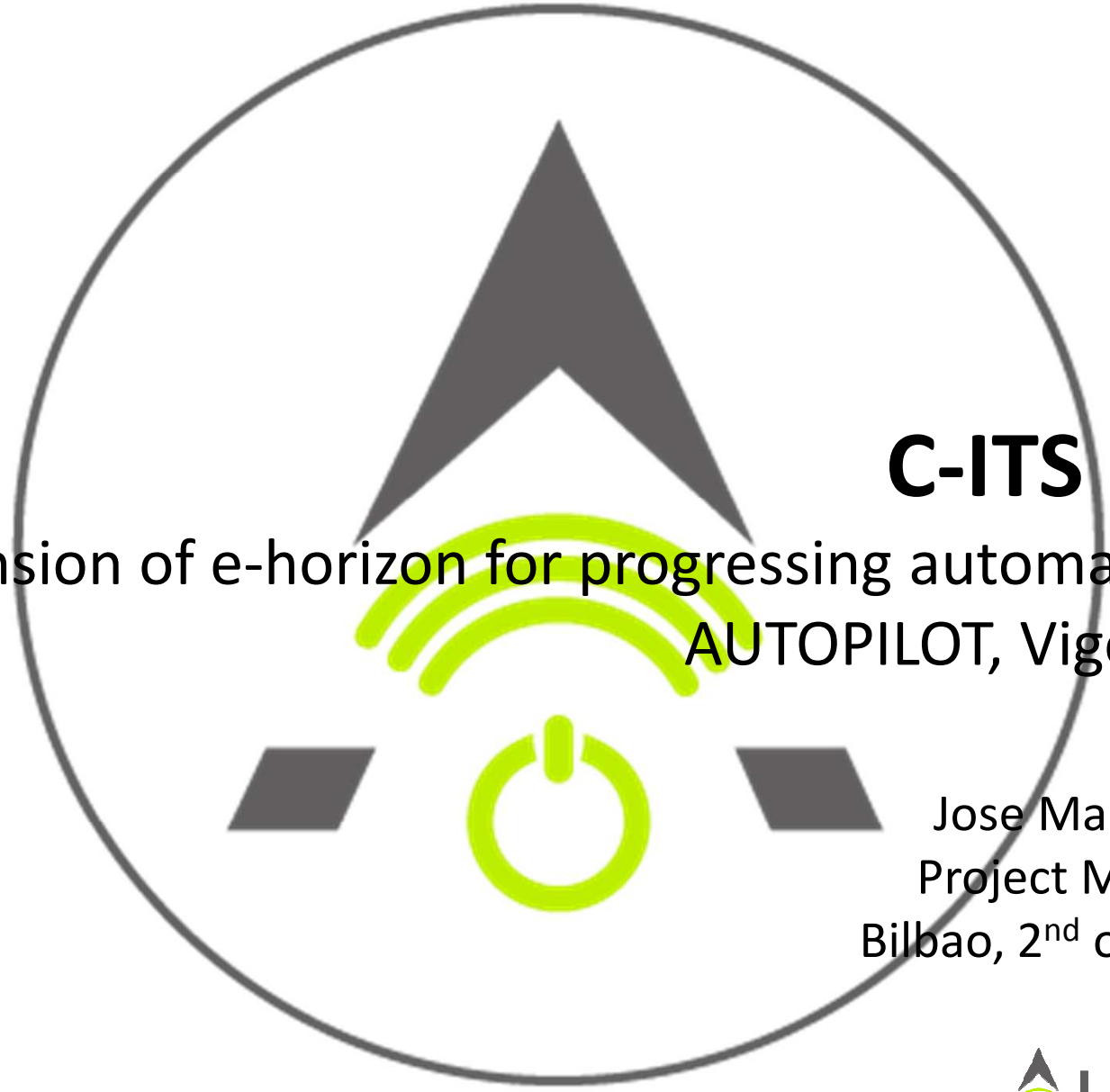


C-ITS into IoT.

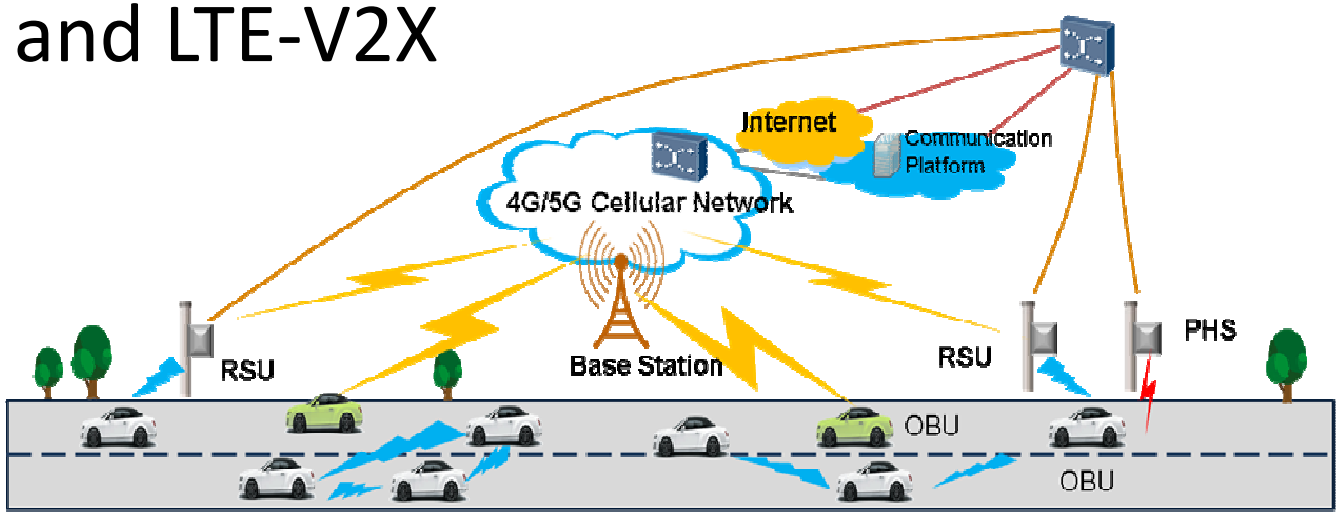
Extension of e-horizon for progressing automated driving. AUTOPILOT, Vigo approach.

Jose Manuel Martínez
Project Manager. CTAG
Bilbao, 2nd of March 2017

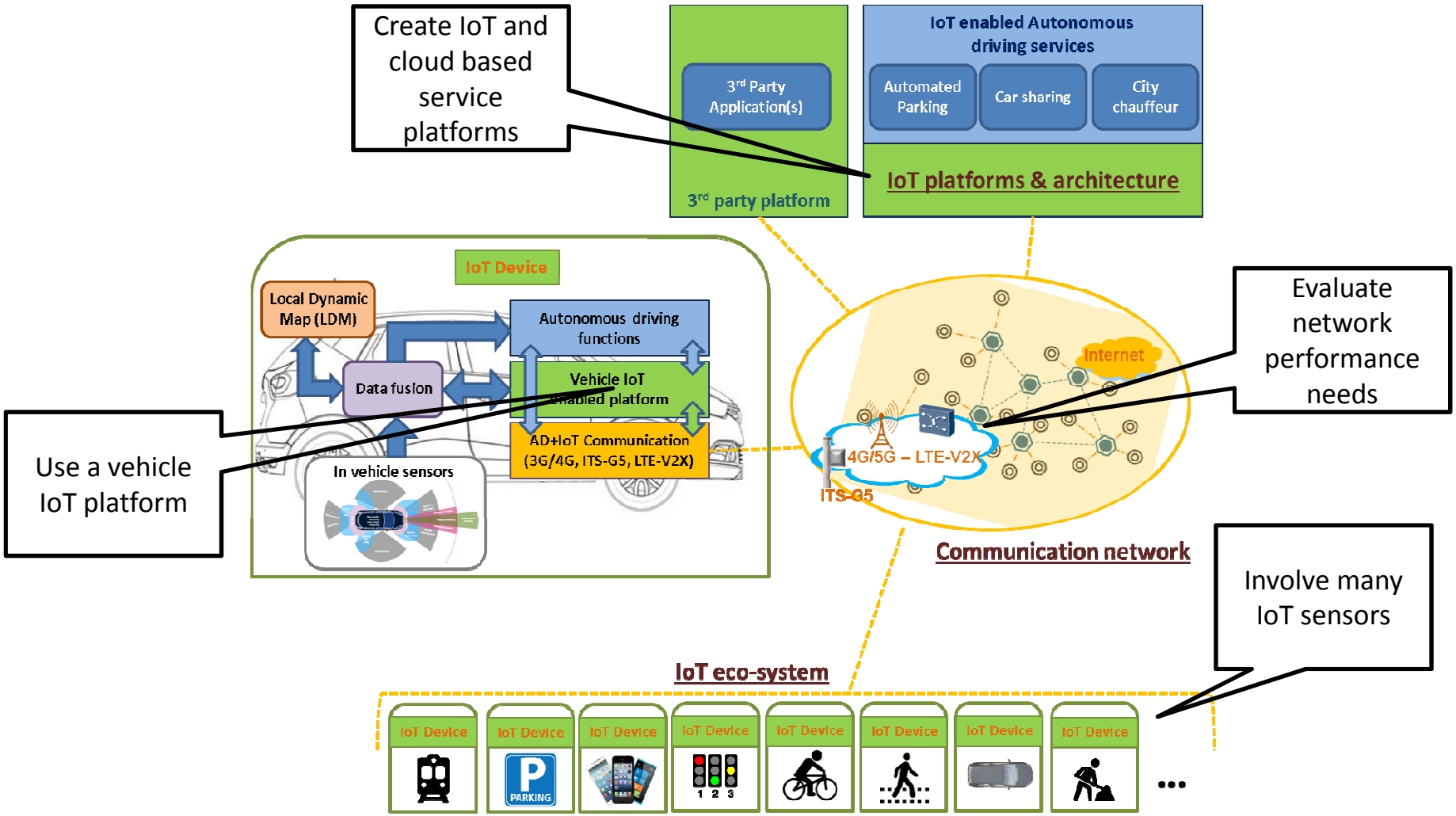
AUTOPILOT

Communication

- IoT information exchanged over a wide range of different networks - especially V2V/V2I: ITS-G5 and LTE-V2X



AUTOPILOT overall concept



AUTOPILOT overall concept

- The **overall IoT platforms and architecture**, for the provision of automated driving application and services
- The **Vehicle IoT integration and platform** to make the vehicle an IoT device, using and contributing to the IoT
- The **Automated Driving relevant sources of information** (pedestrians, traffic lights …) **becoming IoT devices** and extending the IoT eco-systems providing an enhanced perception of the driving environment
- The communication network **using appropriate and advanced connectivity technology** for the vehicle as well as for the other IoT devices

AUTOPILOT

Project objectives

Merging automotive and IoT technologies to move Automated Driving towards a new dimension

- Enhance the driving environment perception with IoT sensors
  - enable safer highly automated driving
- Foster innovation in automotive, IoT and mobility services
- Use and evaluate advanced V2X connectivity technologies
- Involve Users, Public Services, Business Players
  - assess the IoT socio-economic benefits
- Contribute to the IoT Standardisation and eco-system

AUTOPILOT

AUTOPILOT Open IoT design

- STANDARD-BASED
  - A standard-based conceptual architecture, where legacy or proprietary IoT systems can be integrated into a common system.
- ABSTRACTION
  - Abstraction-based information model following the IoT-A ARM or the AIOTI High-Level IoT Architecture
- FEDERATION
  - Federation-based model, in which private IoT systems and public IoT systems can co-exist and collaborate on-demand
- SEMANTIC
  - IoT information model based on formal semantics to achieve automated processing of large variety of information items.
- FUNCTIONAL DISTRIBUTION
  - Architecture enabling functional elements to be allocated into devices, edge systems and Clouds.
- SECURE and PRIVACY-BY-DESIGN
  - The IoT platform will provide security functions and follow the “Privacy-by-Design” principles.

AUTOPILOT

Deploy IoT based automated driving scenarios and services

Automated driving Scenarios

- Urban Driving – Highway pilot – Platooning - Automated Valet Parking

Services for Automated driving

- City chauffeur services for tourists
- Automated driving route optimisation
- Real time car sharing
- Driverless car rebalancing
- HD maps for automated driving vehicles
- Electronic Driving License

AUTOPILOT

Brainport, NL

- Automated Valet Parking
- Highway pilot
- Platooning

Tampere, FI

- Automated Valet Parking
- Urban Driving

Versailles, FR

- Automated Valet Parking
- Urban Driving
- Platooning

Daejeon, KR

- Urban Driving

Vigo, SP

- Urban Driving
- Automated Valet Parking

Livorno, IT

- Urban Driving
- Highway pilot

6 pilot sites

Project information

5 Large Scale Pilots on IoT are funded by the European Commission

- AUTOPILOT is the Pilot 5: autonomous vehicle in a connected environment
- Innovation Action - 3 Years: 01/01/2017 – 31/12/2019
- 44 beneficiaries – coordinator: ERTICO
- Project costs: €25.425.252 - EU contribution: €19.924.984
- European Commission: DG CONNECT unit E.4 – IoT / H.2 Smart Mobility & living / A.1 Robotics & Artificial Intelligence

European Platforms Initiative

European Large-Scale Pilots Programme

AIOTI

The 5 Large scale pilots are cross coordinated and supported by 2 CSA:

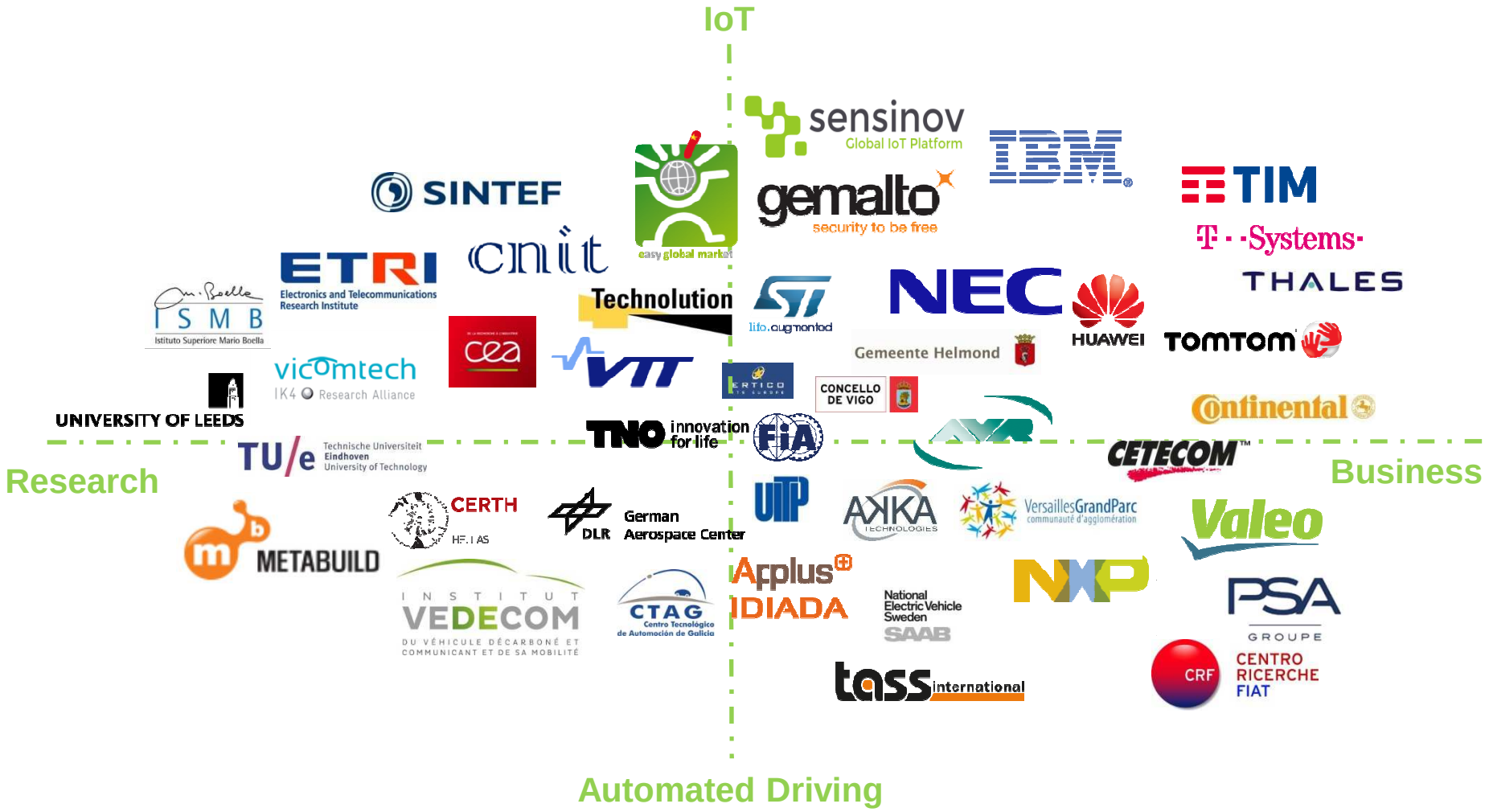
- CREATE-IoT (create-iot.eu)
- U4IoT (www.u4iot.eu)

CREATE-IoT

U4IoT

AUTOPILOT

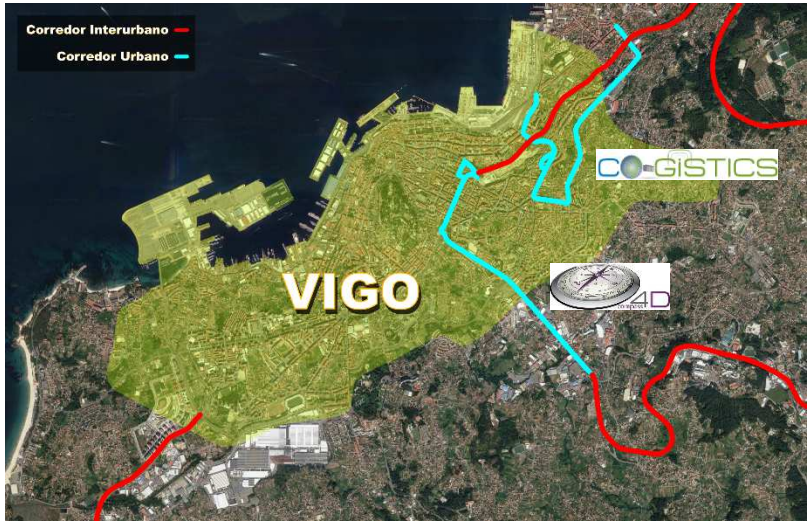
The AUTOPILOT partners

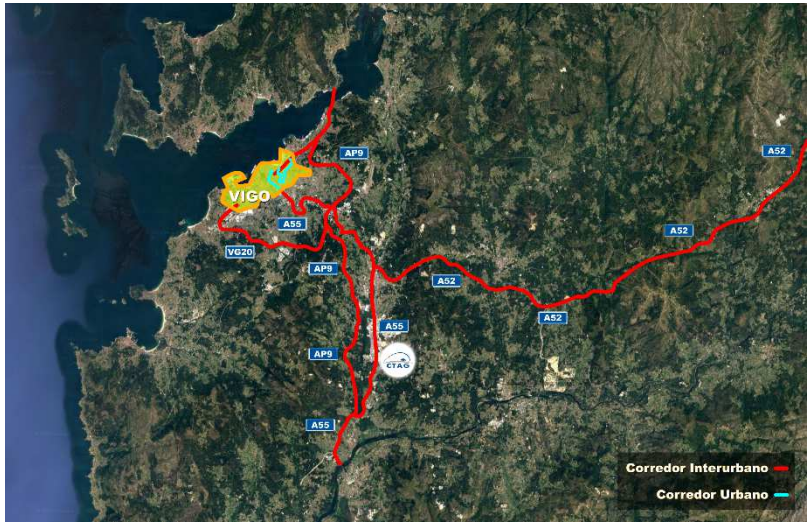


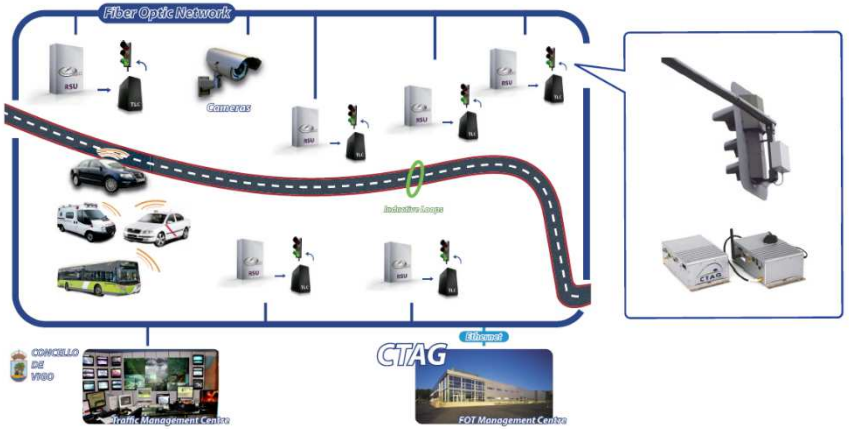
(Spain) SISCOGA Urban Site. Vigo

- Location & General description
- Local Consortium
- AD use cases
- IoT – Connectivity
- Work plan/methodology
- Next steps

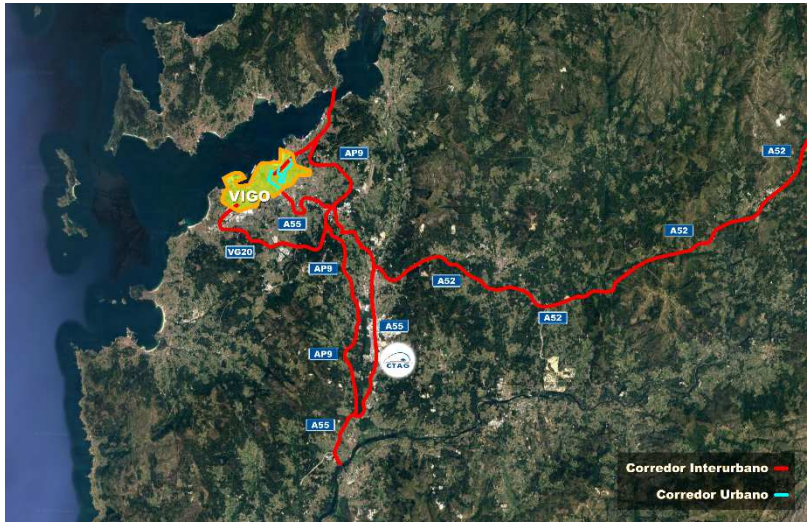
Location & General description

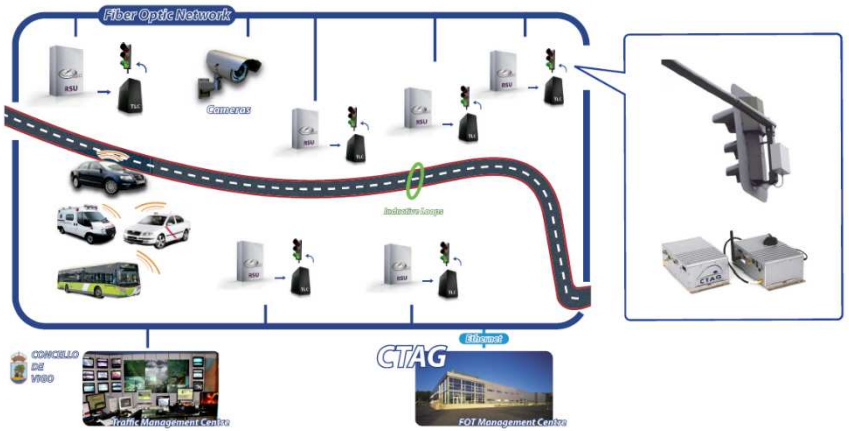






Location & General description

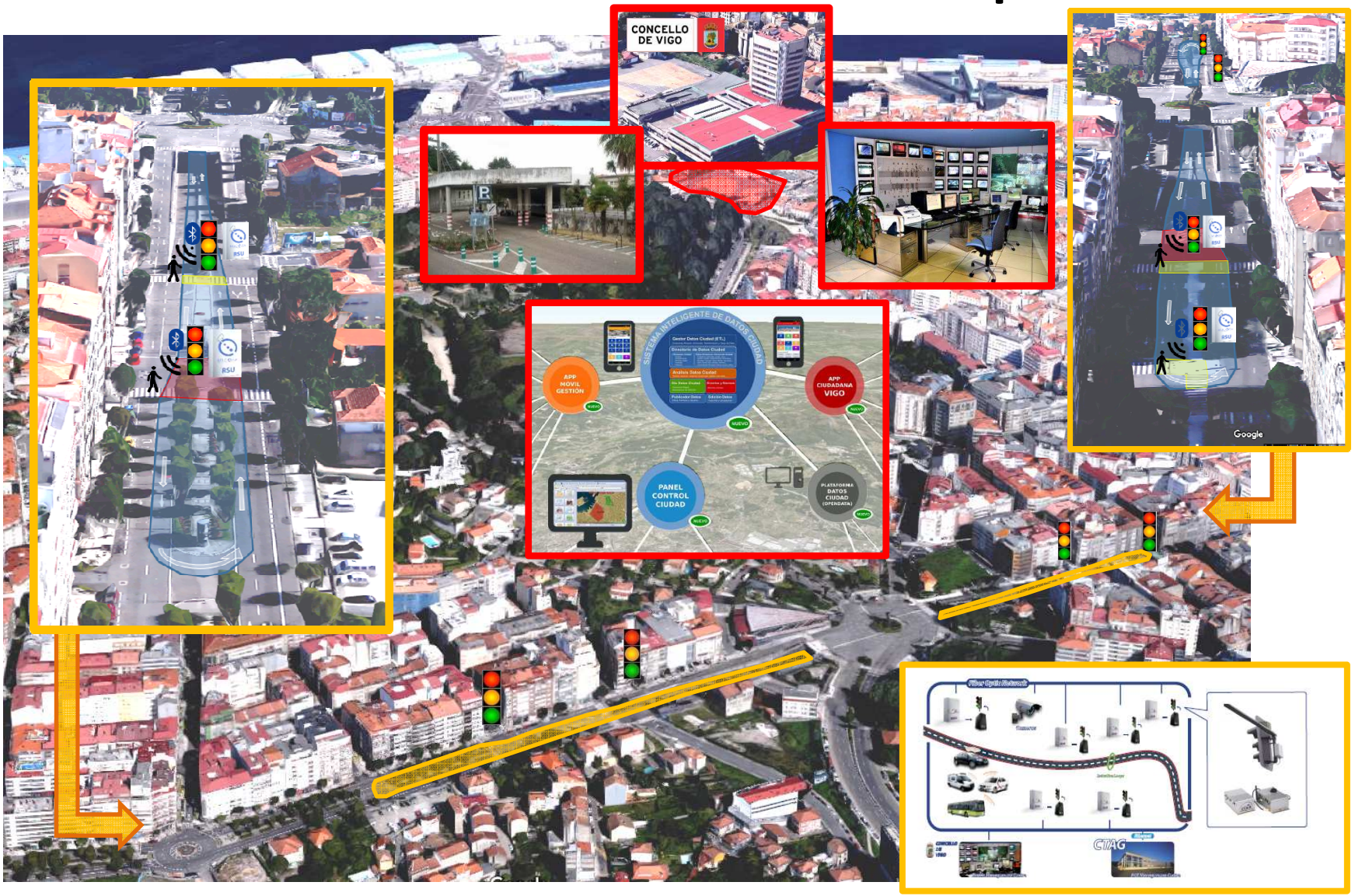




- ITS G5 (50 intersections)
- 3G/4G (LTE-V2X)
- In connection with IoT city platform integrating cameras road sensors
- Centralised in City TMC

AUTOPILOT

Location & General description



Local Consortium

CONCELLO DE VIGO	Traffic Authority Road Enabler	• **Enabling the road infrastructure adaptation and use for piloting AUTOPILOT use cases**
PSA GROUPE	Vehicle Manufacturer	• Wide expertise in C-ITS services, AD functions • **2 vehicles for being automated and equipped with IoT platform.**
CTAG	Test Site Leader	• Developing & testing of automated driving applications • Developing & testing of C-ITS and connected vehicle services • Background in Pilot managing • **1 Vehicles automated with IoT platform**

AUTOPILOT

AD use cases

– Urban Autopilot with Cooperative Sensing

- vehicles circulate in urban roads in autonomous mode **adapting speed to the remaining time of traffic lights** and reacting to potential **warnings provided by TMC**
- **IoT aspect:** the vehicle has access to Traffic light status/timing and hazard warnings through real time connection **to infrastructure.**

AD use cases

– Urban Autopilot with Cooperative Sensing

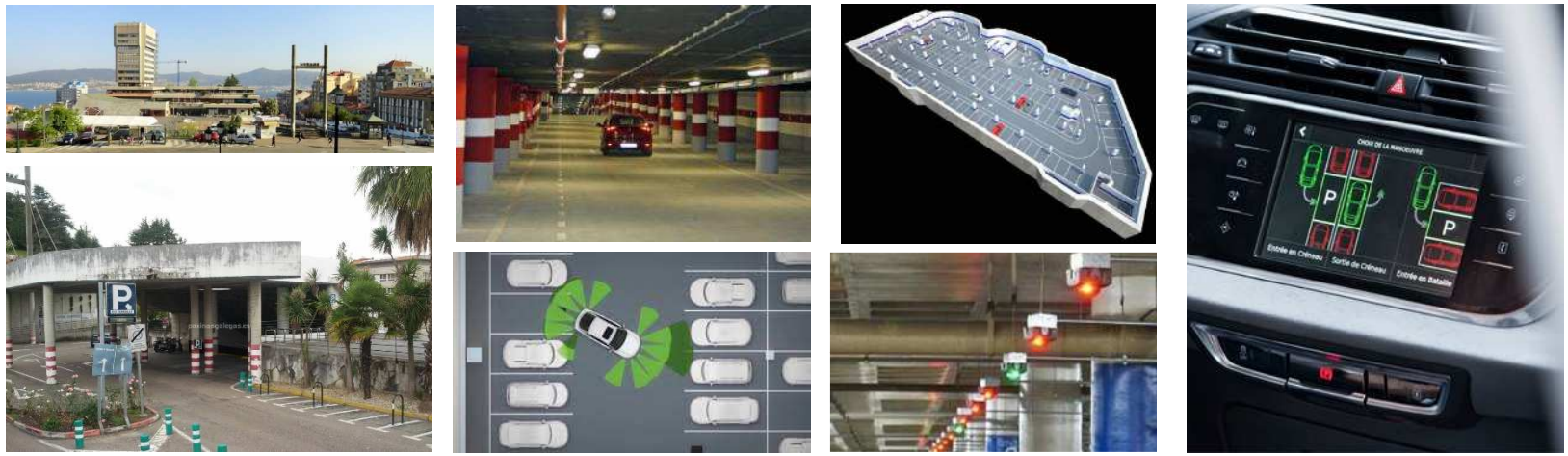
- Information about hazards as a pedestrian on the road will be sent/received and processed to support AD task.
- **IoT aspect:** each vehicle acts as mobile sensor and interchange information with infrastructure and other vehicles. Infrastructure sensors an cameras are integrated in such data interchange

Cooperative Urban Autopilot: Cooperative AEB

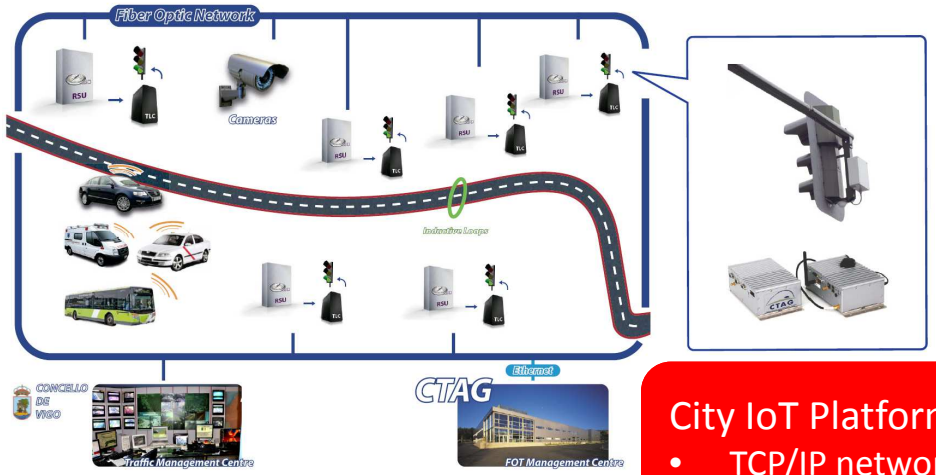
AD use cases

– Automated VALET Parking

- Autonomous guidance and parking of vehicle inside underground parking lot.
- **IoT aspect:** the vehicle stablish connection with parking infrastructure and manoeuvers are supported by information from parking cameras and sensors together with parking mapping and instructions according internal traffic.



IoT – Connectivity



City IoT Platform

- TCP/IP network
- ITS G5
- Cellular 3G/4G
- Bluetooth sensors
- Cameras

On Board IoT Platform

- CAN BUS Connection
- ITS G5
- Cellular 3G/4G LTE-V2X

AUTOPILOT

Work plan

	PM			2017												2018												2019											
				Ene.	Feb.	Mar.	Abr.	May.	Jun.	Jul.	Ago.	Sep.	Oct.	Nov.	Dic.	Ene.	Feb.	Mar.	Abr.	May	Jun.	Jul.	Ago.	Sep.	Oct.	Nov.	Dic.	Ene.	Feb.	Mar	Abr.	May	Jun.	Jul.	Ago	Sep.	Oct.	Nov.	Dic.
				1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
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	CTAG	PSA	VGO																																				
WP1 Requirements, specifications & architecture	4	2	0,5																																				
WP1.1 Autonomous Driving Use-case Specification	1	1	0,5		M				D1.1																									M			D1.1	
WP1.2 IoT architecture and specification	1								D1.2																												D1.2	
WP1.3 Vehicle IOT Platform specification	2	1										D1.3																									D1.3	
WP1.4 Communication Specification												D1.4																									D1.4	
WP1.5 Security, Privacy and Data Specification												D1.5																									D1.5	
WP2 Development, integration & verification	18	3	0																																			
WP2.1 Vehicle IoT integration	5	3							M								D2.1																					
WP2.2 Autonomous driving function adaptation	5																D2.2																					
WP2.3 Development of the open IoT service platform	3																D2.3																					
WP2.4 Development of the IoT "eco-system"	3																D2.4																					
WP2.5 Pilot Readiness Verification	2											D2.5									D2.6																	
WP3 Large scale pilots	18	3	3																																			
WP3.1Pilot site test specification	1		1								M			D3.1						D3.1																		
WP3.2 Pilot site adaptation	6		1																		D3.2																	
WP3.3 Pilot tests	8	3	1																		D3.3														D3.3		
WP3.4 Test data management	3													D3.4					D3.5		D3.6														D3.7			
WP4 Evaluation	4	0	1,5																																			
WP4.1 Evaluation requirement and methodology													D4.1																									
WP4.2 Technical evaluation	2																				D4.2															D4.2		
WP4.3 Business impact assessment																										D4.3										D4.3		
WP4.4 Quality of life impact assessment	2		1,5																																	D4.4		
WP4.5 User acceptance																					D4.5															D4.6		
WP4.6 Legal Issues																					D4.7															D4.7		
WP5 Communication - Dissemination - Exploitation	1	2	2																																			
WP5.1 Communication strategy						D5.1	D5.2																															
WP5.2 Scientific dissemination & project events organisation	1		1																		M							M							M			M
WP5.3 Business exploitation		2	1																											D5.5								D5.5
WP5.4 Cross-fertilization with IoT and Autonomous transport														D5.3												D5.4											
WP5.5 Standardisation & conformance assessment								D5.6																														D5.7
WP6 Coordination	2	0	0																																			
WP6.1 Project administrative management				D6.1										D6.2												D6.2											D6.2
WP6.2 Project technical coordination	2																																					D6.3
WP6.3 Innovation management						D6.4																																
WP6.4 Research data management								D6.5																														
WP6.5 Quality Assurance						D6.6																																

Work plan/methodology

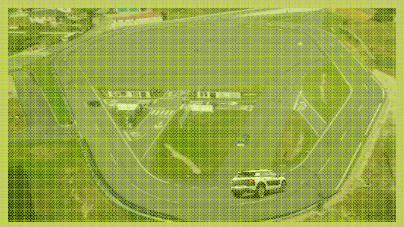
- WP1 WP2 WP3 Scalable approach

Expected Achievements

Use case Complexity
From one single vehicle

To multiple actors

Environmental Control
From controlled environment



Towards real Traffic

Site Area Extension
From reduced areas

To wider extension

AUTOPILOT

Muchas Gracias

AUTOPILOT is an Innovation Action co-funded by the European Union's H2020 Framework Programme under Grant Agreement no 731993