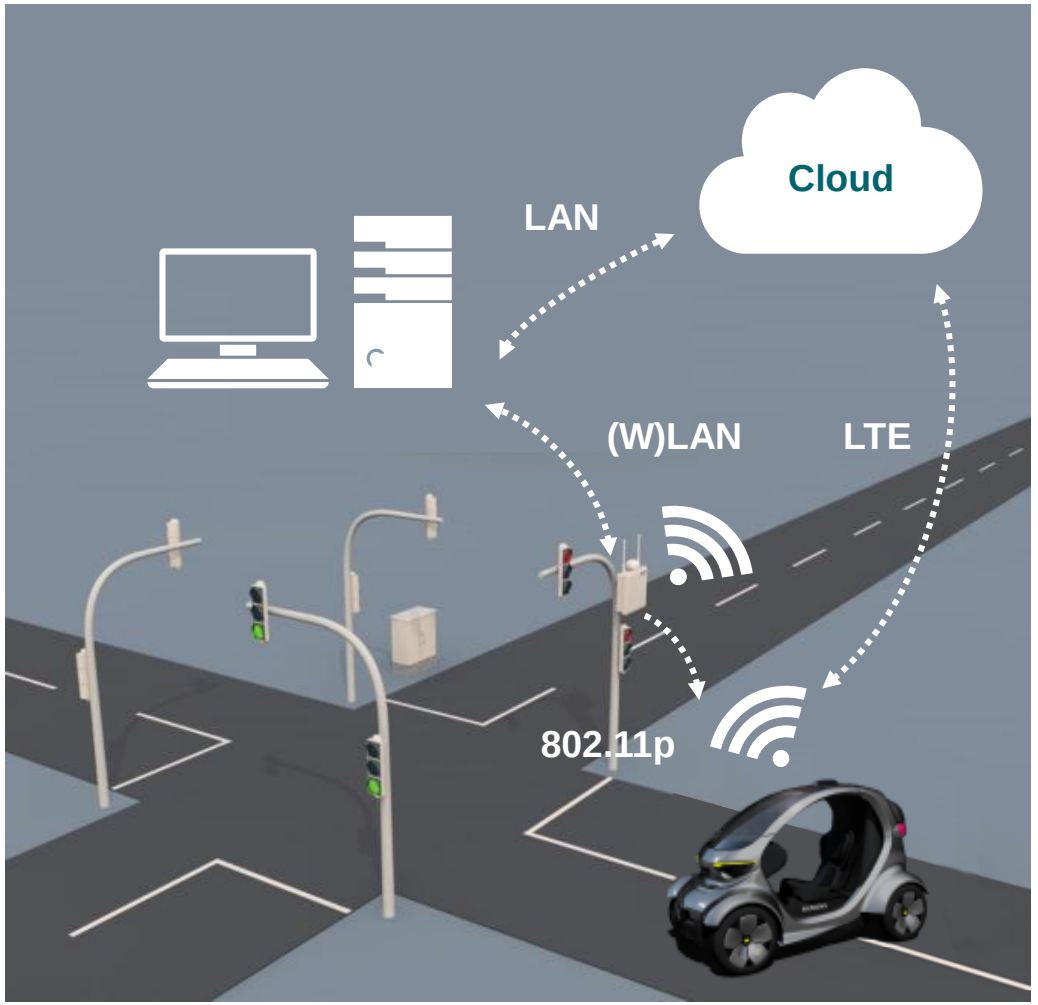
Infrastructure identifies risks – even if they are not in the immediate surrounding of the vehicle

Vehicle reduces its speed to avoid critical situations

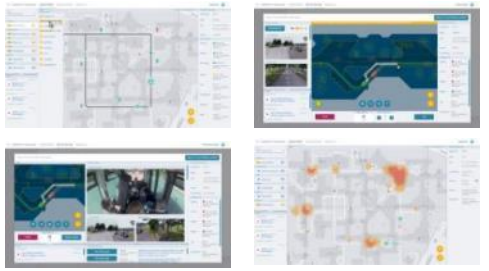
Practical overview of the system

Traffic cell data fusion on TCCC

Roadside cognition and localization



Operation control center in the cloud



Vehicle cognition, localization and control

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Camera

RTLS

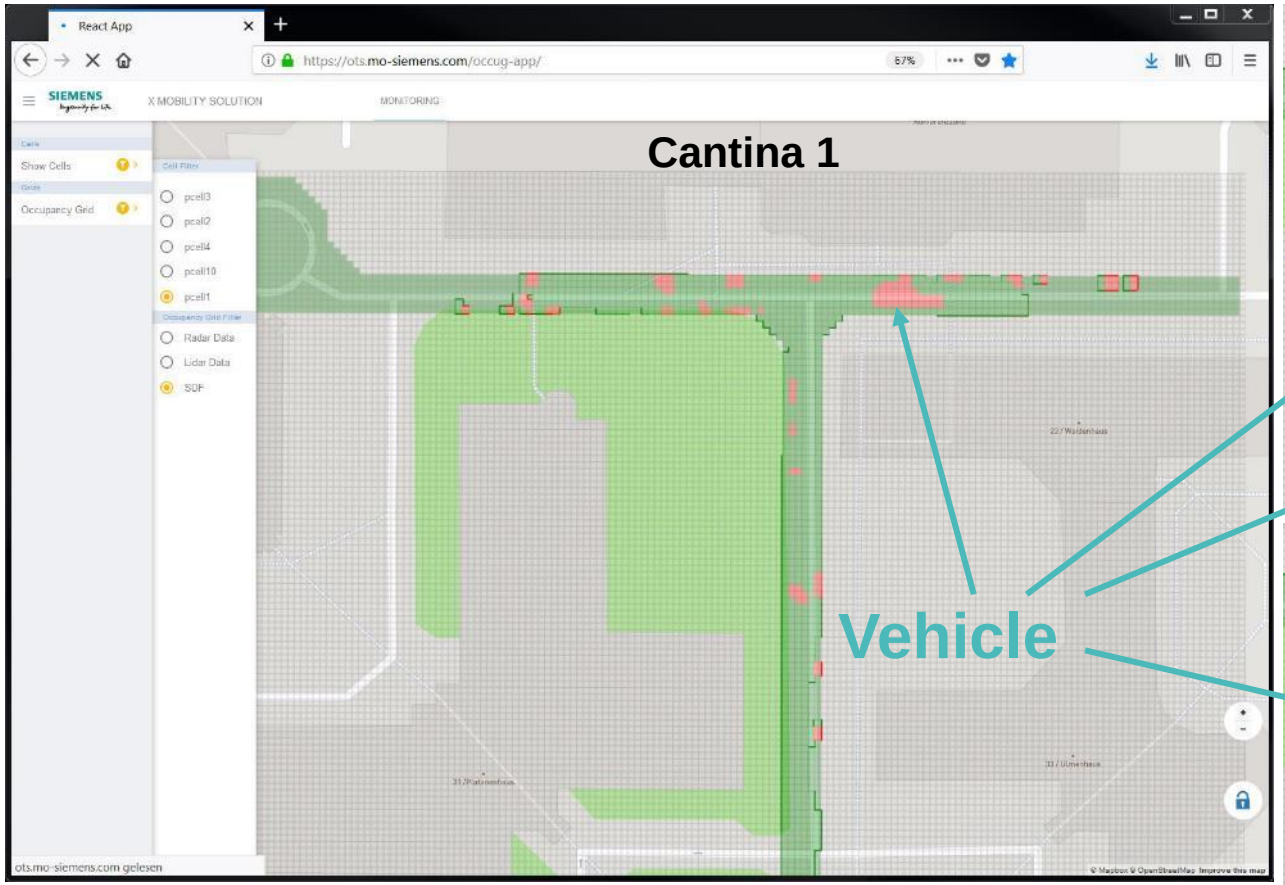
Road Site Unit

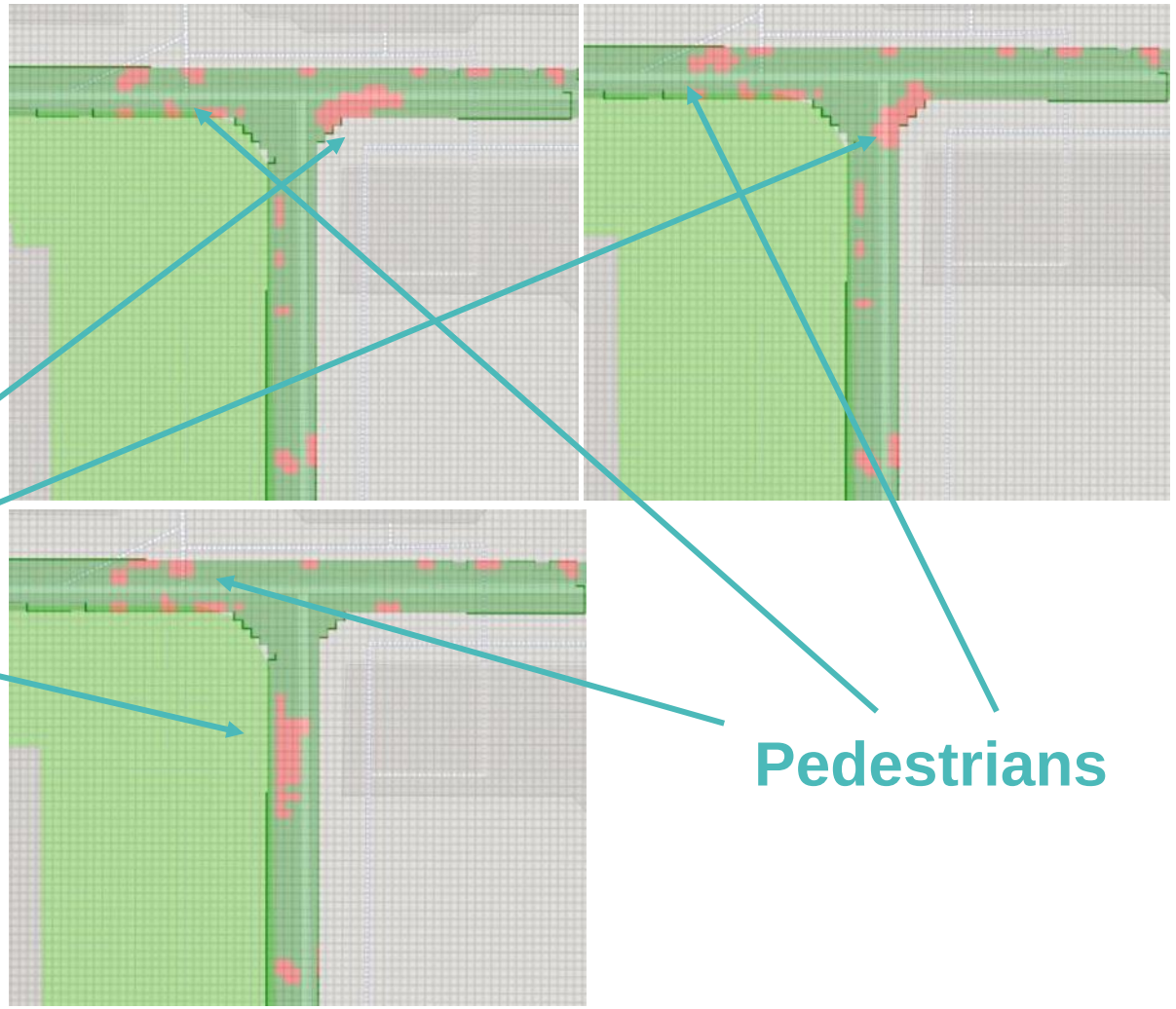
WLAN access point

Radar

Lidar

Occupancy Grid is at the core of our development roadmap





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Cloud-based micro services of SDV Suite – Overview

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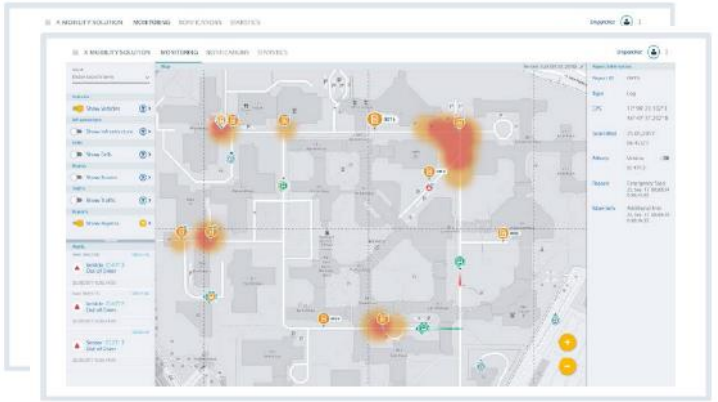
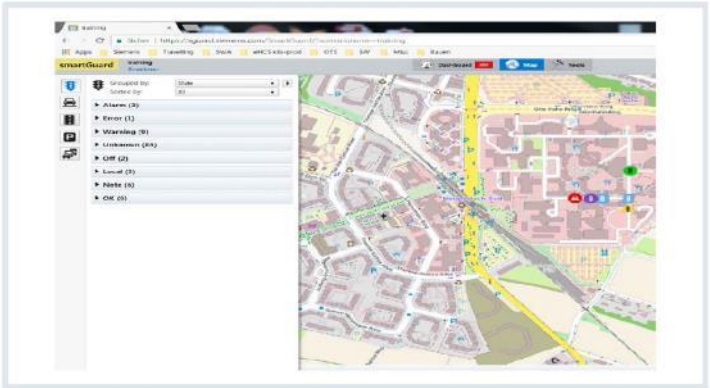
Mobility System Planning



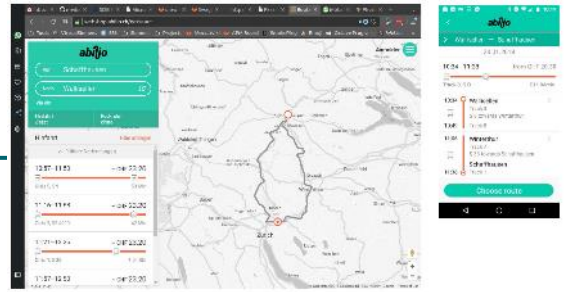
Mobility Service Planning



ITS Traffic Management

Fleet Management

Passenger Management



Intermodal Trip Management

Shuttle Passenger Information

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Our strategy: Be present in the most relevant areas, establish eco-system of partners and implement what we promise

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Area of application	**Urban**	**Campus** (e.g., airports)	**Interurban**
	 		
Pilot Projects	HEAT Sion (Postauto, CH) CETRAN Testbed	Airport Munich Siemens Perlach	KoRA9

SDV Core Technologies

SDV Offering

- **OTS 1.0** (Testbed Munich Perlach)
- **Intelligent Road** (Application Level)
- **SDV Basic Topics** (Basic Technology Level)
- **C2X** (Autonomous parking)

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Test beds in relevant environments – Together in an eco-system of strong partners

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OTS
Munich

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit
Technische Universität München
VDI|VDE|IT
Emm!
UTB Projektmanagement GmbH
IKEM
automotive engineering iav

HEAT
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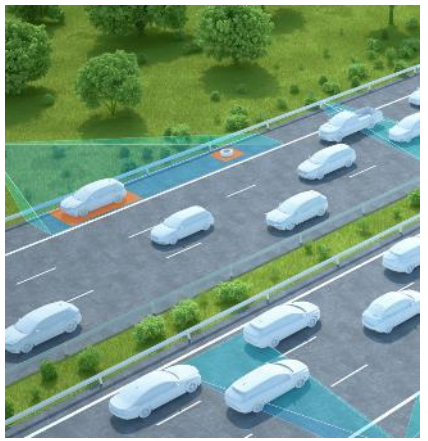
Interurban
KoRa9



Infineon
intel
Technische Universität München
Hochschule Augsburg University of Applied Sciences
Bundesministerium für Verkehr und digitale Infrastruktur
Autobahndirektion Südbayern

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Questions ?

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Seeking partners for 5G-PPP, H2020-ICT calls