



# Rede celular 5G aplicada à mobilidade conectada

FICIS 2019 | Braga, 04 Abril

Restricted © Siemens Mobility 2019

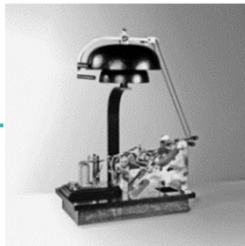
[siemens.com/traffic](https://www.siemens.com/traffic)

# We stand for continuity in innovation on roads, rail and for infrastructure

**SIEMENS**  
*Ingenuity for life*

1847

Werner von Siemens and Johann Georg Halske build the first alarm bell system



Rail signaling systems



**Trainguard MT**  
Driverless metro operation

1879

At the Berlin Trade Fair, Siemens presented the first electric railway



Rolling stock



**Velaro**  
One of the world's most efficient high-speed platforms

1924

Siemens installs the first automatic traffic lights on Berlin's Potsdamer Platz

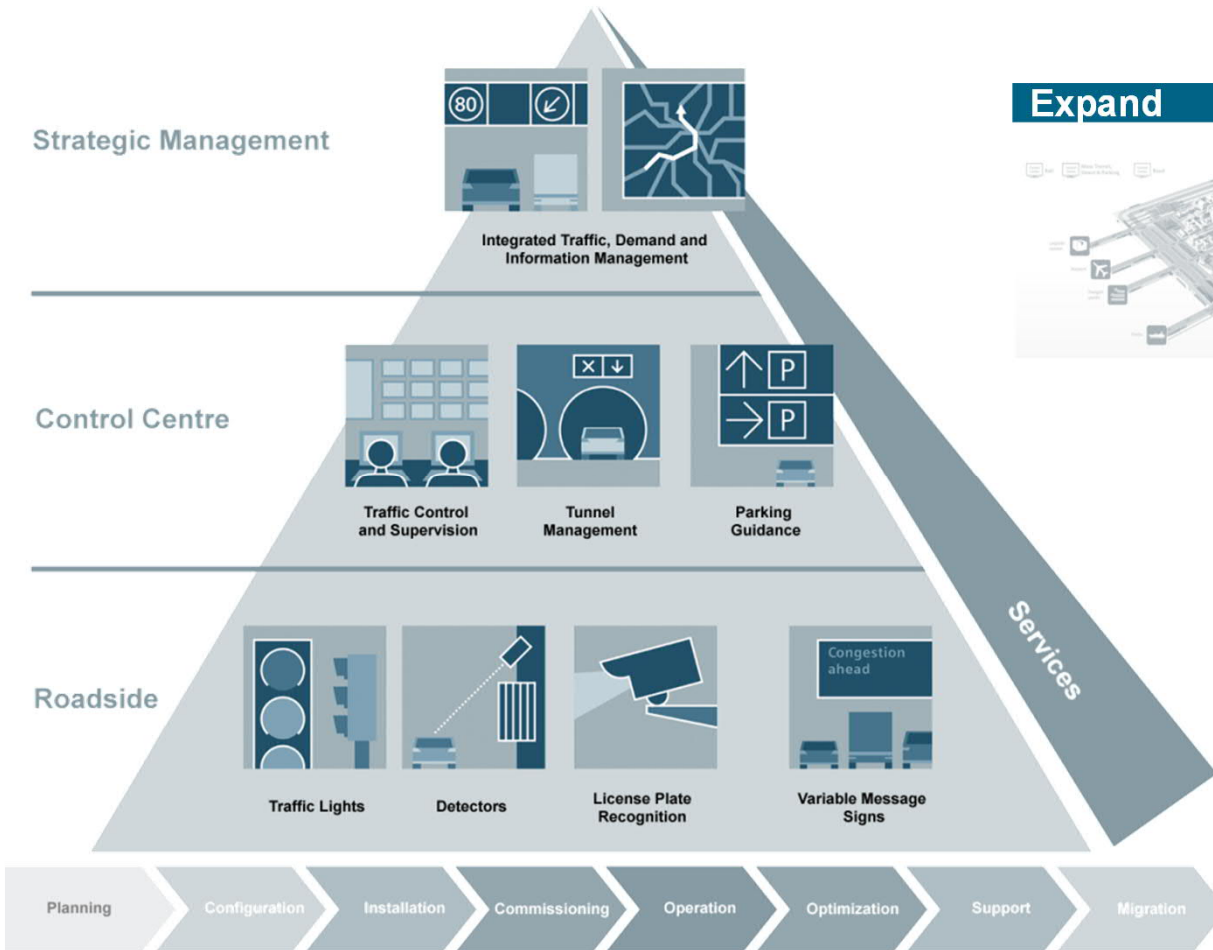


Traffic management systems









**smartGuard**  
Web-based traffic center "to go"

# Intelligent Traffic Systems | Overview



## Key References in Portugal:

-  Service for tunnels in Lisbon
-  Service for traffic management system (Lisbon)
-  Integrated Traffic Management System (Vilamoura)
-  e-Bikesharing system (Lisbon)
-  Service for tunnels in Porto
-  Service in interurban for IP

# Intelligent Traffic Systems | Several devices and sensors

**SIEMENS**  
*Ingenuity for life*



Sittraffic sX



Sittraffic smartGuard



Sivicam



Multilane Radar



Sittraffic Sensus - GPS based tolling



Silux2



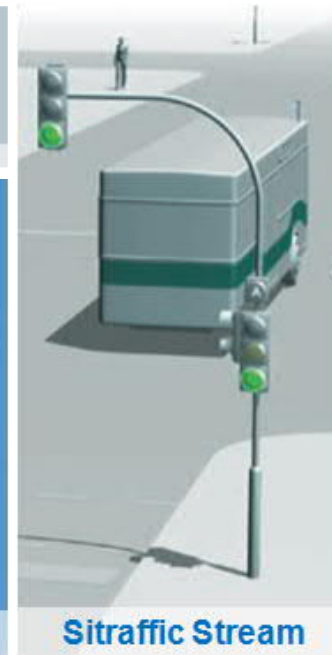
Heimdall



Phoenix



Sittraffic Sicore



Sittraffic Stream



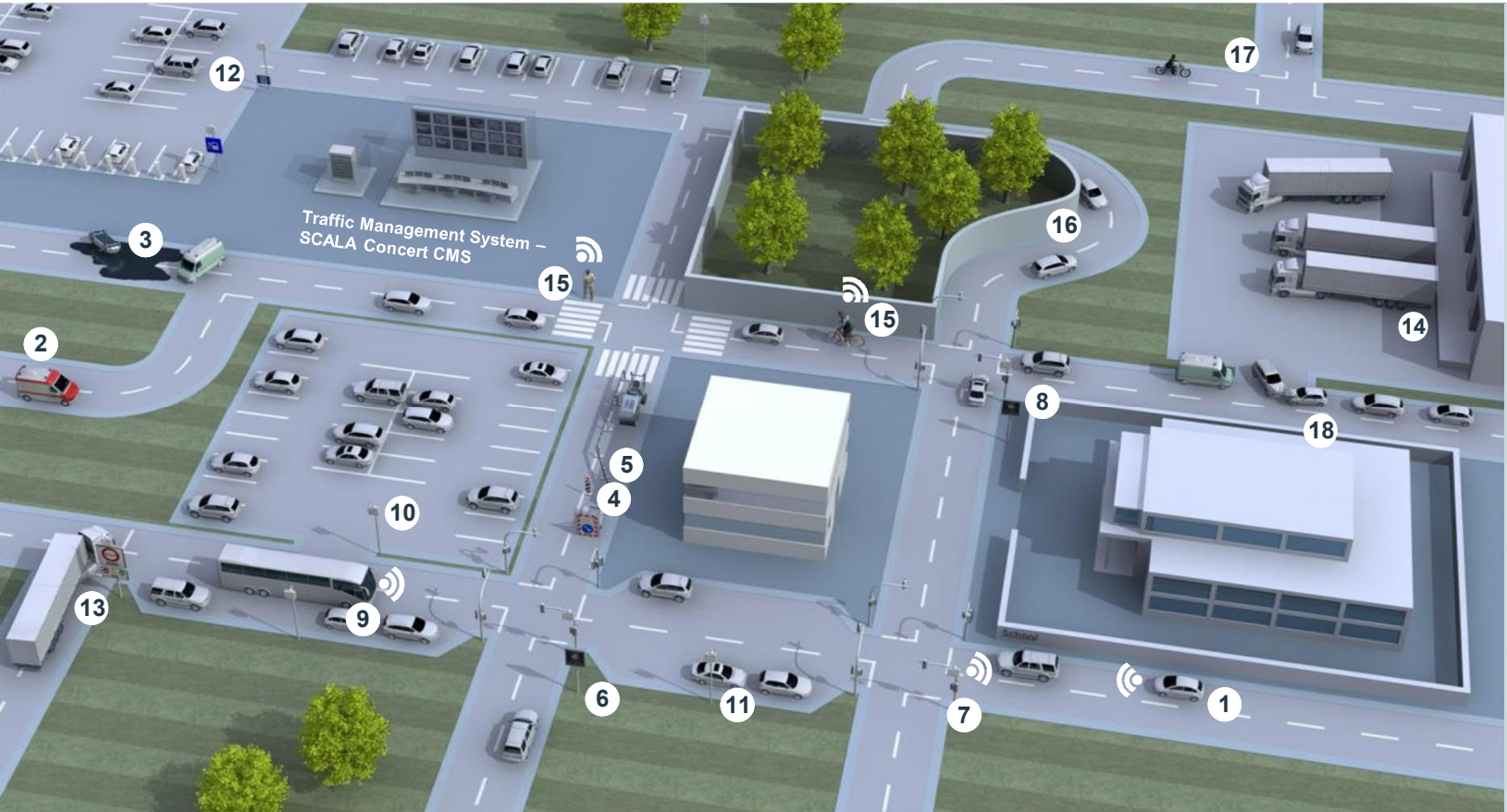
Access Control

Sittraffic ESCoS



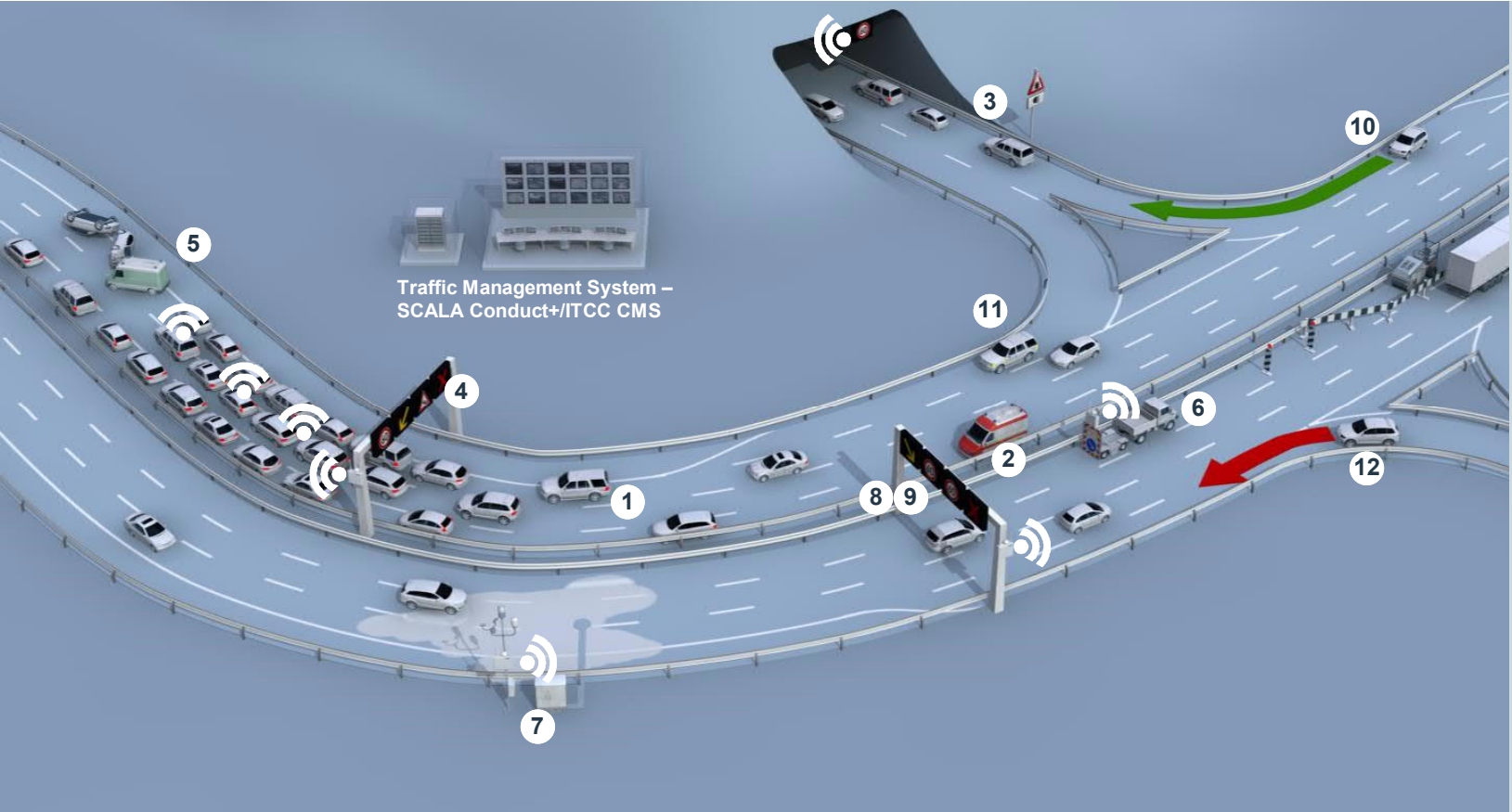
Sittraffic Wimag

# Cooperative, Connected and Automated Mobility | Urban Playground



- 1 Emergency electronic brake light
- 2 Emergency vehicle approaching
- 3 Hazardous location notification
- 4 Road works warning
- 5 In-vehicle signage
- 6 In-vehicle speed limits
- 7 GLOSA / Time To Green (TTG)
- 8 Signal violation/Intersection safety
- 9 Traffic signal priority request by designated vehicles
- 10 Off street parking information
- 11 On street parking information and management
- 12 Park & Ride information
- 13 Zone access control for urban areas
- 14 Loading zone management
- 15 Vulnerable road user protection (pedestrians and cyclists)
- 16 Cooperative collision risk warning
- 17 Motorcycle approaching indication
- 18 Slow or stationary vehicle(s)

# Cooperative, Connected and Automated Mobility | Interurban Playground



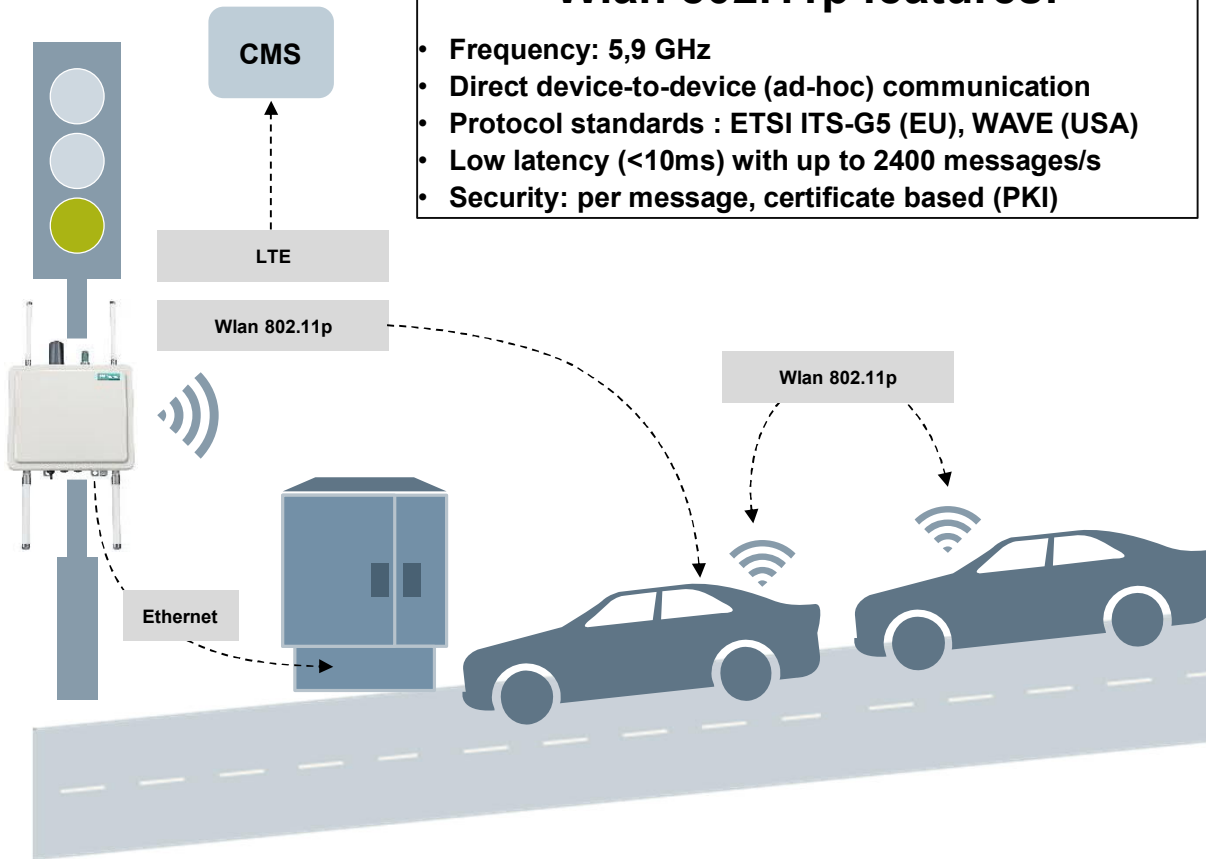
- 1 Emergency electronic brake light
- 2 Emergency vehicle approaching
- 3 Slow or stationary vehicle(s)
- 4 Traffic jam ahead warning
- 5 Hazardous location notification
- 6 Road works warning
- 7 Weather conditions
- 8 In-vehicle signage
- 9 In-vehicle speed limits
- 10 Traffic information and smart routing
- 11 Cooperative collision risk warning
- 12 Wrong way driving

# Sittraffic ESCoS (EcoSystemCooperativeSystem) V2x communication technologies comparison



## Wlan 802.11p features:

- Frequency: 5,9 GHz
- Direct device-to-device (ad-hoc) communication
- Protocol standards : ETSI ITS-G5 (EU), WAVE (USA)
- Low latency (<10ms) with up to 2400 messages/s
- Security: per message, certificate based (PKI)



**Additional** communication system for autonomous driving services in 3.4-3.8GHz band

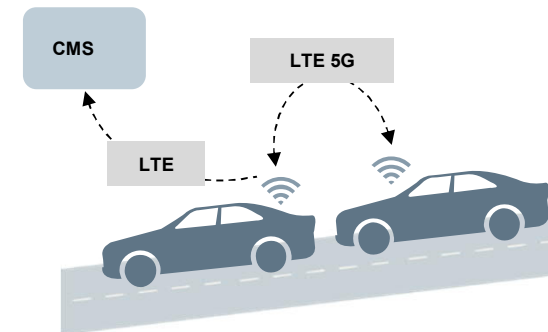
## Cellular-V2x/LTE-V2x features:

### Today:

- release 14 = LTE 3G/4G
- Latency depends on network utilization (500 ms - 6 s)

### In future:

- C-V2x 5G: 5 - 50 ms
- Latency and reliability not proven yet
- No chipsets available yet



## 5G-MOBIX | Objectives of the project

**SIEMENS**

*Ingenuity for life*



**5GMOBIX**

5G-MOBIX will develop and test automated vehicle functionalities along multiple cross-border corridors and urban trial sites, under all conditions of vehicular traffic, network coverage, service demand, as well as considering the inherently distinct legal, business and social local aspects.

**OBJECTIVE 1:** Formulate 5G technological requirements for advanced Cooperative Connected and Automated Mobility use cases.

**OBJECTIVE 2:** Establish corridors to evaluate 5G technologies and advanced CCAM in both highway cross-border and urban mobility scenarios under all conditions.

**OBJECTIVE 3:** Analyse costs and benefits of dedicated and validated 5G architecture and CCAM to justify commercially the technologies and deployments.

**OBJECTIVE 4:** Explore and asses new business opportunities for CCAM with 5G.

**OBJECTIVE 5:** Provide 5G deployment scenarios and recommendations to drive CCAM adoption and effective implementations from business and policy perspectives.

**OBJECTIVE 6:** Sustain standardisation and spectrum allocation by actively contributing to the discourse.

**OBJECTIVE 7:** Scale up and replicate for a global adoption of the 5G for CCAM.



# 5G-MOBIX | Partners

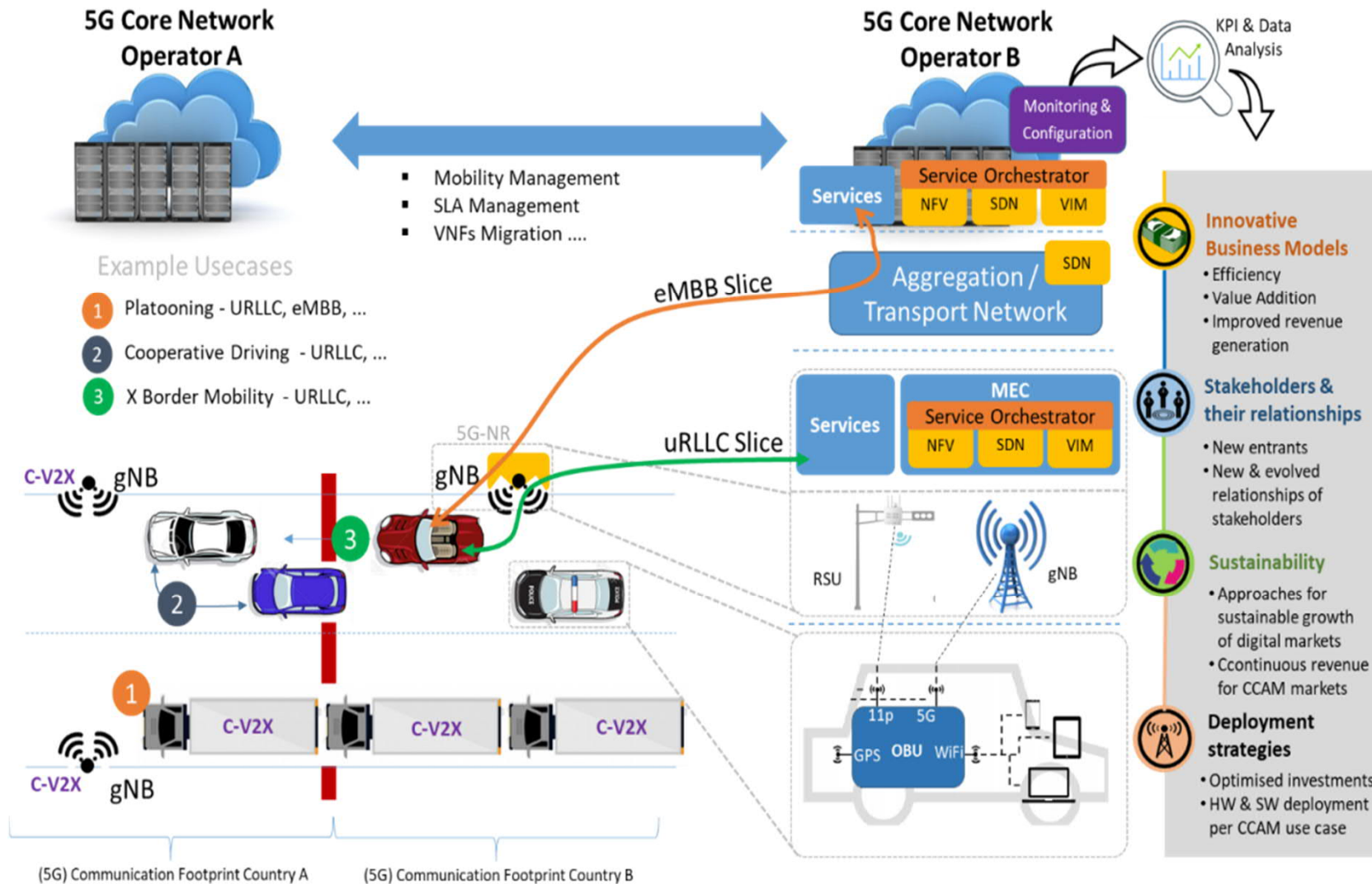


Restricted © Siemens Mobility 2019

## 5G-MOBIX | Scenarios over the trial sites

Sites	CCAM scenarios	Automated driving					MaaS	Digital infrastructure	Info. society on the road
		Critical manoeuvres							
		Highway driving	Truck platooning	Urban driving	Car parking	Public transportation			
GREECE – TURKEY									
SPAIN – PORTUGAL									
FINLAND									
FRANCE									
GERMANY									
THE NETHERLANDS									
CHINA									
SOUTH KOREA									

# 5G-MOBIX | Concept and trial architecture



Trials through 2 network slices:

- eMBB for high data throughputs
- uRLLC for low latency connectivity

Local and cross-border trials with challenging Automated driving scenarios:

- Cooperative manoeuvre
- Platooning

**Innovative Business Models**

- Efficiency
- Value Addition
- Improved revenue generation

**Stakeholders & their relationships**

- New entrants
- New & evolved relationships of stakeholders

**Sustainability**

- Approaches for sustainable growth of digital markets
- Continuous revenue for CCAM markets

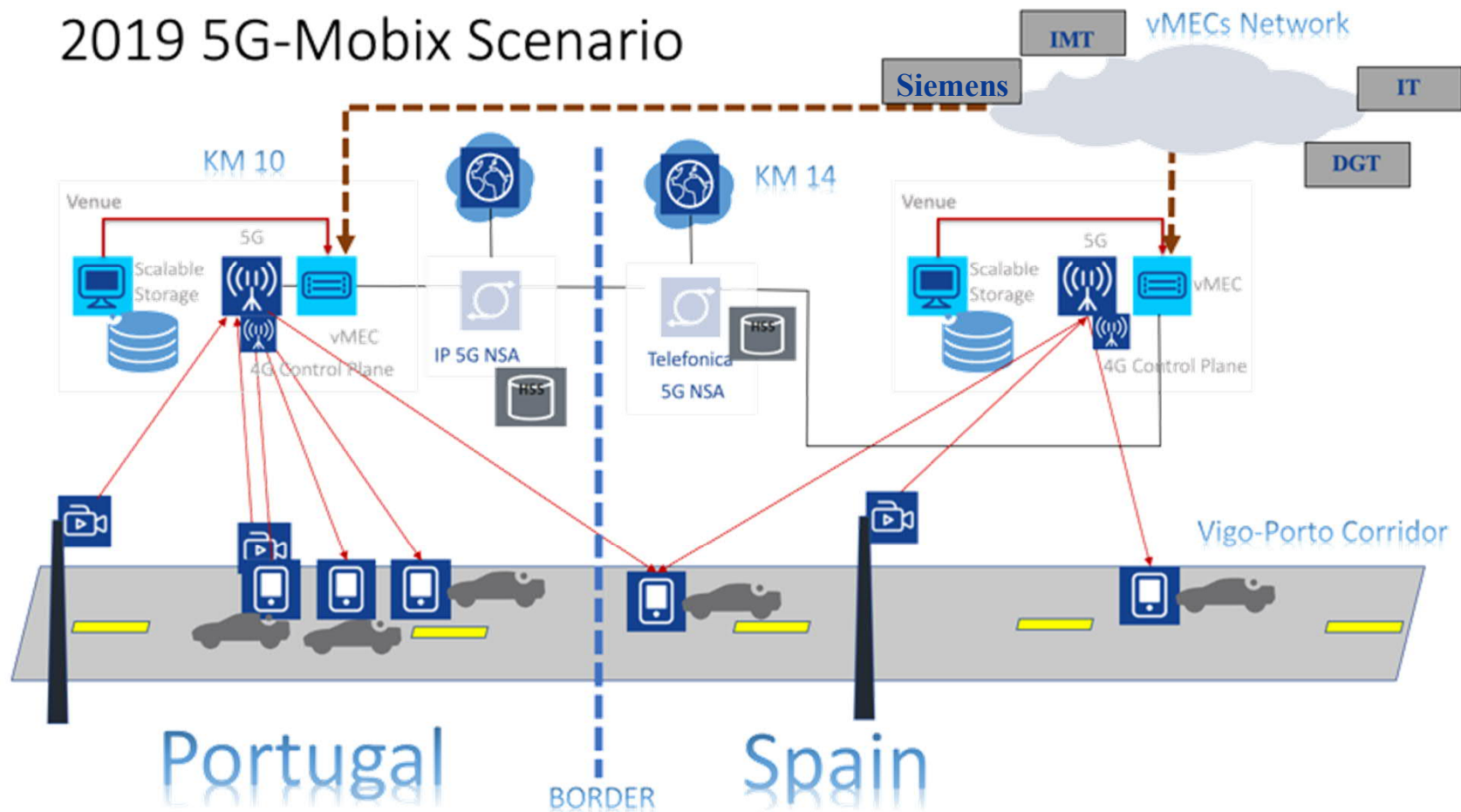
**Deployment strategies**

- Optimised investments
- HW & SW deployment per CCAM use case

# 5G-MOBIX | Portugal – Spain trial site



## 2019 5G-Mobix Scenario



Obrigado!

**SIEMENS**  
*Ingenuity for life*



**Miguel Velosa Rodrigues**  
Head of Business Segment  
Intelligent Traffic Systems

Rua Irmãos Siemens, 1  
2720-093 Amadora

Mobile: +351 919 801 925

E-mail: [miguel.Rodrigues@siemens.com](mailto:miguel.Rodrigues@siemens.com)

LinkedIn: [linkedin.com/in/miguelvelosarodrigues/](https://www.linkedin.com/in/miguelvelosarodrigues/)

**siemens.pt**