



CELLNEX MOBILITY LAB

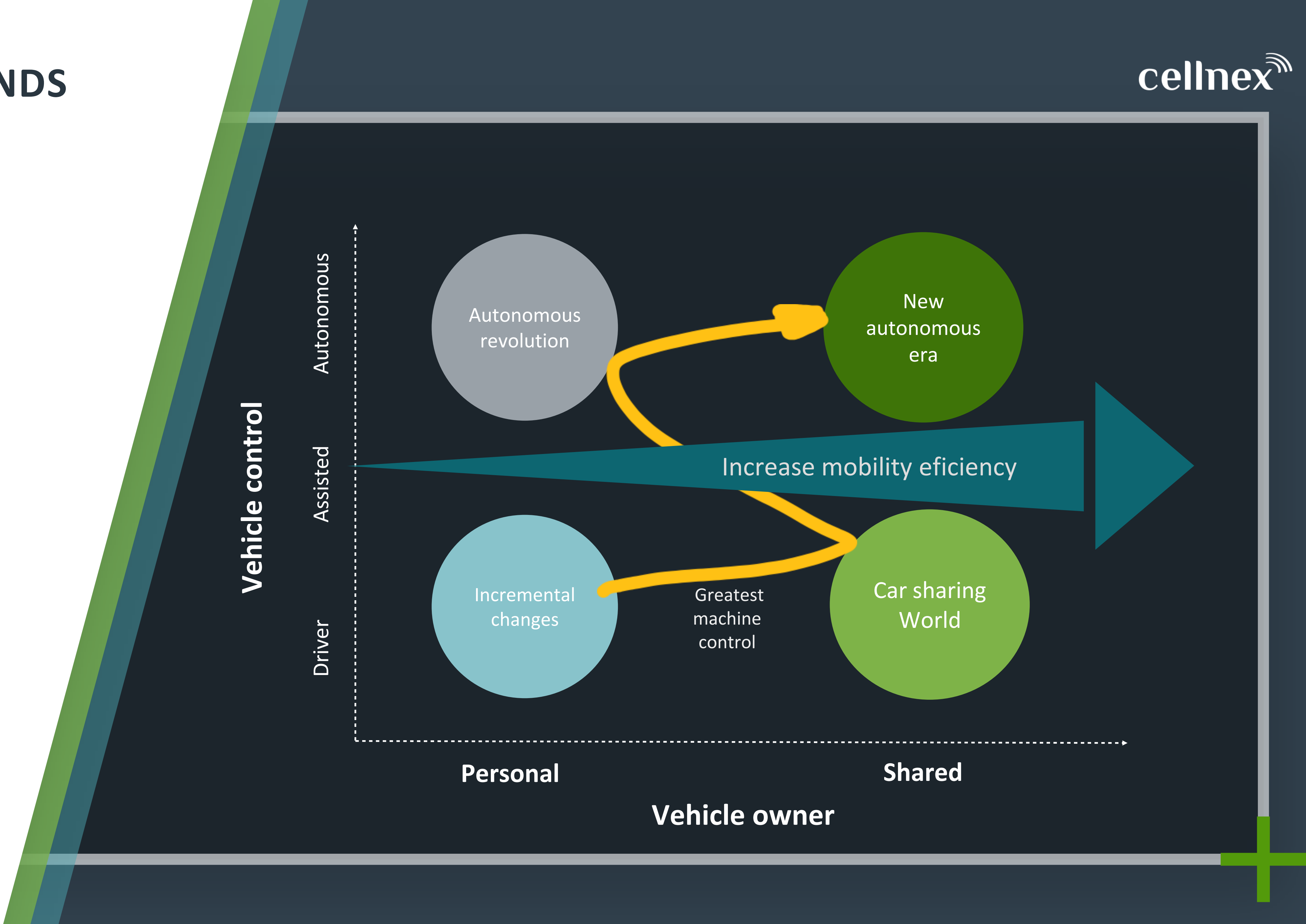
Towards sustainable and
autonomous mobility



cellnex
driving telecom connectivity

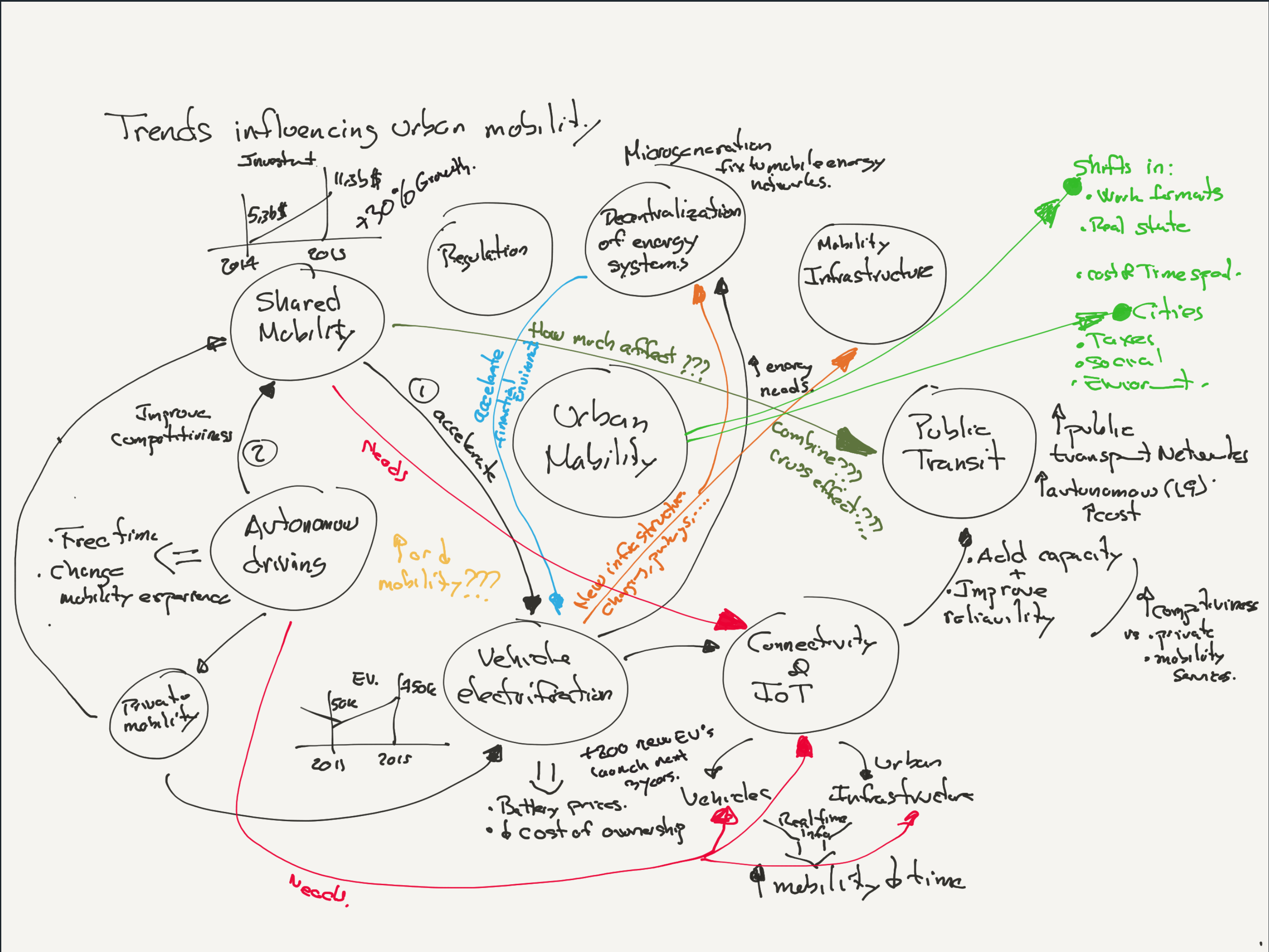
VISION / TRENDS

Future mobility scenarios.



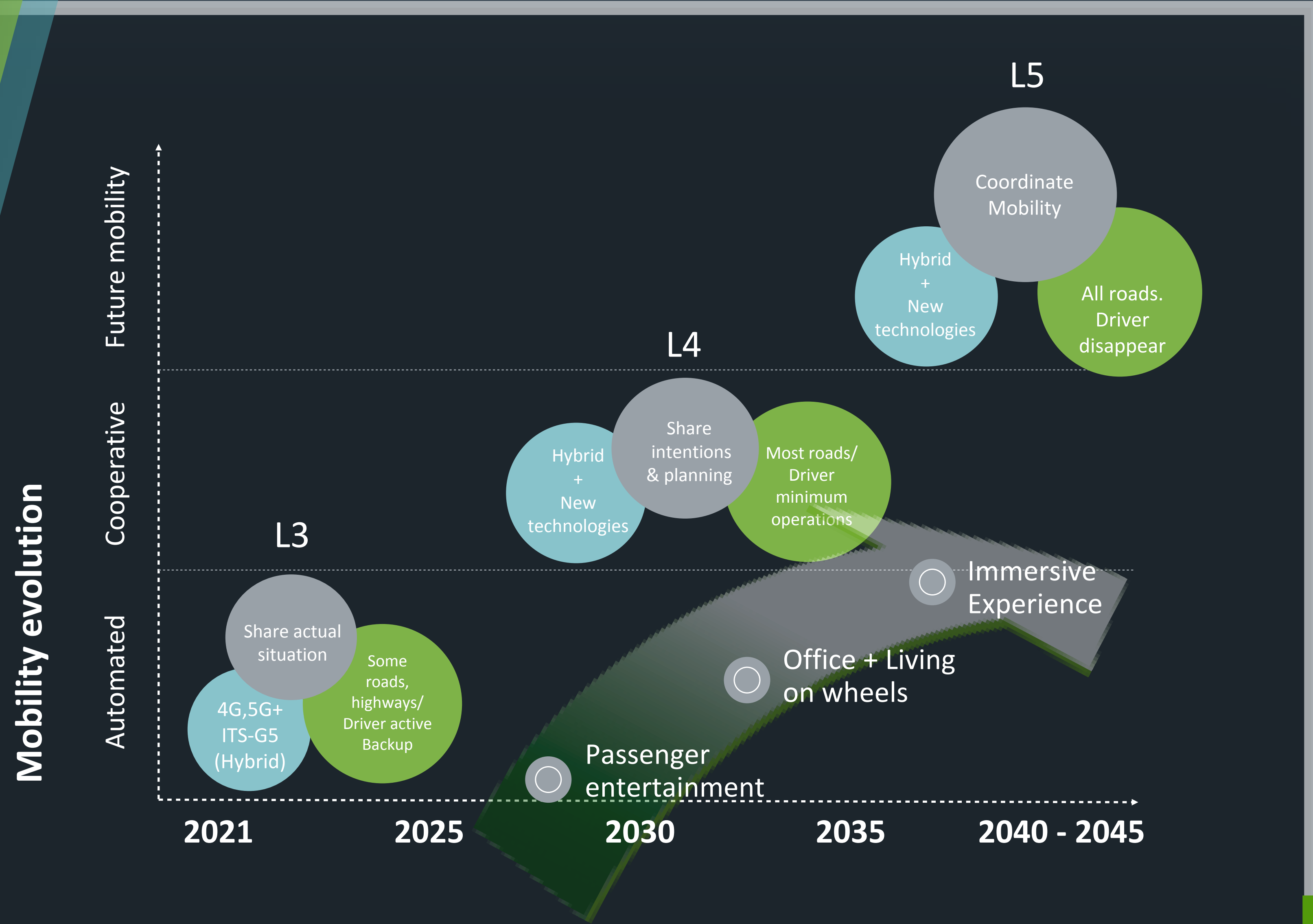
VISION / TRENDS

Future mobility scenarios.



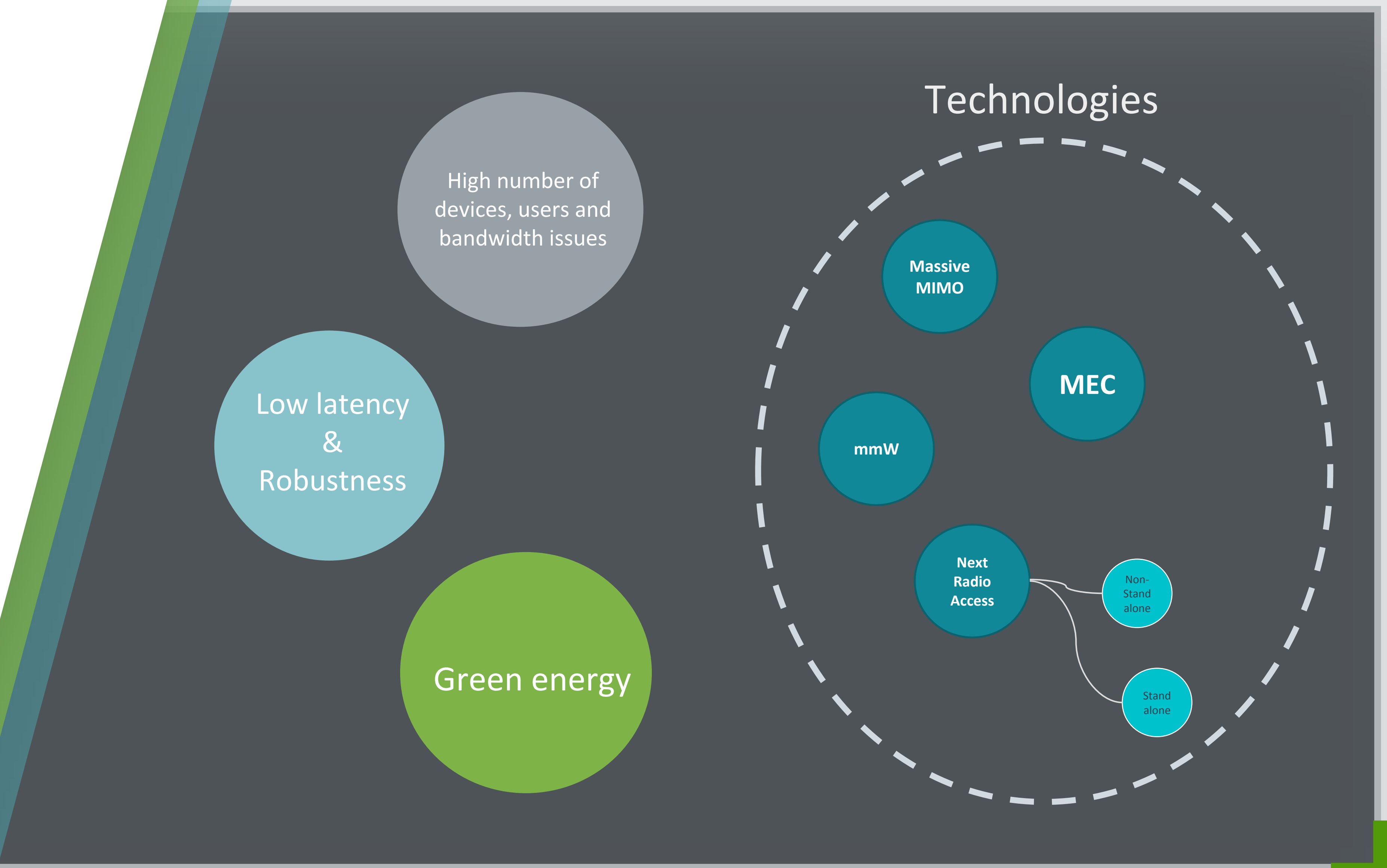
VISION / TRENDS

Cooperative
connectivity towards
automated mobility



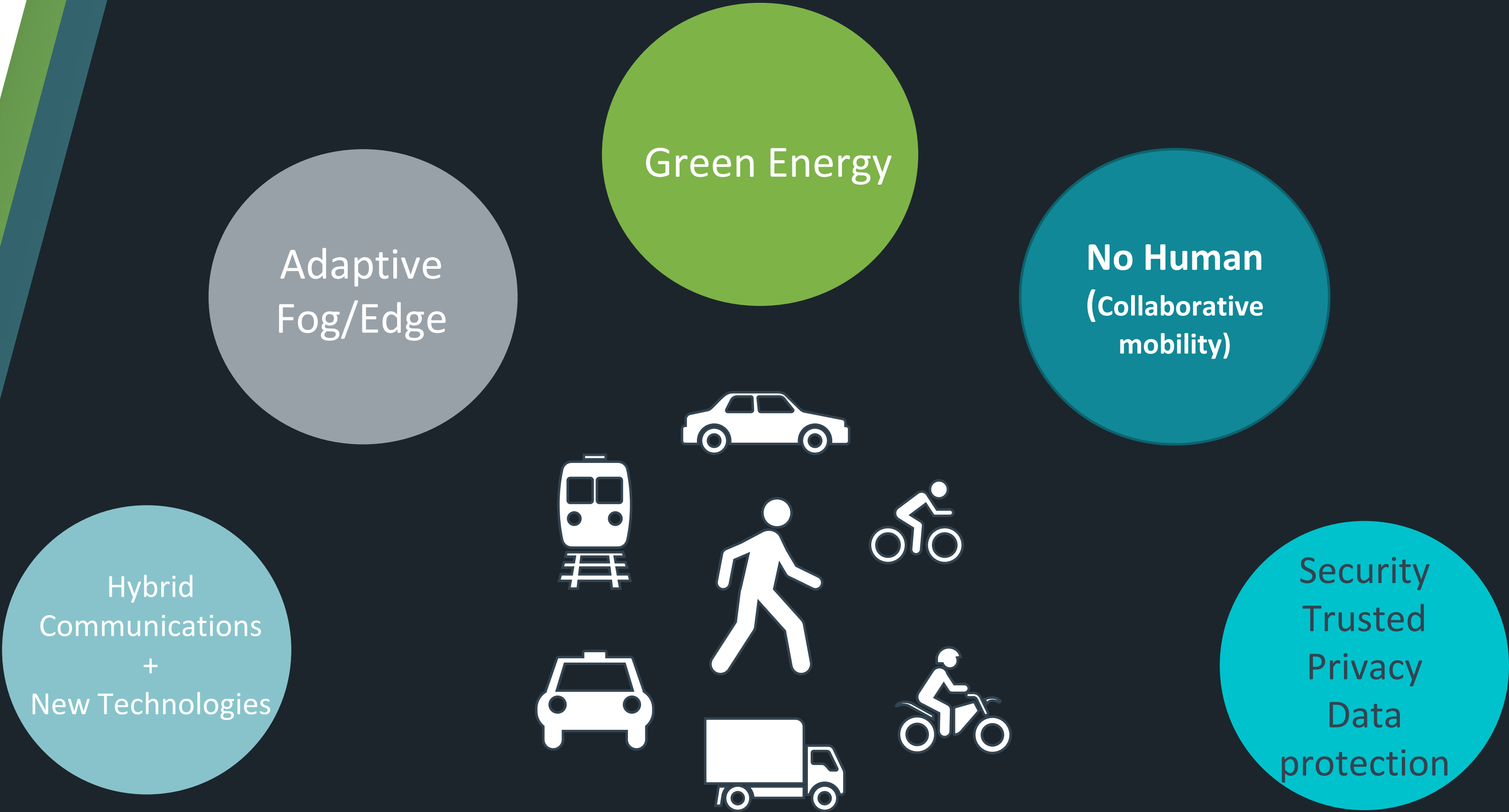
5G

New Mobility Services Design



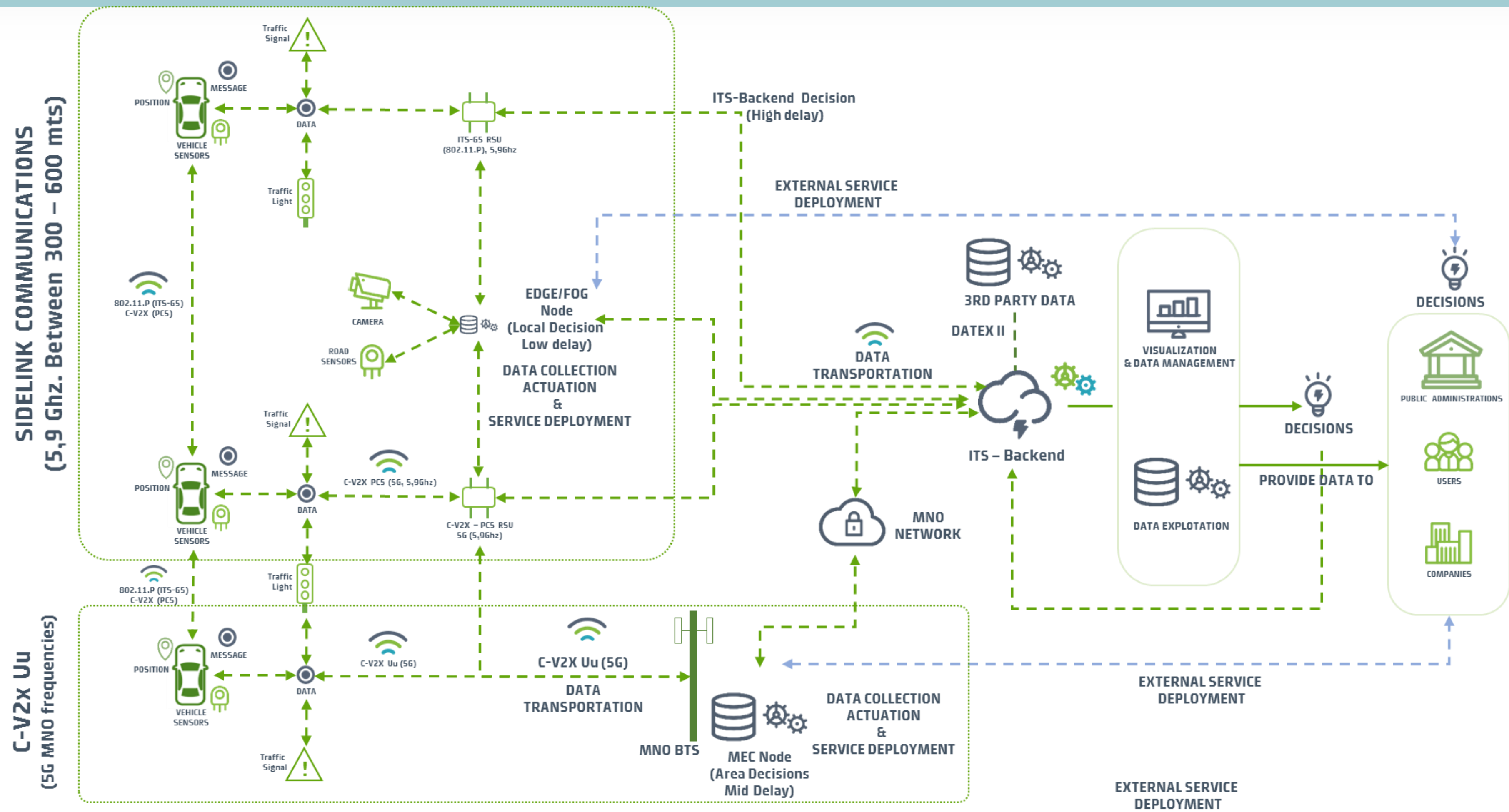
TECHNOLOGICAL CHALLENGES

Cooperative
connectivity towards
automated mobility

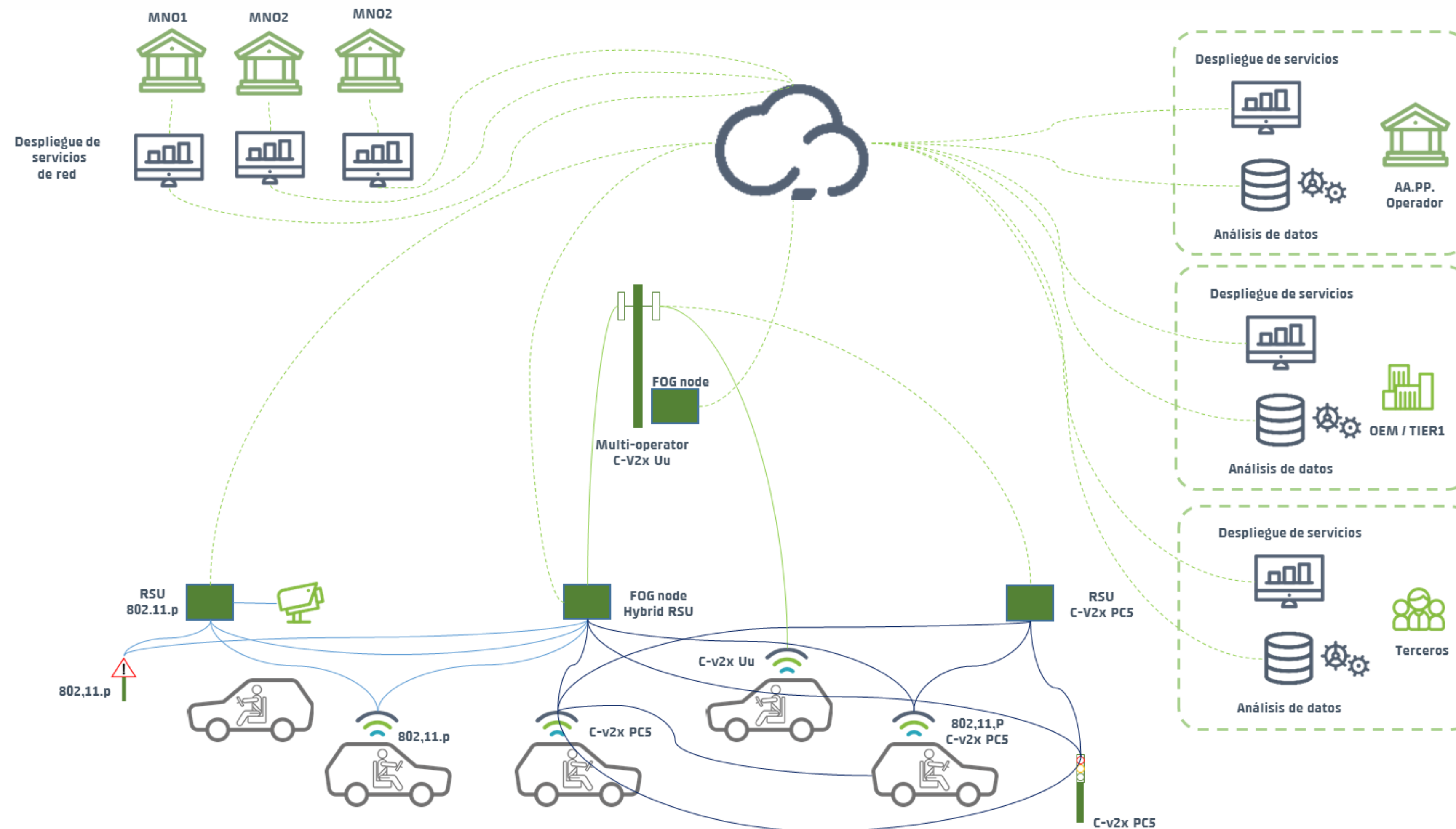


Cooperative and Autonomous Mobility

ITS DATA JOURNEY MAP

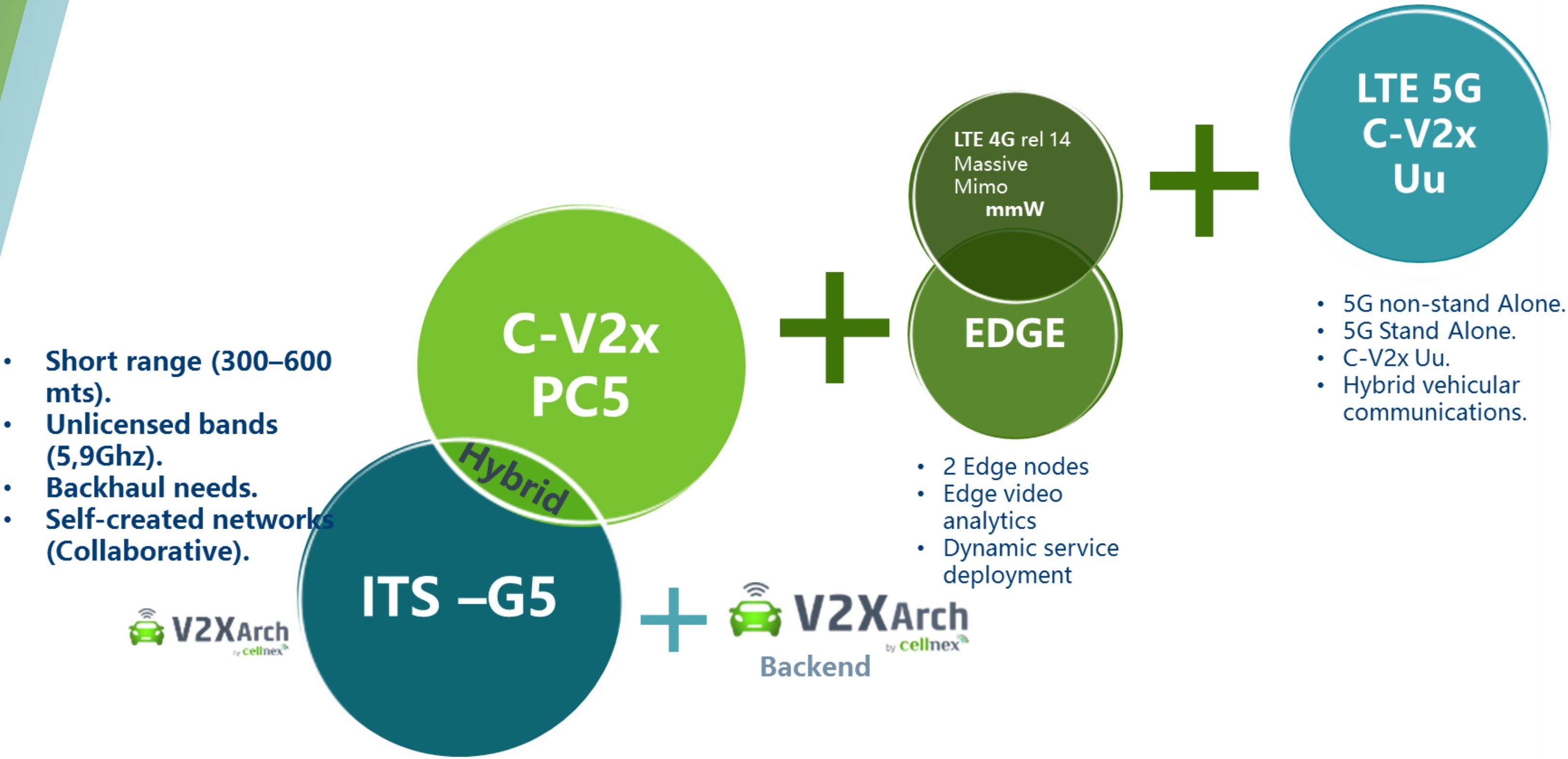


Stakeholders Map



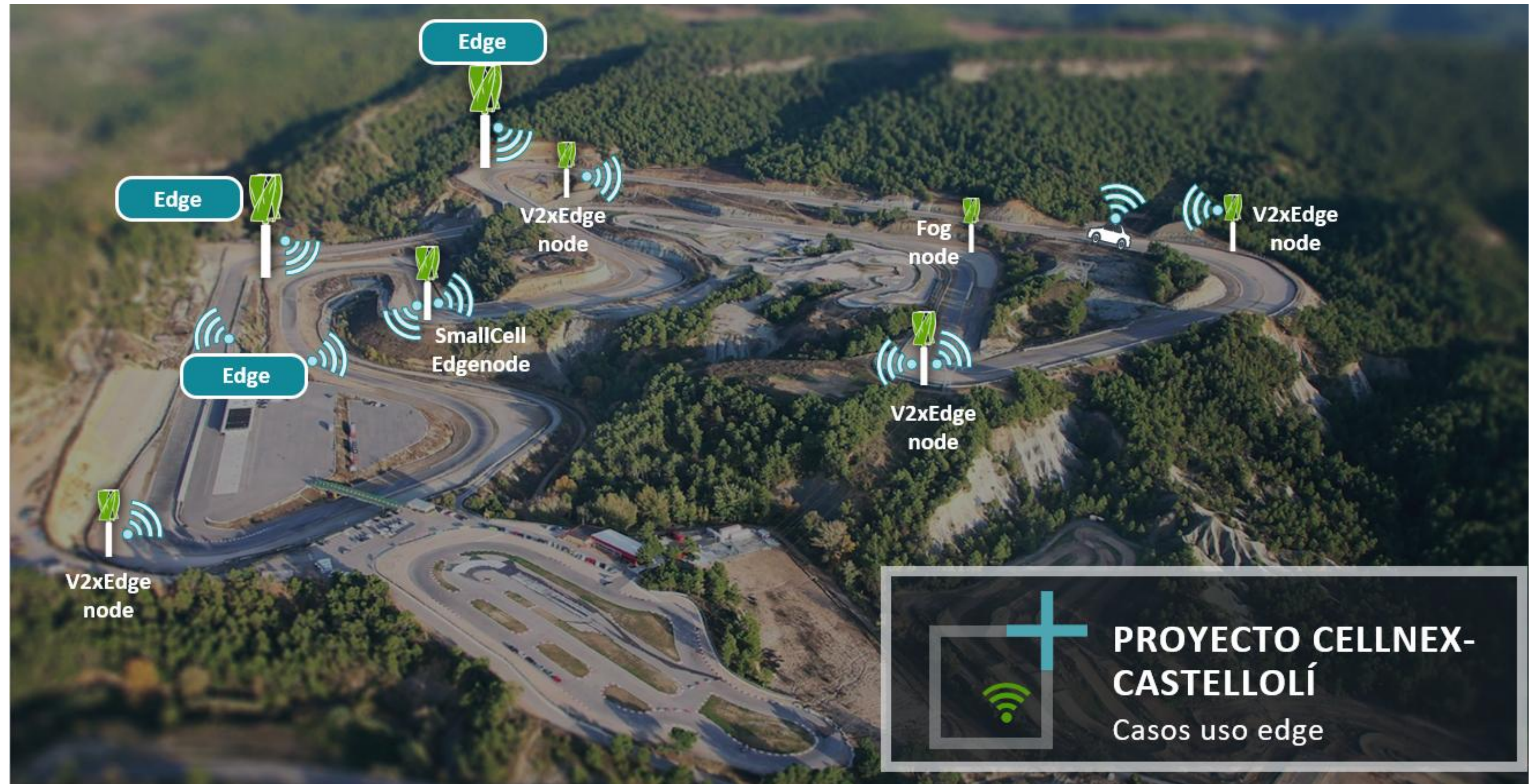
ROADMAP LAB

Technology



Mobility Lab Area.

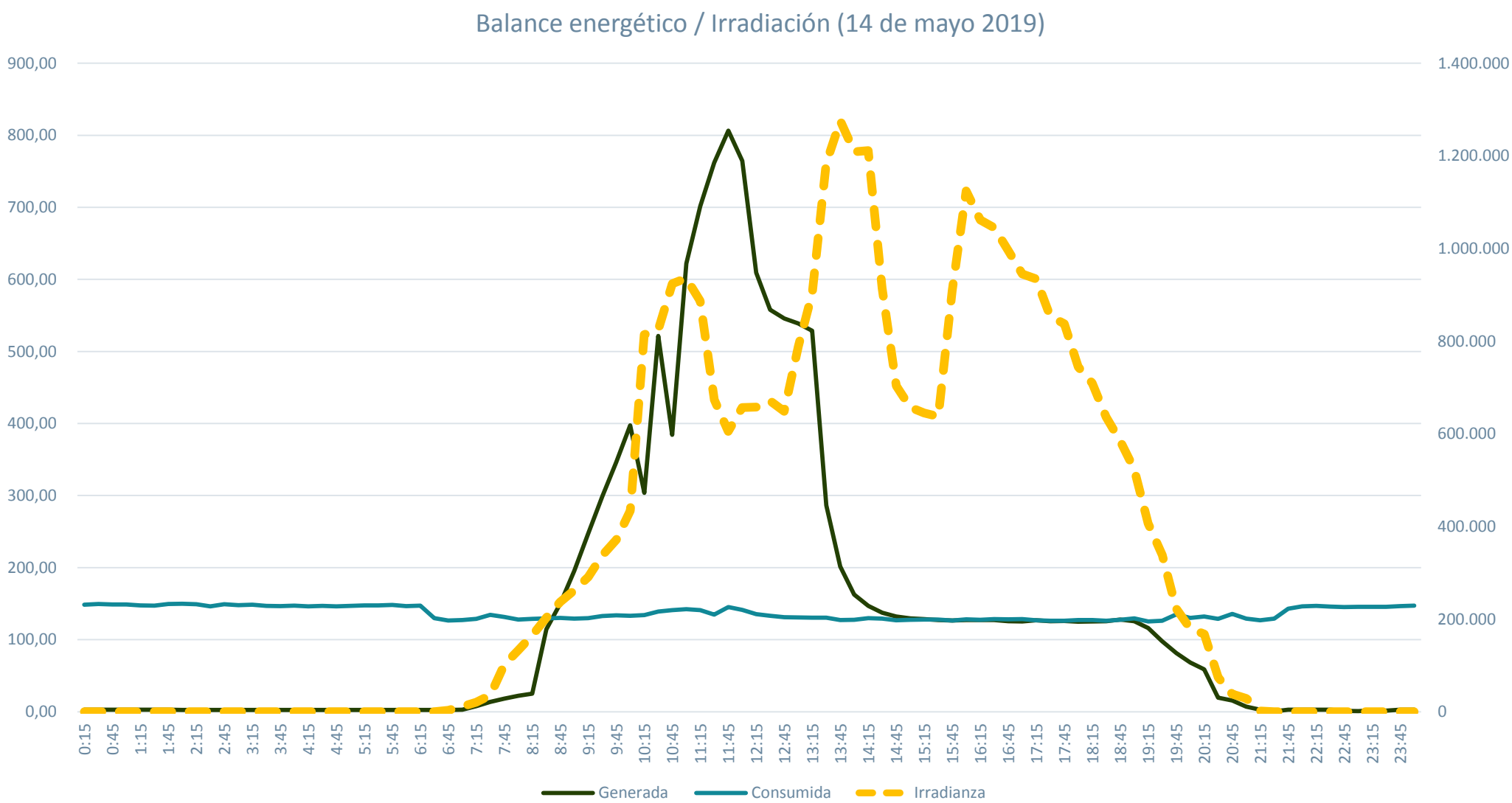
We want create different scenarios to understand better network design scenarios and obtain important information to understand **economics**. We have 8 auto-sustainable sites (Solar and wind local energy production), plus 1 site (connected to grid) to simulate network evolution scenarios.



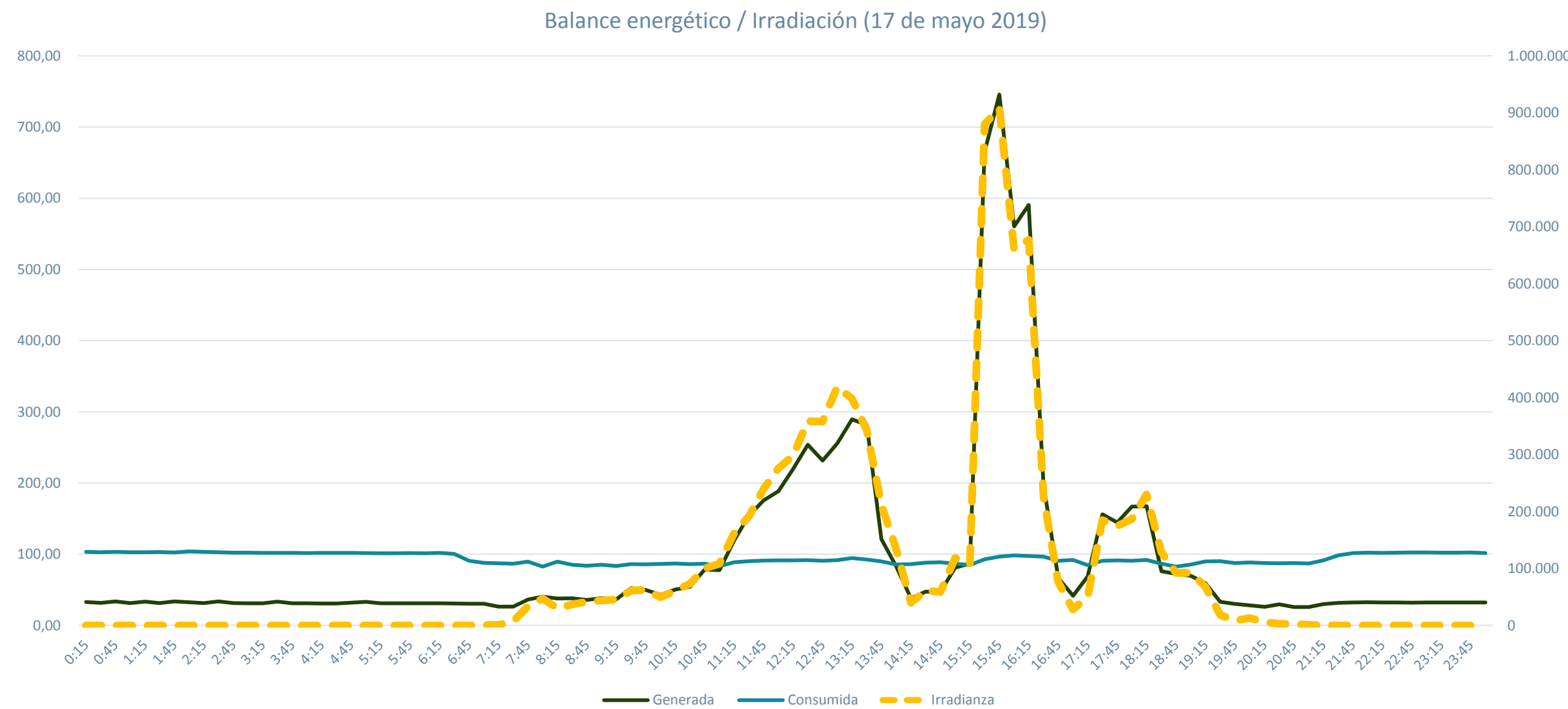
Zero emission Sites



Sunny Day



Raining Day



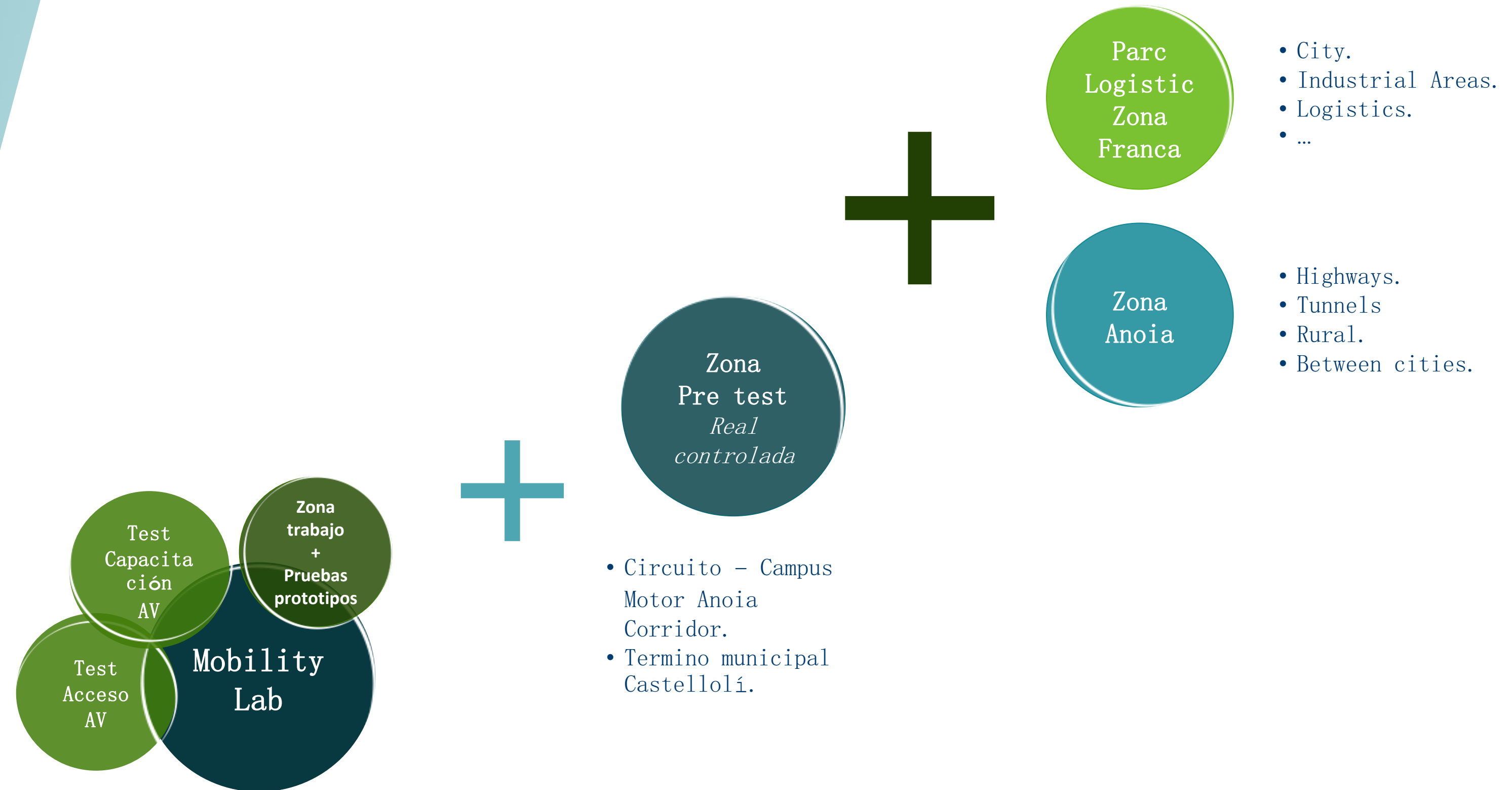
Use Cases: c-V2x Release 14 – 16. (Step 3)



Use Case	Edge features	Area	Challenges
Pedestrian, handicap people, cyclist & Other VRU	- Video & Speech Analytics - AI - V2X - Fusion data (Sensors+Analytics+ AI)	- V2X - Safety track - Smart Cities - Industry	- Position Accuracy - Predict trajectory - Multiple alert outputs - Acc vs. Speed vs. Delay
Tracking & Projection (Tracking specific Cars)	- Video Analytics (LPR or QR code) - AI - V2X - Fusion data (Sensors+Analytics+ AI)	- V2X - Safety track - Smart Cities - Smart Factory - Video creation - Railways, Airports & Ports - Electronic Toll Collection - Classification - Speed enforcement - Oversize vehicle warning	- Position Accuracy - Predict trajectory - Acc vs. Speed vs. Delay - Automatic Video edition
Dynamic 3D Maps Download & Update	- Video & Speech Analytics - AI - V2X - Fusion data (Vehicles + Cameras + Maps + Satellite)	- V2X - Public Safety - Smart Cities - Industry - Road & Infrastructure deterioration Diagnosis	- Position Accuracy - Acc vs. Speed vs. Delay - Verify and Trust information
Multimedia Content Dissemination Message. (Video & Sensor fusion)	- sharing of multimedia content between V2X-capable nodes describing events for different applications. - live video streaming and sensor information from both roadside infrastructure and other vehicles to effectively "see-through" other vehicles and visual obstructions.	- V2X - Safety - Smart Cities - Smart Factory - Infotainment - Logistics	- Position Accuracy - Predict trajectory - Acc vs. Speed vs. Delay - Vehicle + infrastructure jumps - AR & Advanced Traveller Information System. - Alternative Multi-Modal transport information. - Remote /assisted driving

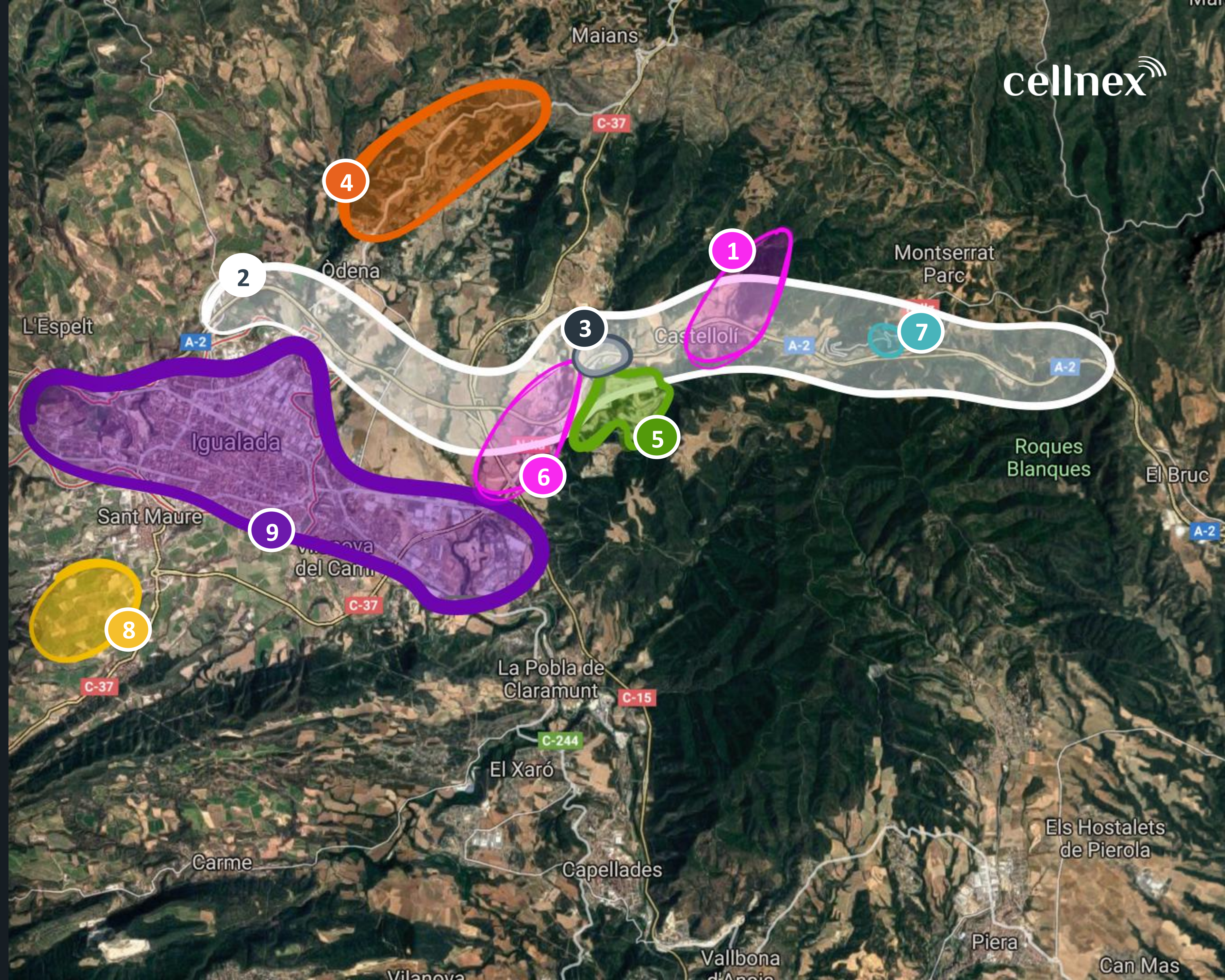
EVOLUTION

From prototype to
Connected Autonomous
Vehicle (CAV)



USE CASE AREAS

- 1 Pre test pedestrian
- 2 Corridor
- 3 Punto negro accidentes
- 4 Rural: Bicycles + Cycles + mountain
- 5 Mobility Lab
- 6 Experimental Zone (Real pre-test)
- 7 Tunnel
- 8 Agricultural
- 9 Public Transport + city



IDEA



Understand

Scalability





THANKS



cellnex
driving telecom connectivity

5G

Evolution

• 5G Deployment:



Phase 1:
LTE 4G rel 14
Massive MIMO
(1H19)

Phase 1.5:
mmW
(26Ghz)
(1H20)

Phase 2:
LTE 5G
Non-Stand
Alone
(2H19)

Phase 3:
5G
(1H20)

Phase 4:
5G Stand
Alone
(2H20)

- **Phase 1:** LTE (4G future upgrade to 5G). Massive MIMO (2,5Ghz - 3,5Ghz). Enterprise CORE.
- **Phase 2:** Software upgrade 5G Non-Stand Alone (3,5Ghz).
- **Phase 3:** 5G (1800 – 2100)
- **Phase 4:** 5G Stand Alone. New Core network (Identify and evaluate risk + Implications)

• Strategy:



**Network
design
optimisation**

Innovation

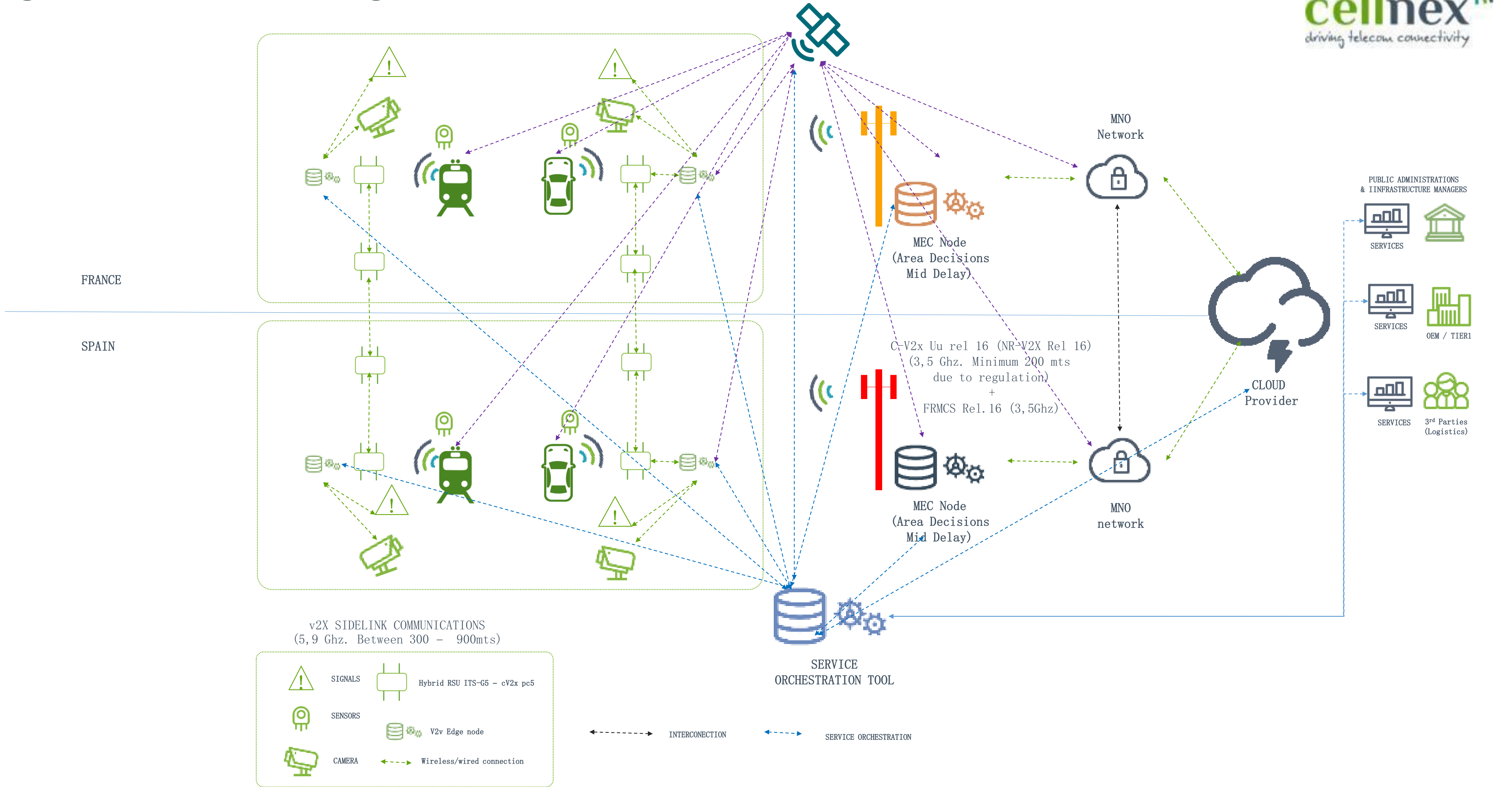


**Basic Service
catalogues
network tests +
use cases**

**Innovation
projects**

**One Stop Shop
Global Test**

High level architectural diagram



Day 1. x Use Cases not implemented by Cellnex (actually)



In Green, use cases in Cellnex Roadmap (Hybrid network ITS-G5 + c-V2X)

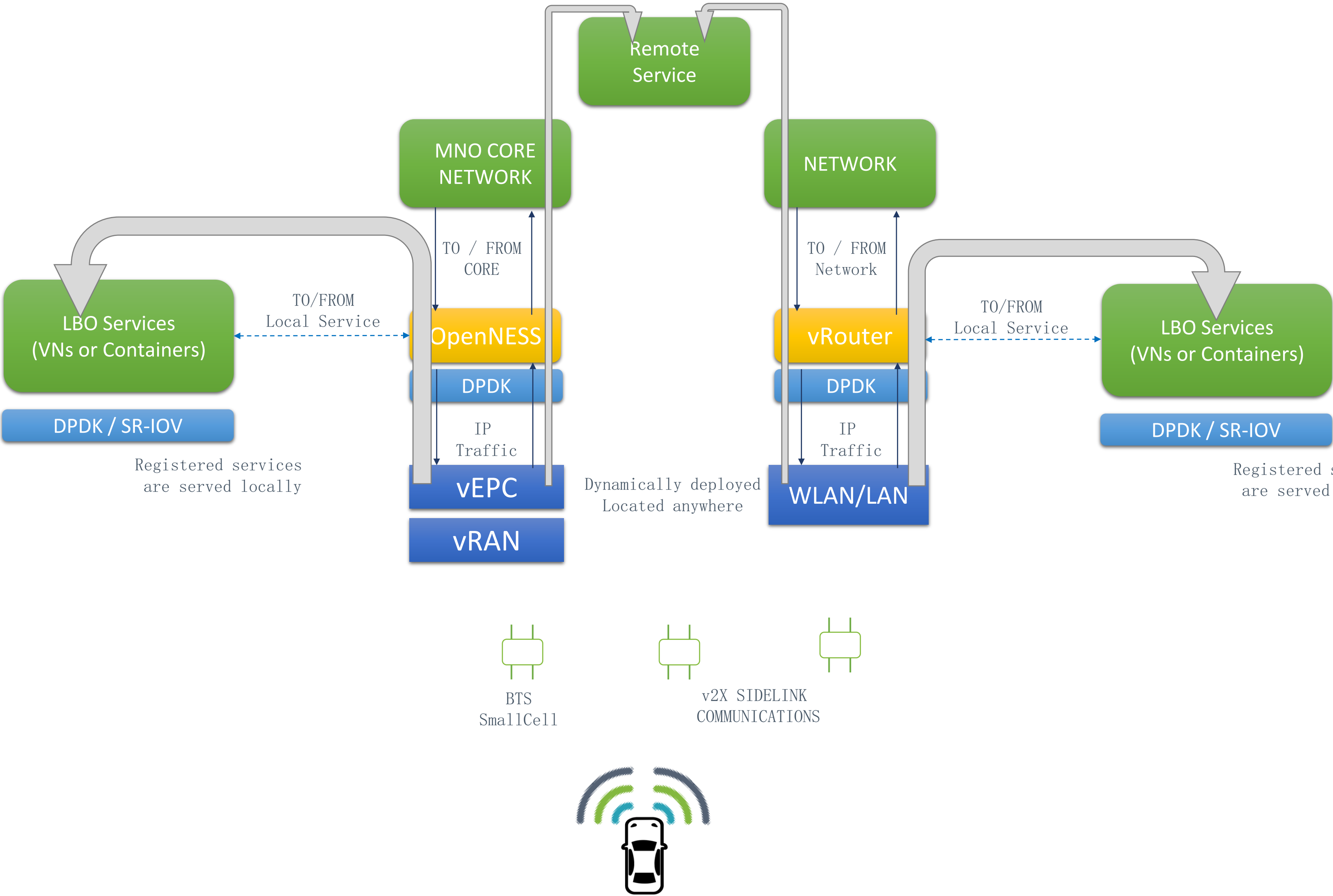
Identified C-ITS Services (European Commission)

Day 1 Services		Day 1.5 Services	
V2V	Road works or obstacles warning	- Information on fuelling & charging stations alternative fuel vehicle. - On street parking management & information - Off street parking information - Park & Ride information	
	- Weather conditions (Linked to dynamic in vehicle limits) - Intersection safety. - In vehicle speed limits, including dynamic speed limits	- Traffic information & Smart routing. - Connected & Cooperative navigation into & out the city (1st and last mile, parking, route advice, coordinated traffic lights).	
V2P		Vulnerable road user protection	

Castellolí Edge and network diagram (Private LTE + Sidelink V2X)



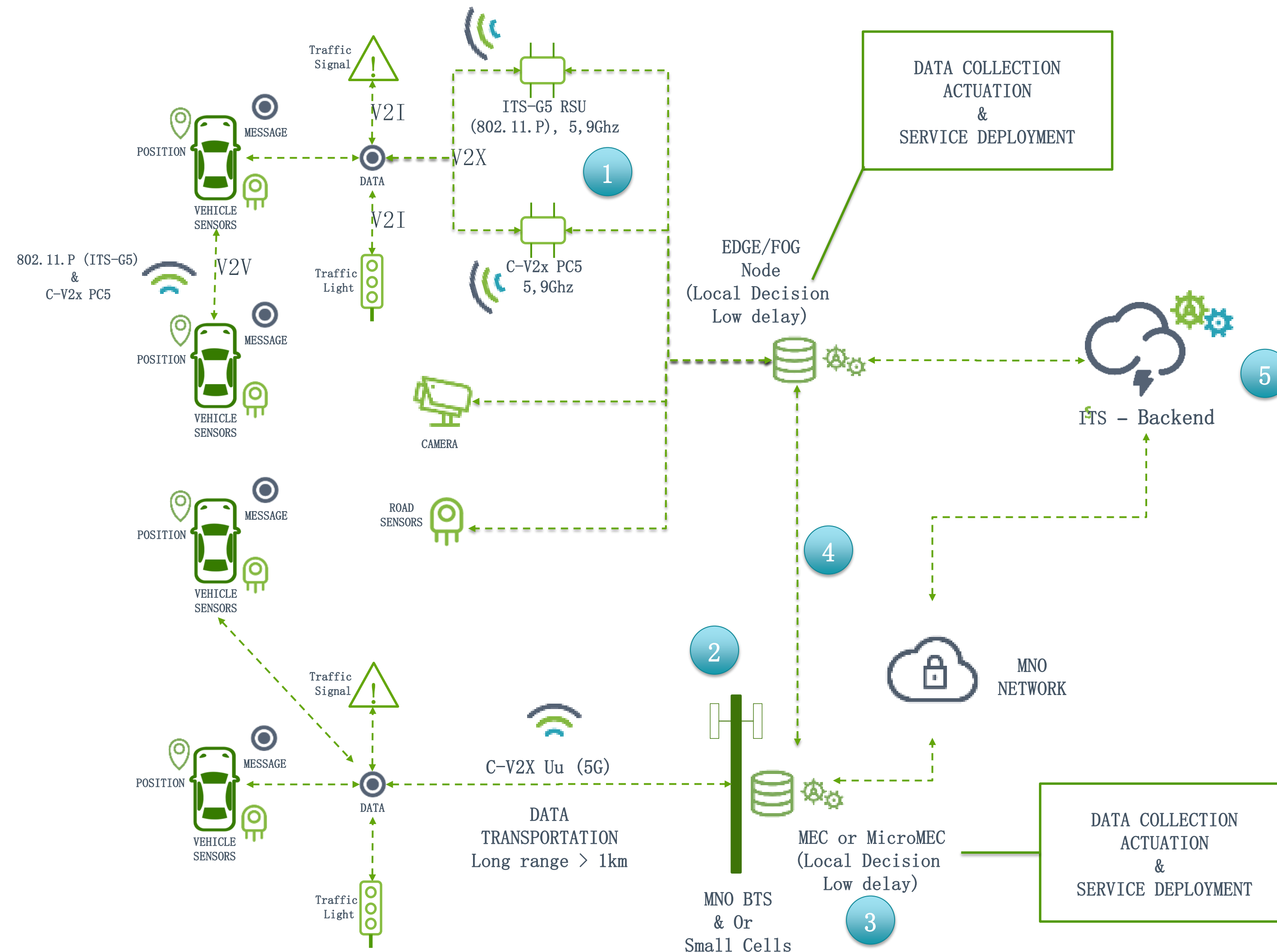
- Video & Speech Analytics
- AI
- VR
- 3D Maps
- UAV control
- Fusion data (Sensors+Analytics+ AI)



- Video & Speech Analytics
- AI
- V2X
- 3D Maps
- Fusion data (Sensors+Analytics+ AI)

Test: Hybrid V2x communications

Test Objective: analyse, design, evaluate different network topologies combining v2x technologies & frequencies to optimise future network deployments. We will implement day 1 and Day 2 uses cases in the different network topologies and evaluate their performances.



Test & Scenarios:

- 1 • Side-Link hybrid communications (5,9Ghz).
- 2 • Create a private LTE and work on:
 - c-V2x rel 14 and c-v2X rel 16 (2,6Ghz & 3,5 Ghz). Small cells – Macro scenarios.
 - 4G - 5G evolution.
 - Energy efficiency
- 3 • Evaluate different MEC deployments combining MEC and microMEC
- 4 • **Interoperability (Real hybrid scenario):** Analyse and experiment with data exchange and service deployment between Edge/Fog nodes and MEC or MicroEdge (Direct mode).
- 5 • Analyse and experiment with data exchange and service deployment between Edge/Fog nodes and MEC or MicroEdge through ITS backend(Backend mode).