EuCNC 2015
European Conference on Networks and Communications | Paris, France

PSA PEUGEOT CITROËN
Direction Recherche et Développement

EuCNC 2015 - Special Sessions
5G connected car
01/07/2015

A. SERVEL

5G connected car

Connected cars, a reality since 12 years for our customers !

2003

A Pioneer for emergency 1.6 million of equipped vehicles

2006

One of the first for a navigation combined with traffic information (RDS-TMC)

2012

Application portal for Infotainment

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To satisfy the 4 major customer needs

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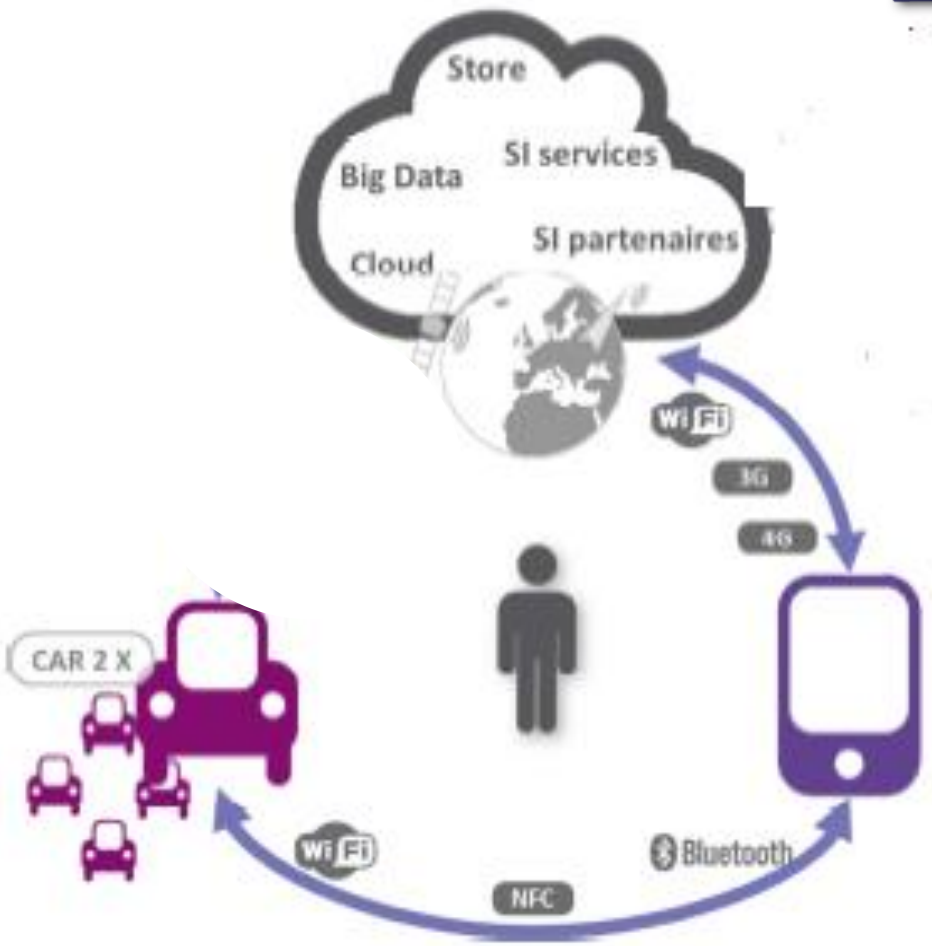

Current solutions :

- Services supported by Big Data servers
- The Smartphone assumes telematics
- Smartphones continuity of usage
- Vehicle to smartphone connectivity expands smartphone display resources

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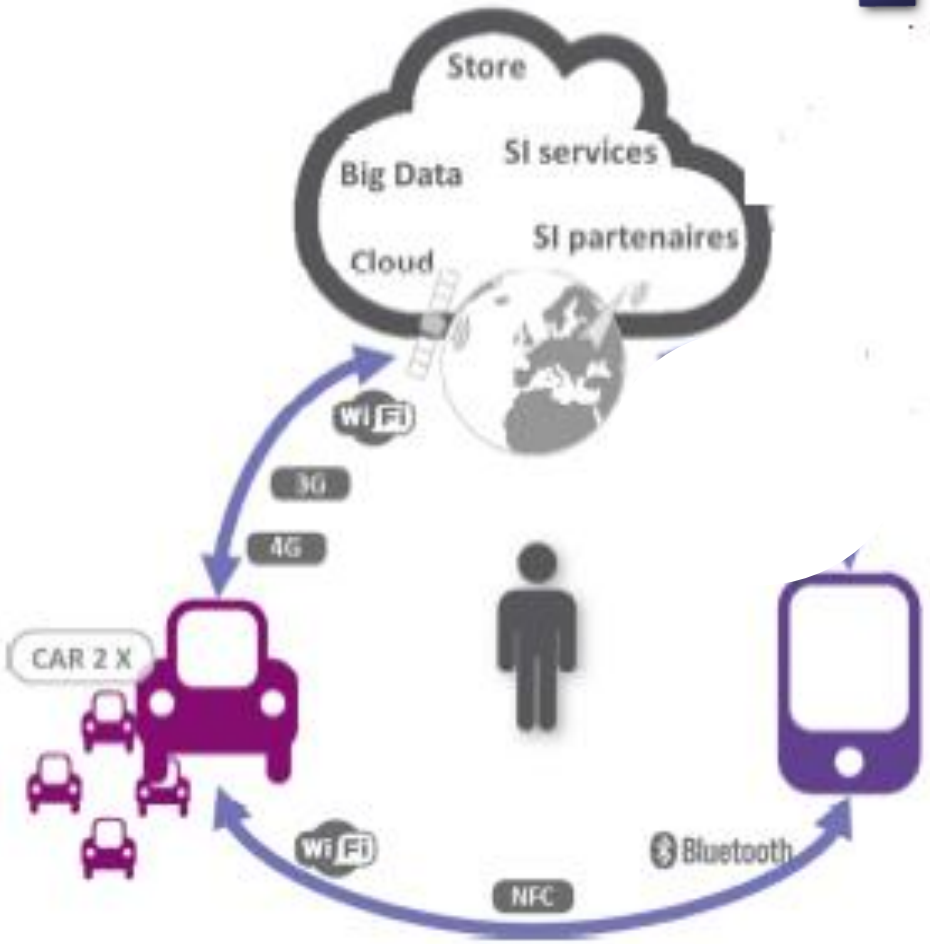

Next evolutions :

- Telematics are natively integrated in vehicle
- More secured and efficient connections are ensured
- OEM backend can supervise vehicle continuously (extended vehicle concept)
- On-board Smartphone(s) connected to Internet through an embedded router (3G/4G <–> Wifi)

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Cooperative ITS :

- Cooperative Awarness to feed a Local dynamic Map of road objects (vehicles, road events, vulnerables..)
- Direct ad-hoc, low latency communications between users
- Multi-hop propagation of events
- IEEE 802.11p (G5) technology
- Secured, anonymous and authentified communications

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C-ITS station architecture

ETSI TC ITS protocol stack

- Adds a facilities layer in-between transport and applications
- The access technologies do not only focus on *ad hoc* networking

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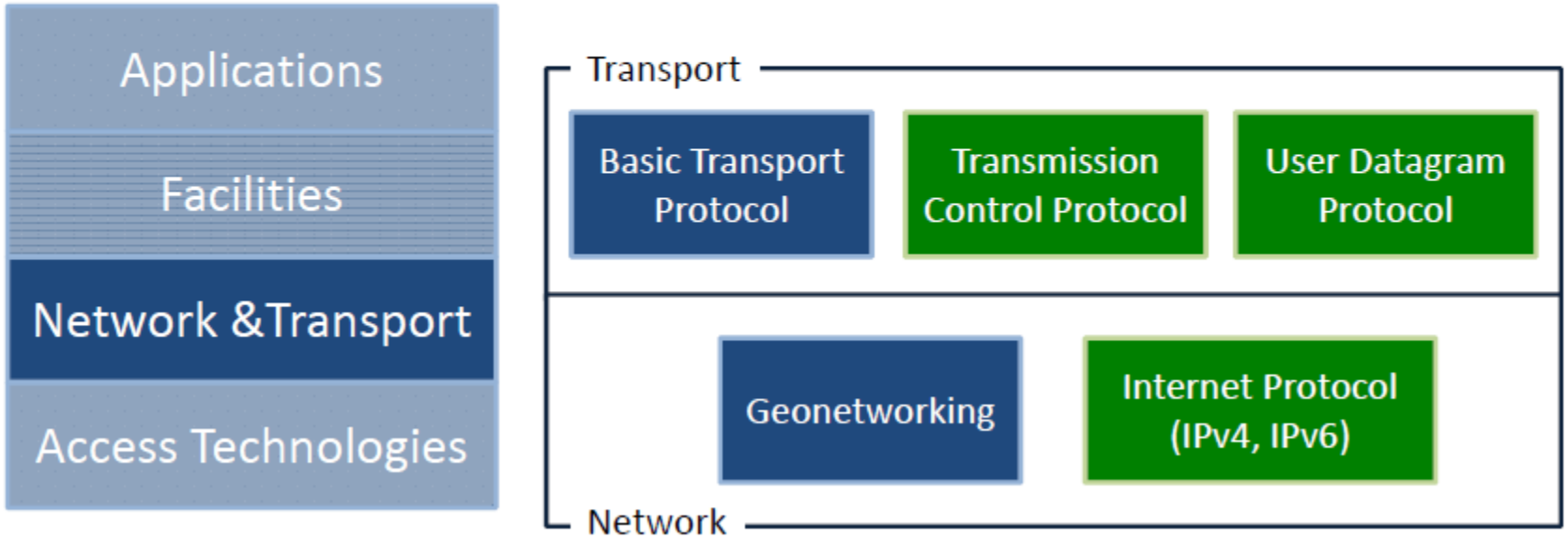
C-ITS station architecture

ETSI – Network and transport



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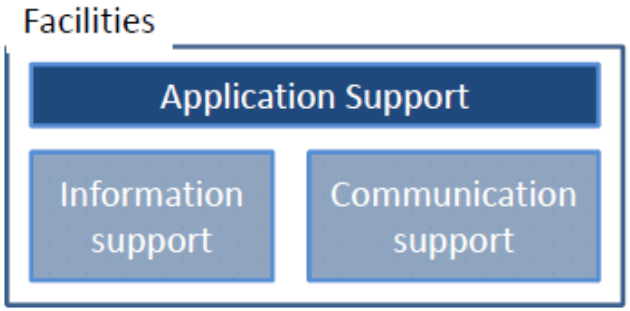
C-ITS Facilities Layer

- Two central message types
- Cooperative Awareness Messages (CAM)
  - TS 102 637-2
  - Periodic time-triggered position messages
  - ”Here I am”
  - 1-10 Hz, packet length including security up to 800 bytes
- Decentralized Environmental Notification Messages (DENM)
  - TS 102 637-3
  - Event-driven hazard warnings



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C-ITS pilot (SCOOP@F)

- Founded by DG MOVE from 07/14 until end 2017.
- Driven by MEDDE (French Ministery of Transports)
- Specifications of about **12 V2X road safety oriented use cases**
- **ITS-G5** interoperability validations (different suppliers for RSUs and OBUs)
- **2000 kms** of equipped roads, more than **2500 vehicles**
- Fleets deployments (1100 vehicles for PSA) starting in 09/2016
- Technical and User impacts analysis (from Logs collection)
- 3G/4G/G5 hydridation tests with Orange
- Spain / Portugal as new partners. Cross tests with Austia.

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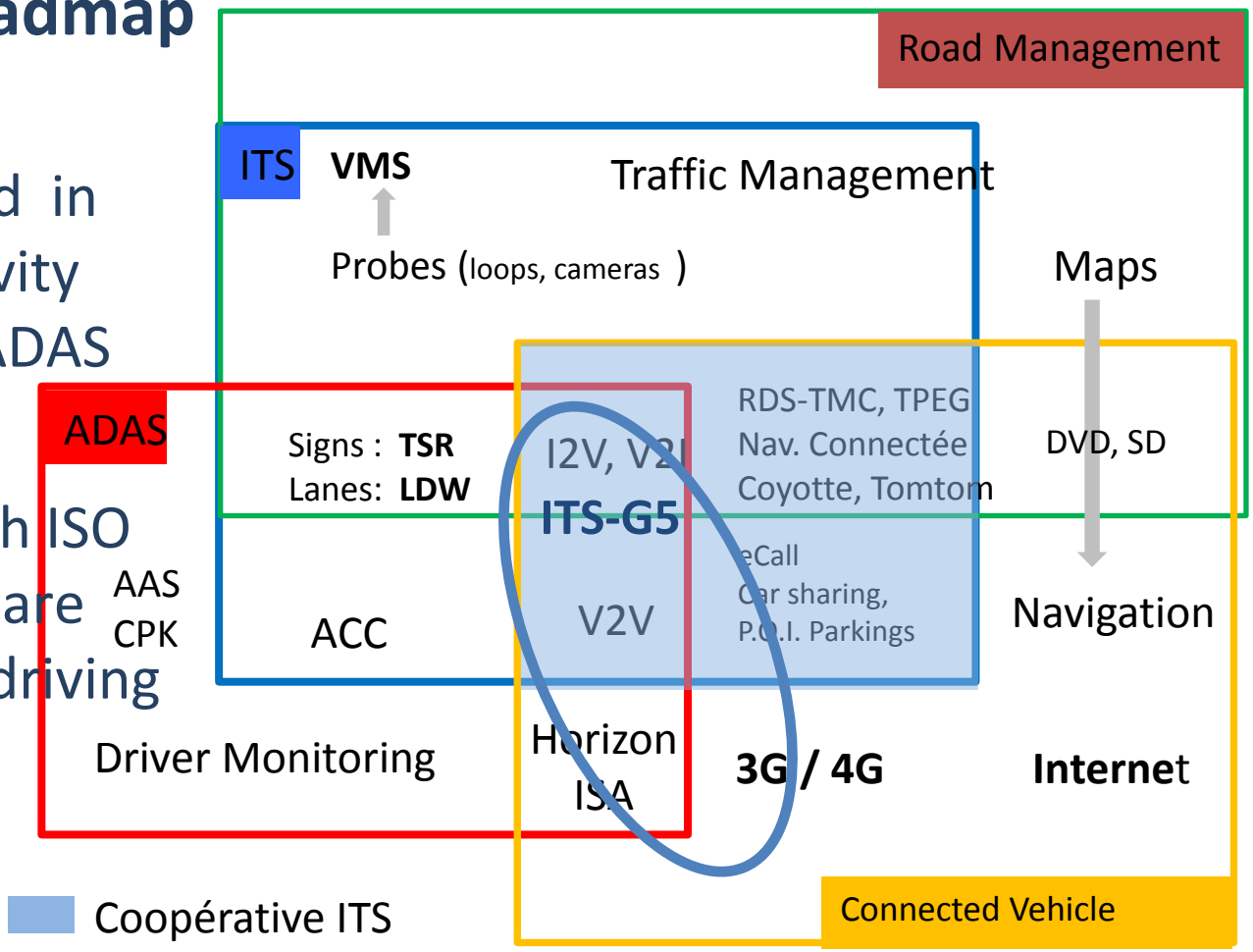
- **ADAS / ITS roadmap after 2020+:**
  - V2X integrated in next connectivity systems and ADAS
  - Compliant with ISO 26262 to prepare Autonomous driving



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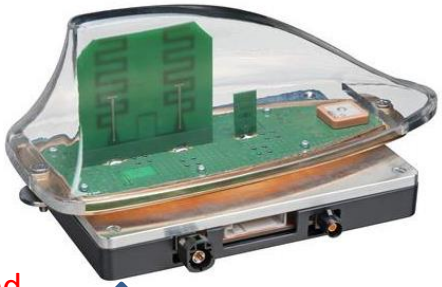
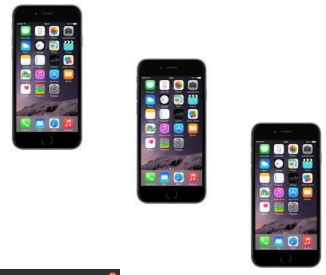
Scenarios of architectures by 2020+

Multistandard modems:
- DAB, DVB, FM…
- 3G/4G
- Satellites
- GNSS
- ITS-G5

Smart Antenna



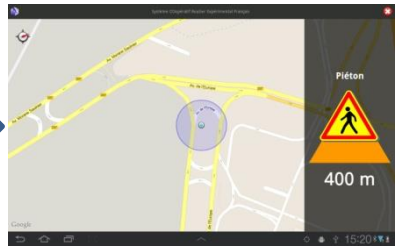
Smartphones
(Driver, passengers)



Short secured V2X messages

ADAS controler

Ethernet



Radars, Cameras, Lidars, US

Head Unit:
- Navigation
- Displays

Virtual reality

12

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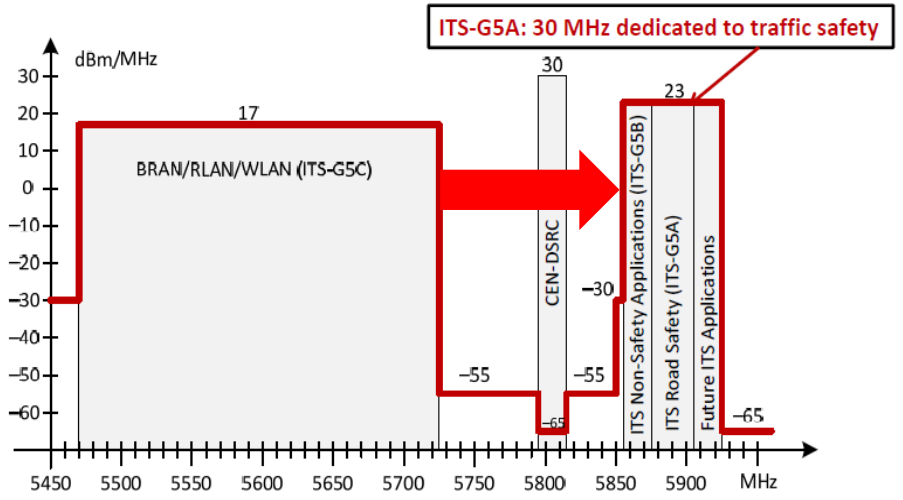
Issues on ITS-G5 (5.9GHz) roadmaps

- Difficulty to integrate it in multi-standards antennas. G5 noise floor can increase dramatically when 3G/4G is transmitting
- Spectrum is competed by other services:
  - RLAN (IEEE 802.11ac)
  - CEN DSRC (5.8GHz)

Frequency bands in Europe



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Issues on ITS-G5 (5.9GHz) roadmaps

- Security standards are still not stable
  - PKI governance aspects (regional, national, European ?)
  - Encryption algorithms
- ITS - RSU will be installed essentially along main roads, but:
  - Periodic PKI distribution will be necessary everywhere in rural areas by cellular.
  - Applications releases, vehicle status monitoring will be assumed everywhere by private or public cellular networks
- ITS – RSU operators ensure Internet access by their private networks

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What could be benefit of C-ITS by 5G ?

- The same chipset (smart antenna) could assume telematics and V2X ad-hoc
- C-ITS could re-use the efficient centralized security algoritms and management of cellular networks
- Bandwidth for V2X channel could be adjusted according to the number of vehicles to maximize V2X capacity and manage a better congestion control
- Better overall system QoS could be offered: higher reliability, high mobility

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What could be benefits of C-ITS in 5G ?

- C-ITS deployment in vulnerable world (Smartphones) could be accelerated by the use of this technology.

5G D2D

5G

- Positionning offered by cellular networks could enhance current embedded GNSS (ex: in urban canyons)

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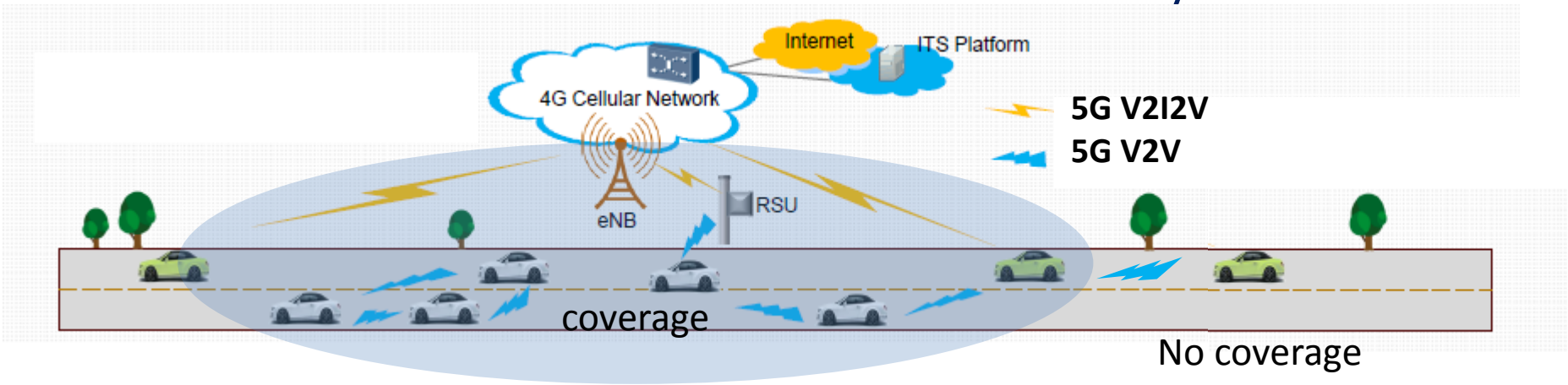
Functionnalities to be supported by 5G for C-ITS:

- Short messages broadcasted between vehicles, vehicles and vulnerables or vehicles and RSUs
- Compatible with existing ITS high level layers standards
- **V2Cloud & Cloud2V** communications for high latency tolerant use cases
- **V2V** direct communications with or without any local eNB



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Thank You

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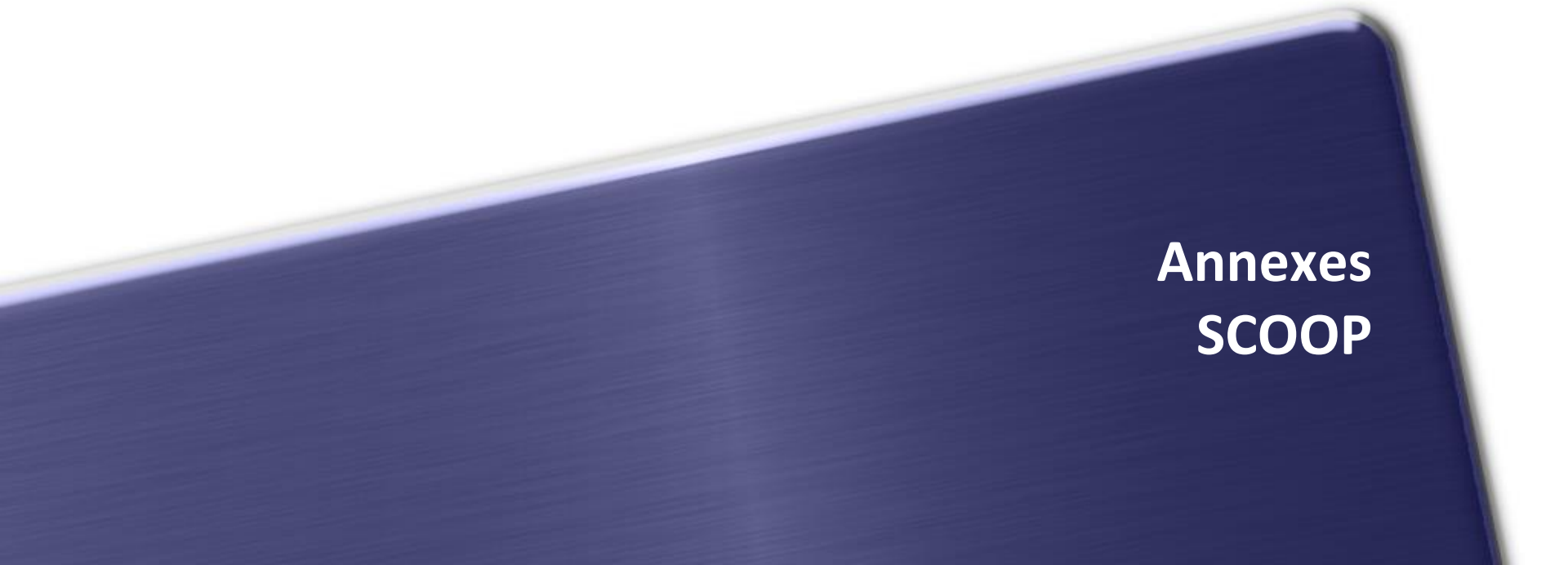
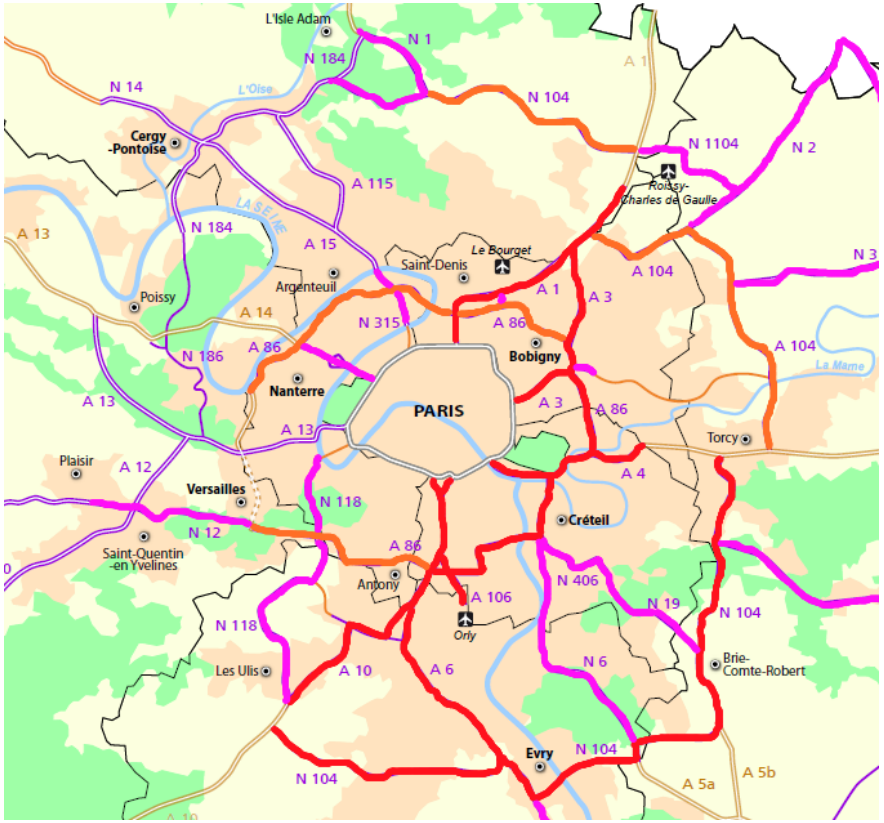


Annexes SCOOP

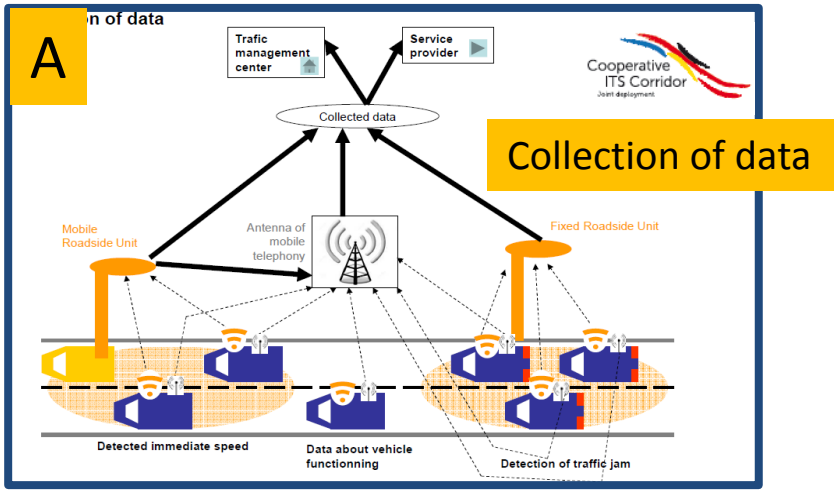
What is SCOOP@F pilot ?

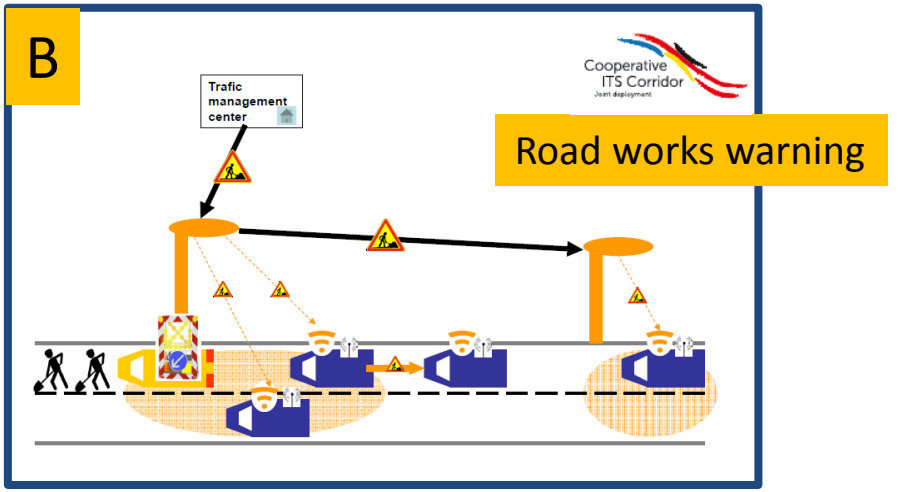
Phase 1: Five regions of deployment

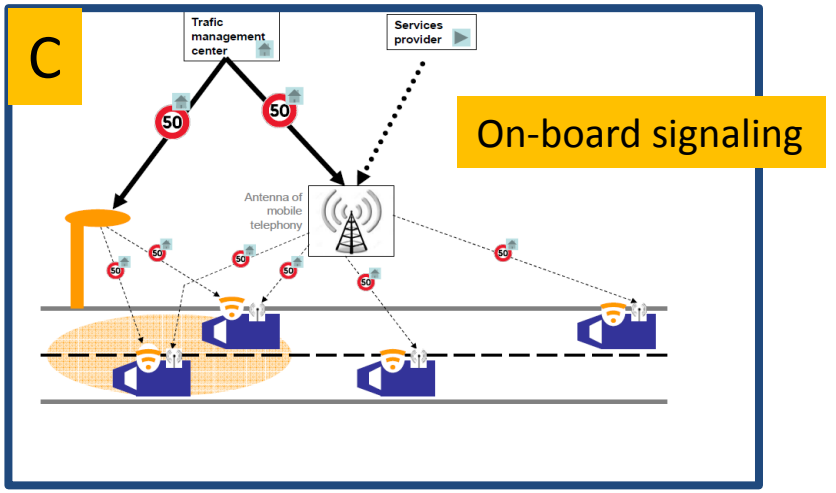


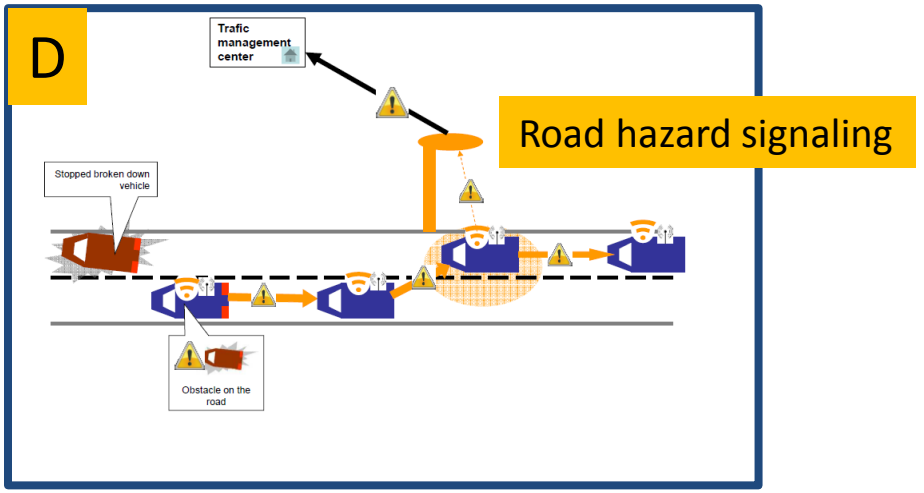
What is SCOOP@F pilot ?

Phase 1: Four groups of Use cases





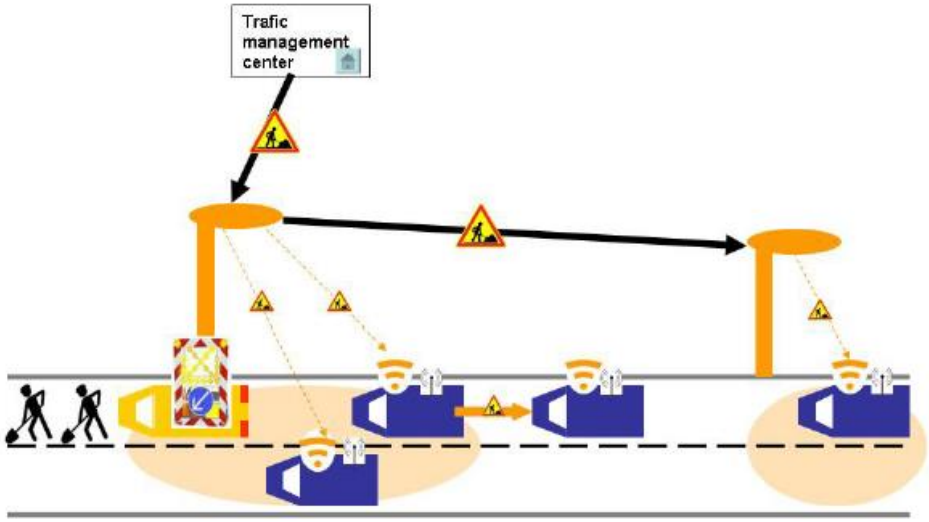




What is SCOOP@F pilot ?

Phase 1: Day One Use cases

B1	*alert programmed fixed roadwork (fixed and mobile)*
B2	Intervention alert on lanes
B3	*Alert vehicles prioritary for winter activities*
D1	temporarily slippery road warning
D2-A	*animal on the road warning*
D2-B	human on the road warning
D3	obstacle on the road warning
D4	*vehicle stopped, broken-down*
D5	*accident area warning unsecured*
D6	*Reduced visibility*
D9	exceptional weather conditions
D10	Emergency braking



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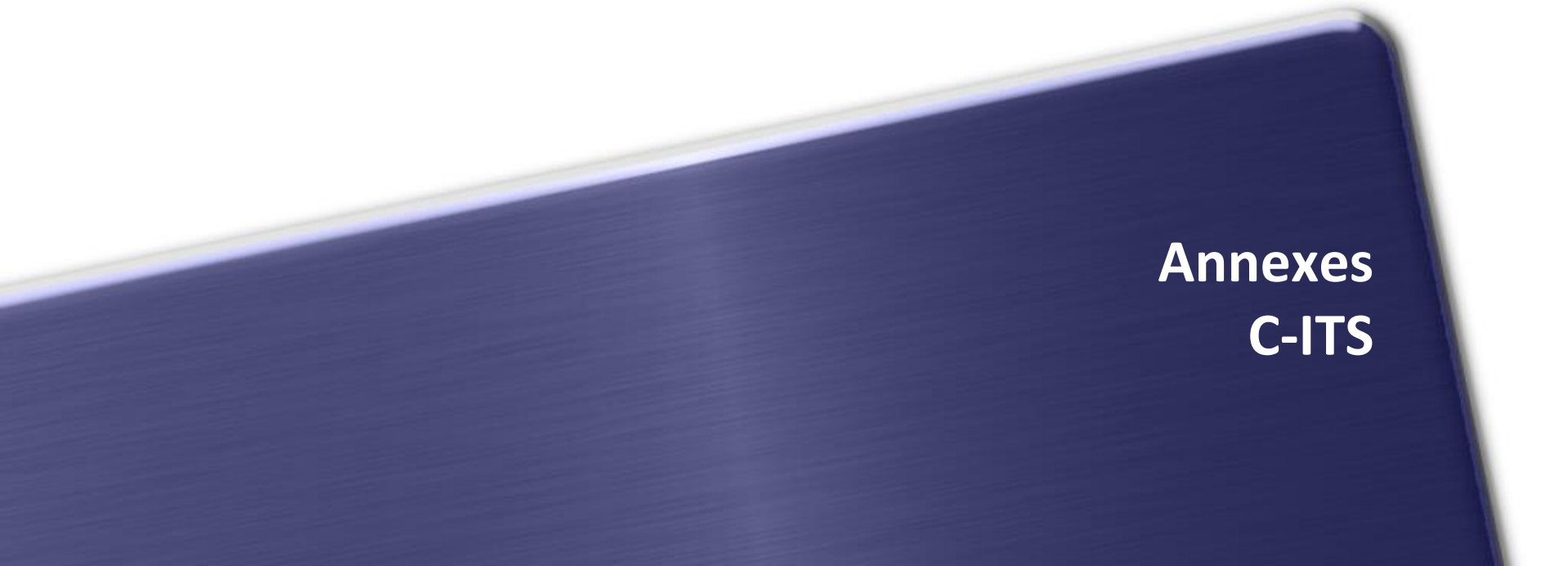

Annexes
C-ITS

	1. Cooperative road safety (sécurité routière)					
	Type de fonction			Faisabilité en GSM (2/3G)		
	ADAS au sens large	NAV étendue	Services	OK	partiel	NOK
Emergency electronic brake lights	X					
Emergency vehicle warning	X					
Slow vehicle warning	X					X
Motorcycle warning	X					X
Vulnerable road user Warning	X					
Traffic hazard warnings	X					
Wrong way driving warning	X					X
Stationary vehicle warning	X			X		
Traffic condition warning	X	X		X		
Signal violation warning	X					X
Roadwork warning	X	X			X	
Decentralized floating car data		X				
Overtaking vehicle warning	X					X
Lane change assistance	X					X
Pre-crash sensing warning	X					X
Co-operative glare reduction	X				?	
Collision Risk Warning	X					X
Across traffic turn collision risk warning	X					X
Merging Traffic Turn Collision	X					
Risk Warning	X				?	
Co-operative merging assistance	X					
Hazardous location notification	X	X		X		
Intersection Collision Warning	X					X
Co-operative forward collision warning	X					X
Collision Risk Warning from RSU	X				?	

	3. Mobility services						
	Type de fonction				Faisabilité en GSM		
	ADAS élargi	NAV étendue	Infodiv	Services	OK	partiel	NOK
Point of interest notification		X			?		
Automatic access control / parking access				X			?
Local electronic commerce				X	?		
Car rental/sharing assignment/reporting				X		?	
Media downloading			X				
Map download and update		X					
Ecological/economical drive		X					
Instant messaging			X				
Personal data synchronization			X				
SOS service				X			
Stolen vehicle alert ????				X			
Remote diagnosis and just in time repair notification				X			
Vehicle relation management ????			?	X			
Vehicle data collect for product life cycle management							
Insurance and financial				X			
Services Fleet management				X			
Vehicle software/data provisioning and update				X			
Loading zone management		X					
Vehicle and RSU data calibration				?			

	2. Traffic efficiency (gestion du trafic)					
	Type de fonction			Faisabilité en GSM		
	ADAS au sens large	NAV étendue	Services	OK	partiel	NOK
Regulatory/contextual speed limits	X					X
Traffic light optimal speed advisory	X					X
Traffic information and recommended itinerary		X		X		
Enhanced route guidance and navigation		X			?	
Intersection management	X					X
Co-operative flexible lane change	X					X
Limited access warning, detour notification		X			?	
In-vehicle signage	X					
Electronic toll collect			X			?
Co-operative adaptive cruise control	X					X
Co-operative vehicle-highway automation system (Platoon)	X					X