AUTOPILOT

AUTOmated driving **P**rogressed by the **I**nternet **O**f **T**hings

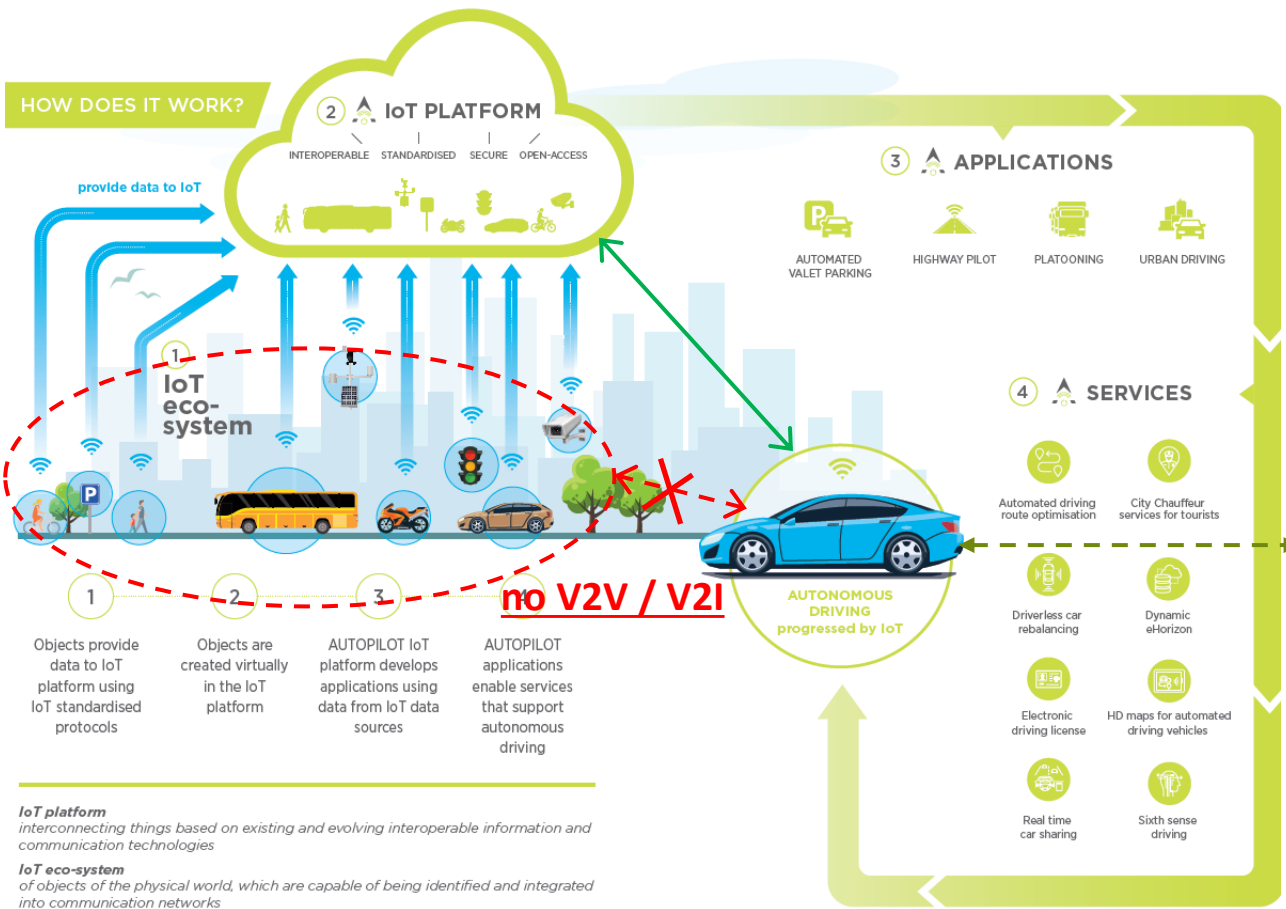# Vehicle centric and Cloud approaches
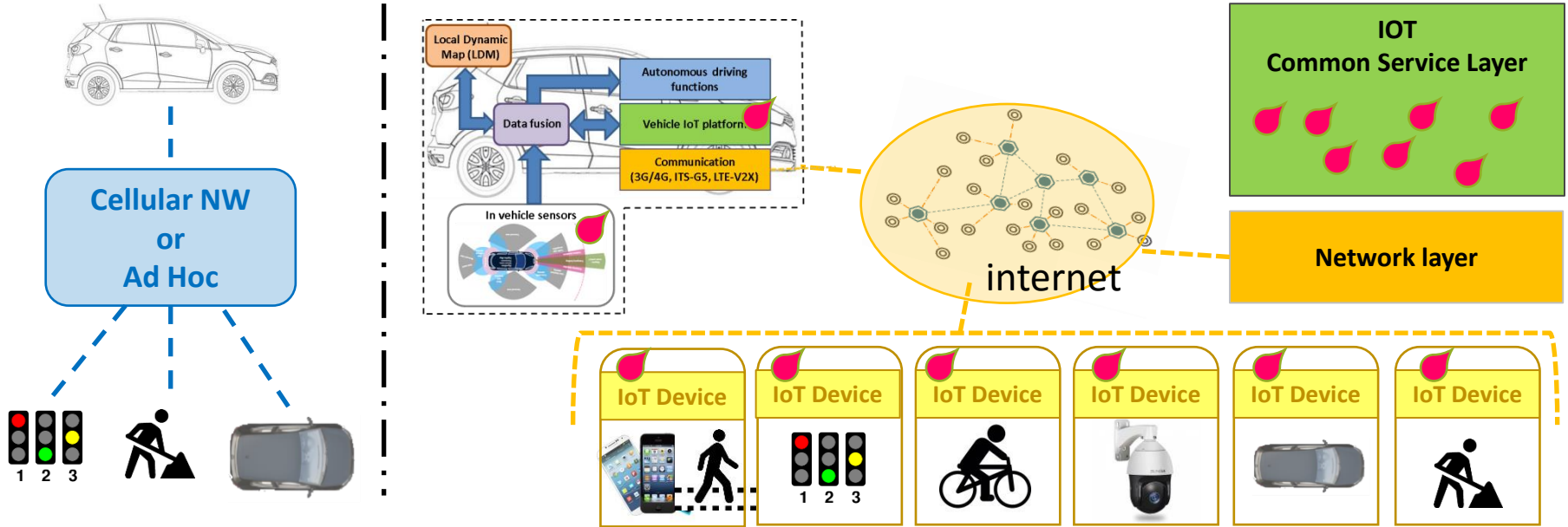
New connectivity paradigm: Cloud and IoT

- V2X approach - vehicle centric
  - limited scope: only device with compatible connectivity
  - Limited functionalities – missing connected devices diversity – "mere" data (no filtering / augmentation)

- Cloud IoT approach – augmented data provided as a service
  - Connectivity agnostic
  - Semantics enhancing device representation (metadata)
  - 2 levels management: device and context
    - "Augmented" data representation out of the context management
    - E.g. traffic jam or other hazards / traffic : environment events from individual Things' data
  - Easy cross domain service integration - aggregation
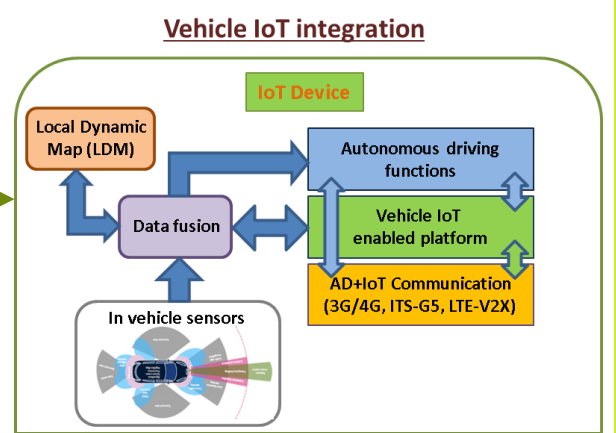 - Standardised data models - platform openness – higher cyber-security

HOW DOES IT WORK?

2 IoT PLATFORM

INTEROPERABLE   STANDARDISED   SECURE   OPEN-ACCESS

provide data to IoT

1 IoT eco-system

no V2V / V2I

1	2	3	
Objects provide data to IoT platform using IoT standardised protocols	Objects are created virtually in the IoT platform	AUTOPILOT IoT platform develops applications using data from IoT data sources	AUTOPILOT applications enable services that support autonomous driving

IoT platform
interconnecting things based on existing and evolving interoperable information and communication technologies

IoT eco-system
of objects of the physical world, which are capable of being identified and integrated into communication networks

3 APPLICATIONS

AUTOMATED VALET PARKING   HIGHWAY PILOT   PLATOONING   URBAN DRIVING

4 SERVICES

Automated driving route optimisation   City Chauffeur services for tourists

Driverless car rebalancing   Dynamic eHorizon

Electronic driving license   HD maps for automated driving vehicles

Real time car sharing   Sixth sense driving

AUTONOMOUS DRIVING progressed by IoT

IOT to transform automated driving

Vehicle IoT integration

IoT Device

Local Dynamic Map (LDM)

Data fusion

Autonomous driving functions

Vehicle IoT enabled platform

AD+IoT Communication (3G/4G, ITS-G5, LTE-V2X)

In vehicle sensors

Perspective of IoT for automated driving

- Current use cases (AUTOPILOT)
  - Enhance driving environment perception for the AD DDT and RT HD maps update
  - Provide SaaS/PaaS for mobility (OEM vehicle management platform or MaaS)

- Future usages
  - Driven by usage of AI and data analytics in the IoT cloud platforms
  - Enabled by future Cellular network performances:
    - Massive IOT providing more information for the AD functions – (mMTC)
    - Higher data rates (eMBB) allowing high volume data representation (videos)
    - Lower latency (URLLC) and MEC enabling
    - use of IoT for RT DDT in the vehicle and DDT combined with Infrastructure control

IoT BigData for Automated driving

- Hybrid approach for access to BigData:
  1. Centric approach for OEMs:
     - Sensitive data with relevance only for OEM
     - Contains vehicle specific data
       - Cannot be shared (confidential)
       - Long term relevance for analytics and deep learning for instance
  2. Distributed and open data access
     - Essential for sharing **safety** relevant data (e.g. CAM/DENM data)
       - It is as important for each user that other vehicles get as much useful data as my vehicle get – accident may occur from another vehicle
       - Data consolidation for higher integrity
     - 2 levels of time relevance
       - For open data access – only **short term relevance for cooperative and automated driving**
         - Disable access to "older data"
       - Older data has relevance for **investigation in case of incident/accident**
         - Limited access – only for relevant organisations (police/justice – insurance)
         - Similar as the situation with the signalling data in TelCo networks

Thank you

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