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A reflection on Enabling Connected Mobility

Converging paths: New Generation Networks and Cooperative ITS

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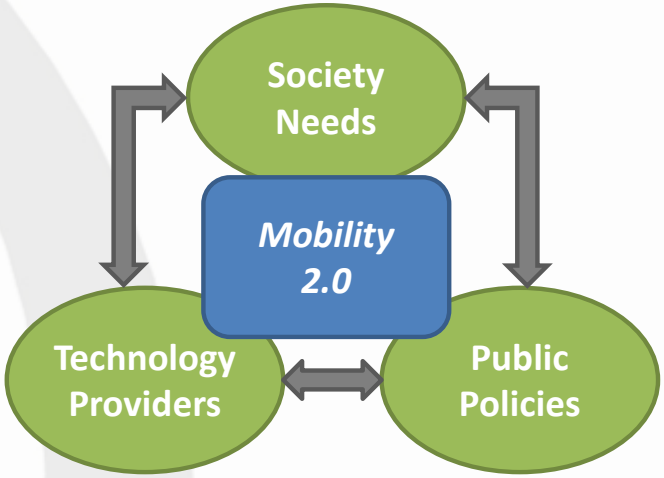
Connected Mobility
Who is driving?

- Urban and interurban mobility environment has been evolving more and more rapidly in recent decades.
- Challenges in transport focus on the **areas of mobility efficiency, road safety, security and environmental sustainability**.
- Relevant trends:
  - **Electric mobility**
  - **Mobility mode shifts**
  - **Connected/Automated Mobility**



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Connected Mobility
Information focus

- Increasing needs of data exchages at physical level, at network level, at service level.

Cooperative ITS approach

Natural evolution of increasingly complex ITS solutions.
Key for deployment is the interoperability of solutions.

New Generation Networks approach

Technical evolution of an all-purpose platform, which can at some point be used for mobility solutions.

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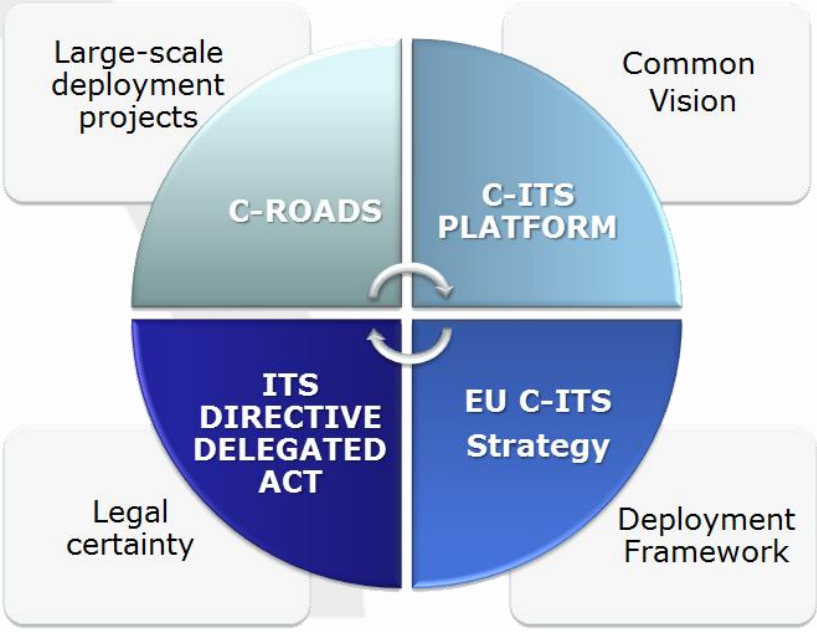
Connected Mobility
Cooperative ITS

- Traditionally focused on short-range vehicular communication technologies.
  - Very low latency & High speed mobility
- Currently under deployment of certain functions on road safety V2X perspective.
  - **Day 1 & Day 1.5 solutions**
  - Key radio access on the **5.9 GHz band**.
  - Working **towards Cooperative, Connected and Automated Mobility**.



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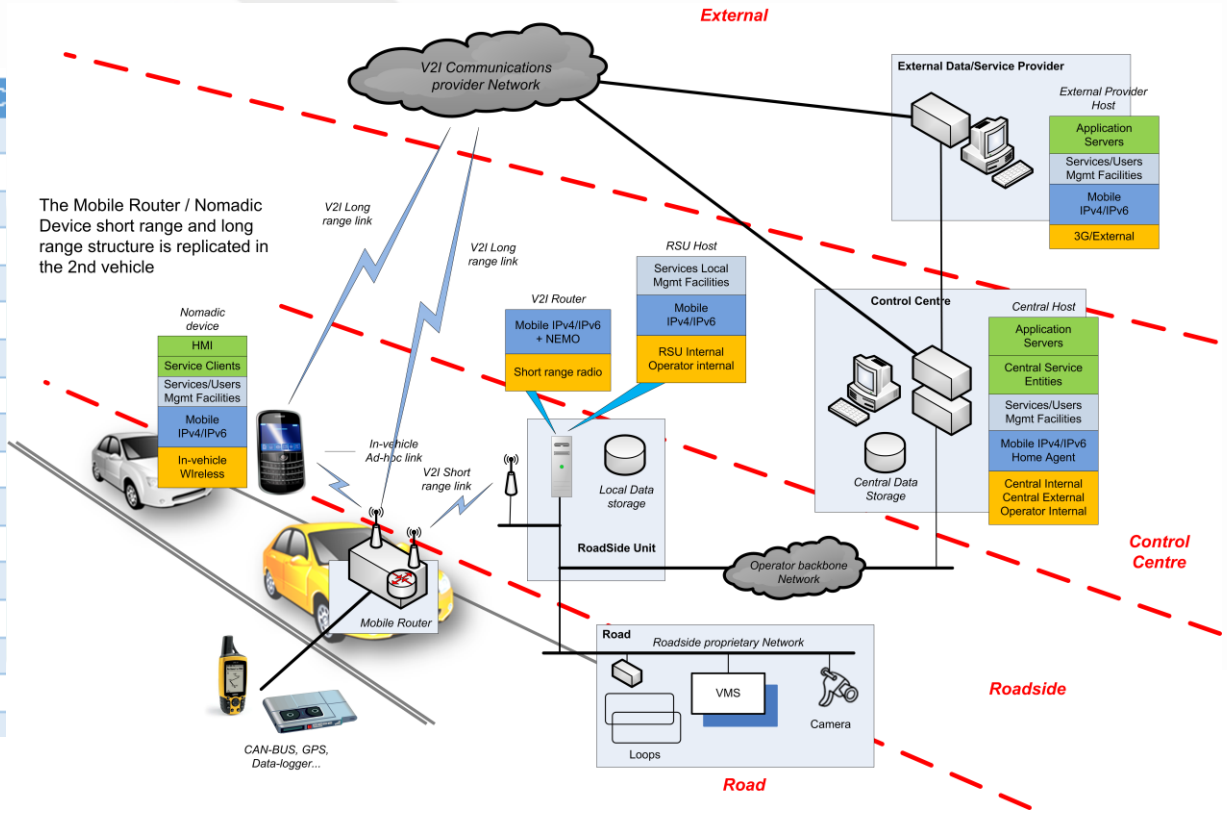
Connected Mobility
Cooperative ITS

- Research initiatives in the last years have consolidated many technical aspects of the Cooperative ITS architecture.

EU Project	C
CIMEC	
Compass4D	
DriveC2X	
FOTsis	
FOTNet	
FREILOT	
OPTICITIES	
TEAM	
VRUITS	
AUTOCITS	
CAPITAL	
C-MOBILE	
CODECS	
CO-GISTICS	
C-ROADS	
C-THE-DIFFERENCE	
SPICE	



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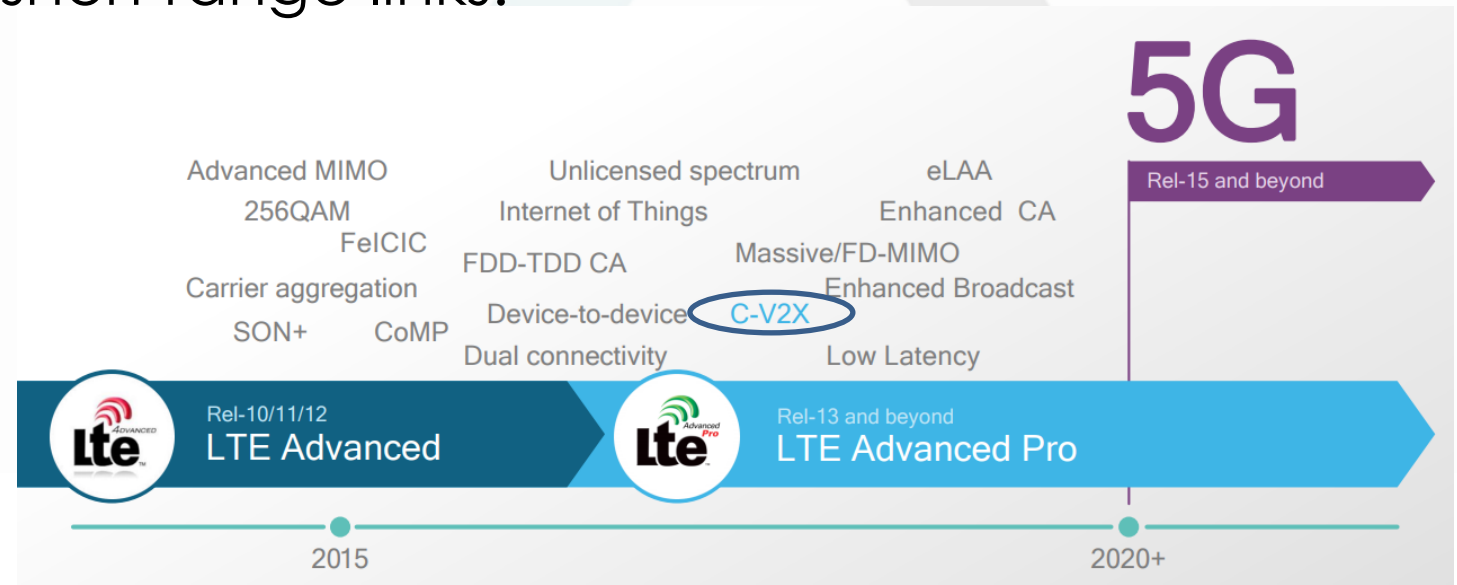
Connected Mobility
New Generation Networks

- Cellular-based communications have started to offer capabilities adequate for the provision of critical ITS services.
- The main factor has been the emergence of very small cells, approaching the behaviour of traditional short range links.



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Connected Mobility
NGN – 5G Concepts

- 5G is not just an evolution of previous radio access and network technologies.
- 5G has to be seen as a paradigm shift in the way to manage network resources, in the broadest sense, and at all levels.
- Central aspects of 5G architecture are:
  - **NR - New Radio.** Advanced physical air links between entities, ensuring the required performance at any given circumstance.
  - **NFV/SDN. Network Function Virtualization/Software Defined Networks.** Isolating physical resources from service virtual resources increases the efficiency of the use of the available components.
  - **Network Slicing.** Management control mechanism binding service network requirements to a virtual and physical 'slice' of network resources, facilitating management from the service point of view.
  - **Edge computing.** Although not 5G-exclusive, the concept that 'intelligence' of the network can be located at the core, or distributed for example 'at the edge', enables critical roadside-based ultra low latency services.

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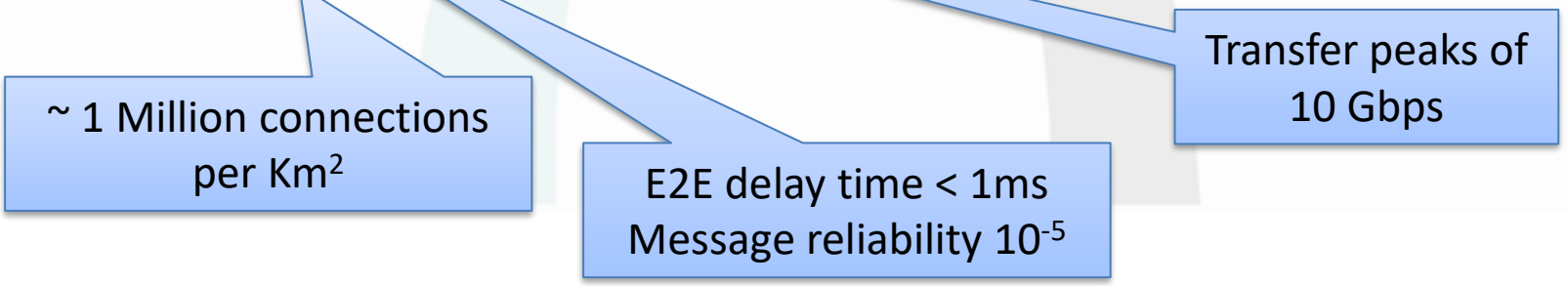
Connected Mobility
NGN – 5G Concepts

- Technical specifications of different aspects of 5G are still ongoing. The most recent specification dates from February 2018. Addresses basically the physical access parameters.
- Technical specifications point at the following advanced service classes:
  - **eMBB. Enhanced/Extreme Mobile BroadBand.**
  - **URLLC. Ultra Reliable Low Latency Communications.**
  - **mMTC. Massive Machine Type Communications.**



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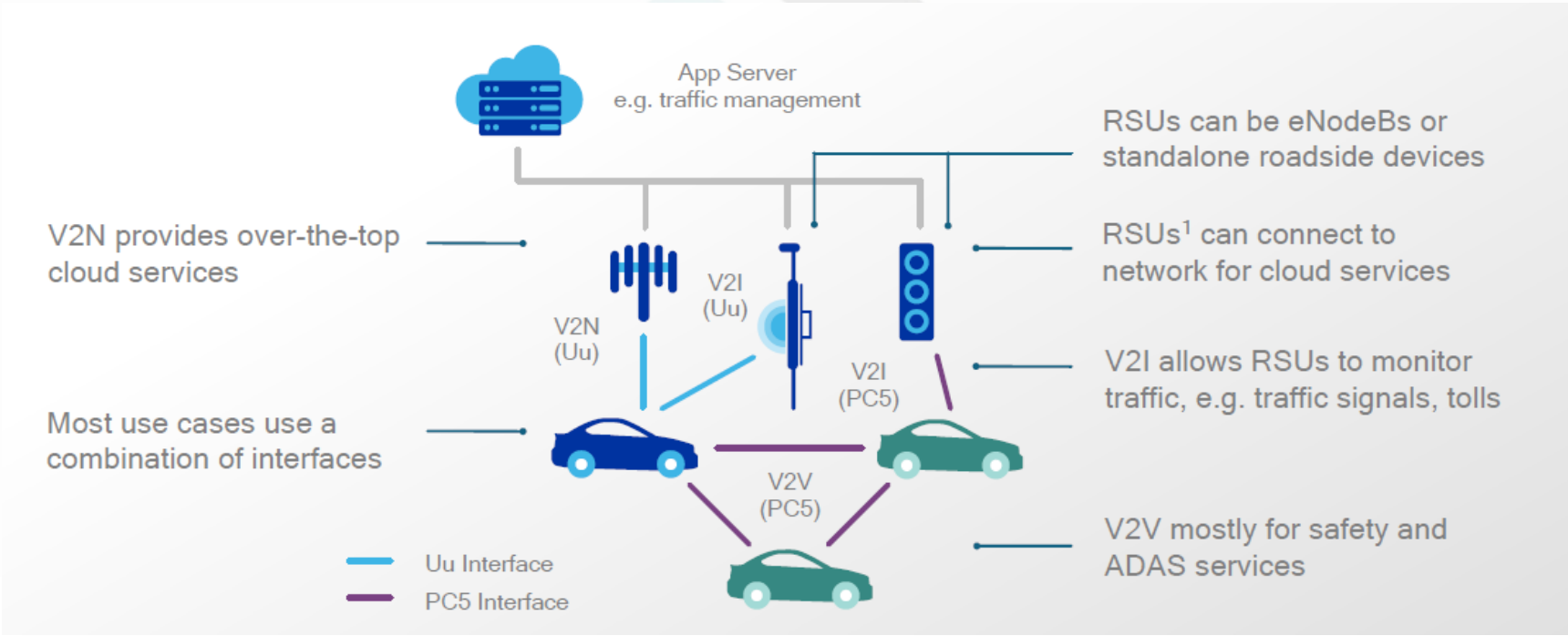
Connected Mobility
NGN & Mobility

- Automotive vertical sector is already addressing possible particular performance requirements for 5G specification working groups.



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Connected Mobility
C-ITS and NGN

- The latest 5G specification did not address fully the problems of connected mobility.
  - 5G-based safety critical solutions rely on positioning accuracies that are not resolved in 5G at the moment. C-ITS was developed with these applications as a priority.
  - Physical specifications are detailed, but other relevant aspects such as the approach to edge computing or URLLC network slices resource management are still undefined.
- Deployment of the 5G infrastructure to deliver the performance quality required of mobility services is still ahead in time. Select functions are still being validated in research initiatives.
- Integration of certain Cooperative ITS functions as basis for CV2X/5G mobility services is a possible solution.

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