Hyper-connected Society

3D IoT Architecture

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Architecture Approach

Left panel

APPLICATION LAYER
- AUTOPILOT APPLICATIONS

IOT LAYER
- CONTEXT MANAGEMENT
  - Process & service management
  - Analytics
  - Device management
  - Semantics
- SECURITY

NETWORK LAYER
- END TO END COMMUNICATION
- NETWORK COMMUNICATION
- HOP BY HOP COMMUNICATION

EXTERNAL SERVICES
- Web services
- Public offices

AUTOPILOT THINGS
- Pedestrians
- Public transportation
- Autopilot vehicles
- Airlines
- Traffic lights
- Other devices & vehicles

Right panel

Application Layer
- AUTOPILOT Applications

IoT Layer
- Analytics
- Process and Service Management
- Context Management
- Semantics
- Device Management
- Security

Network Layer
- End-to-end Communication
- Network Communication
- Hop by hop Communication

AUTOPILOT Things
- Web services
- Public offices
- External services
- Autopilot vehicles
- Drones
- Airlines
- Other devices
- Pedestrians
- Public transportation
- Other vehicles
- Traffic lights

European Large-Scale Pilots Programme

Architecture Approach

IoT reference architectures

- ❖ AIOTI - Reference Architecture
- ❖ ISO/IEC 30141 IoT Reference Architecture
- ❖ ITU-T Y.2060
- ❖ IOT-A ARM

Architecture patterns

- ❖ Four-tier architecture
- ❖ Gateway-mediated and direct cloud connectivity
- ❖ Connectivity and management
- ❖ Device-to-Cloud
- ❖ Multi-tier data storage
- ❖ Distributed analytics

Characteristic features of IoT

- ❖ Data correlation and information retrieval
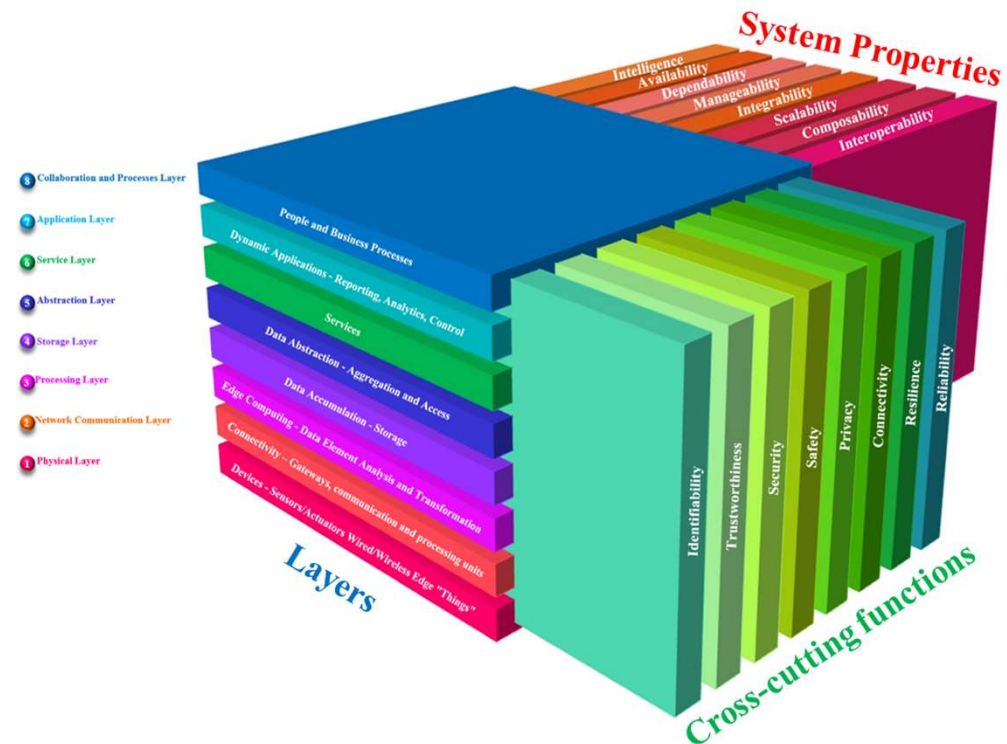- ❖ Communication
- ❖ Integration and interoperability
- ❖ Security, privacy and trust
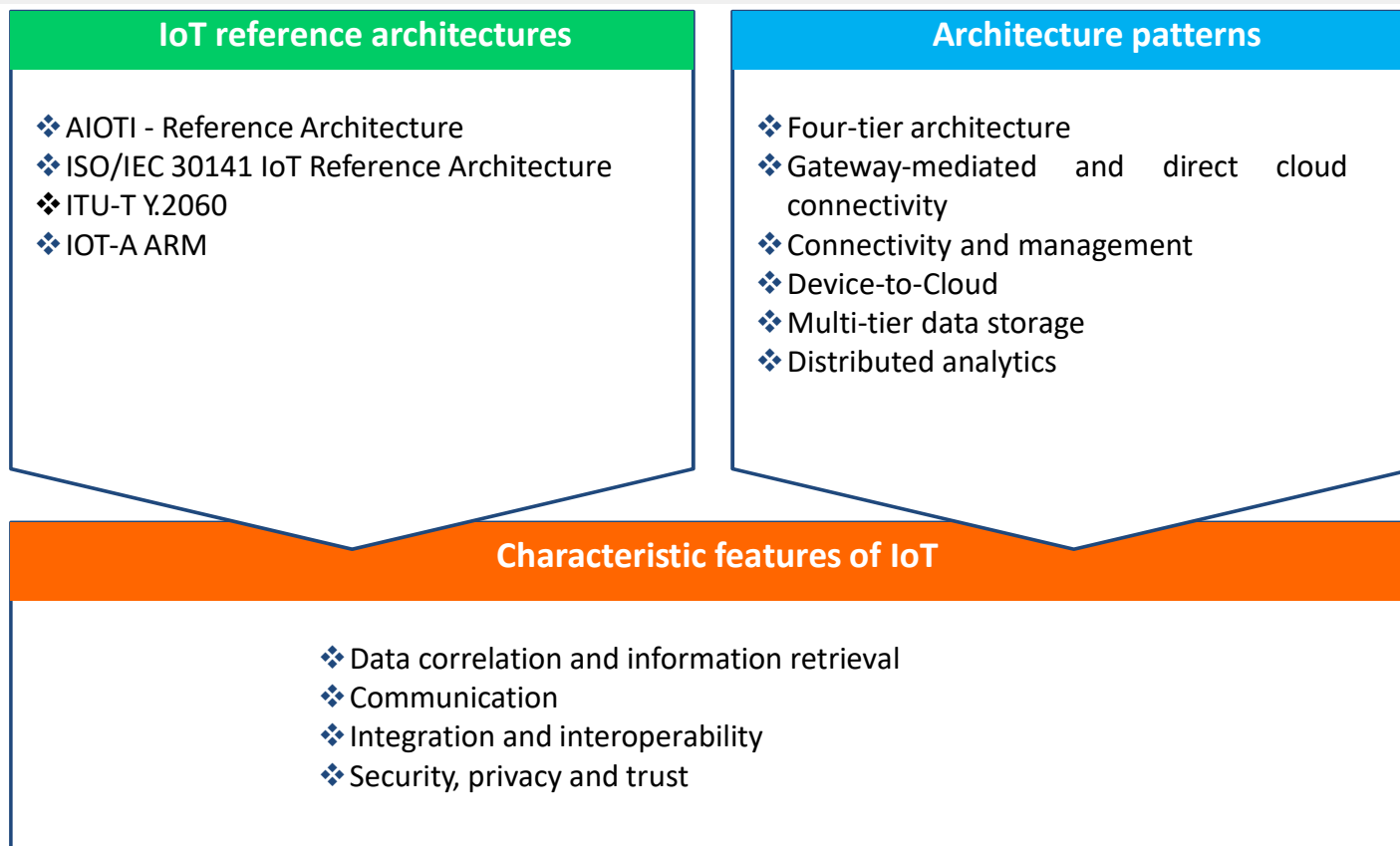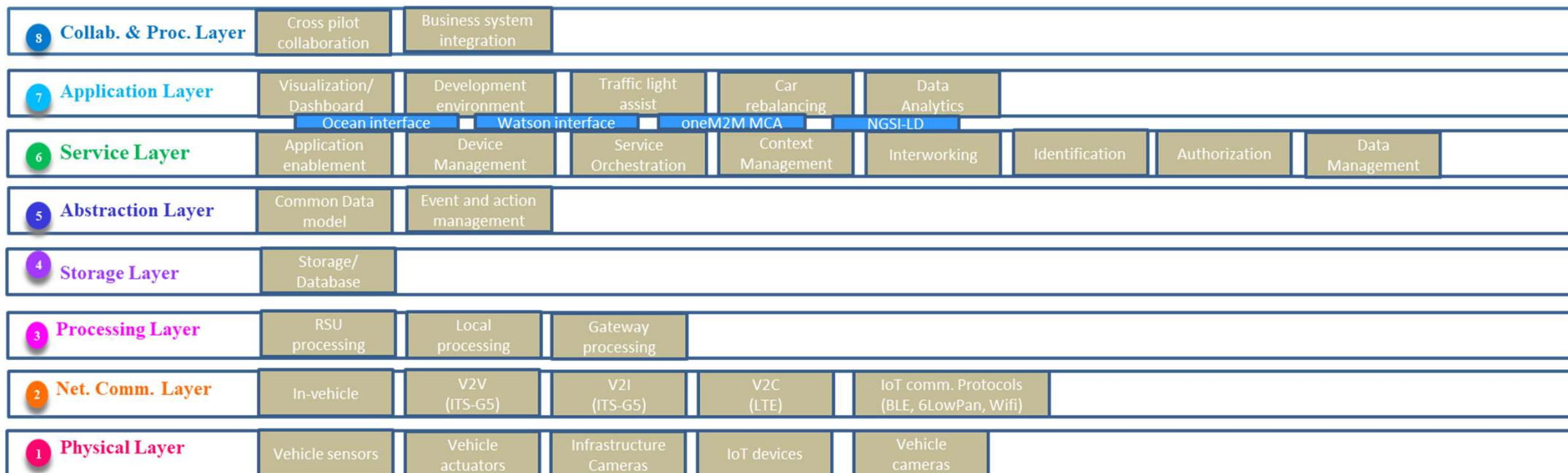
Architecture Approach

- 3D Reference IoT Architecture
- Objectives:
  - Ensure that the model deals with
    - All the functional aspects, in particular "cross layers"
    - More than the functional aspects
  - Explain how it can be mapped on other reference architectures
- Main aspects
  - A three dimensional model
    - Layers
    - Cross-cutting functions
    - Properties
  - Addressing more explicitly some expected properties of the system

Architecture Approach

AUTOPILOT

IoT European Large-Scale Pilots Programme

#	Layer								
8	**Collab. & Proc. Layer**	Cross pilot collaboration	Business system integration						
7	**Application Layer**	Visualization/ Dashboard	Development environment	Traffic light assist	Car rebalancing	Data Analytics			
		Ocean interface	Watson interface	oneM2M MCA	NGSI-LD				
6	**Service Layer**	Application enablement	Device Management	Service Orchestration	Context Management	Interworking	Identification	Authorization	Data Management
5	**Abstraction Layer**	Common Data model	Event and action management						
4	**Storage Layer**	Storage/ Database							
3	**Processing Layer**	RSU processing	Local processing	Gateway processing					
2	**Net. Comm. Layer**	In-vehicle	V2V (ITS-G5)	V2I (ITS-G5)	V2C (LTE)	IoT comm. Protocols (BLE, 6LowPan, Wifi)			
1	**Physical Layer**	Vehicle sensors	Vehicle actuators	Infrastructure Cameras	IoT devices	Vehicle cameras			

IoT Architectural Layers

ACTIVAGE PROJECT   AUTOPILOT   IoF INTERNET OF FOOD & FARM   MONICA   SYNCHRONICITY   CREATE-IoT   U4IoT   Co-funded by Horizon 2020 programme of the European Union

Architecture Approach
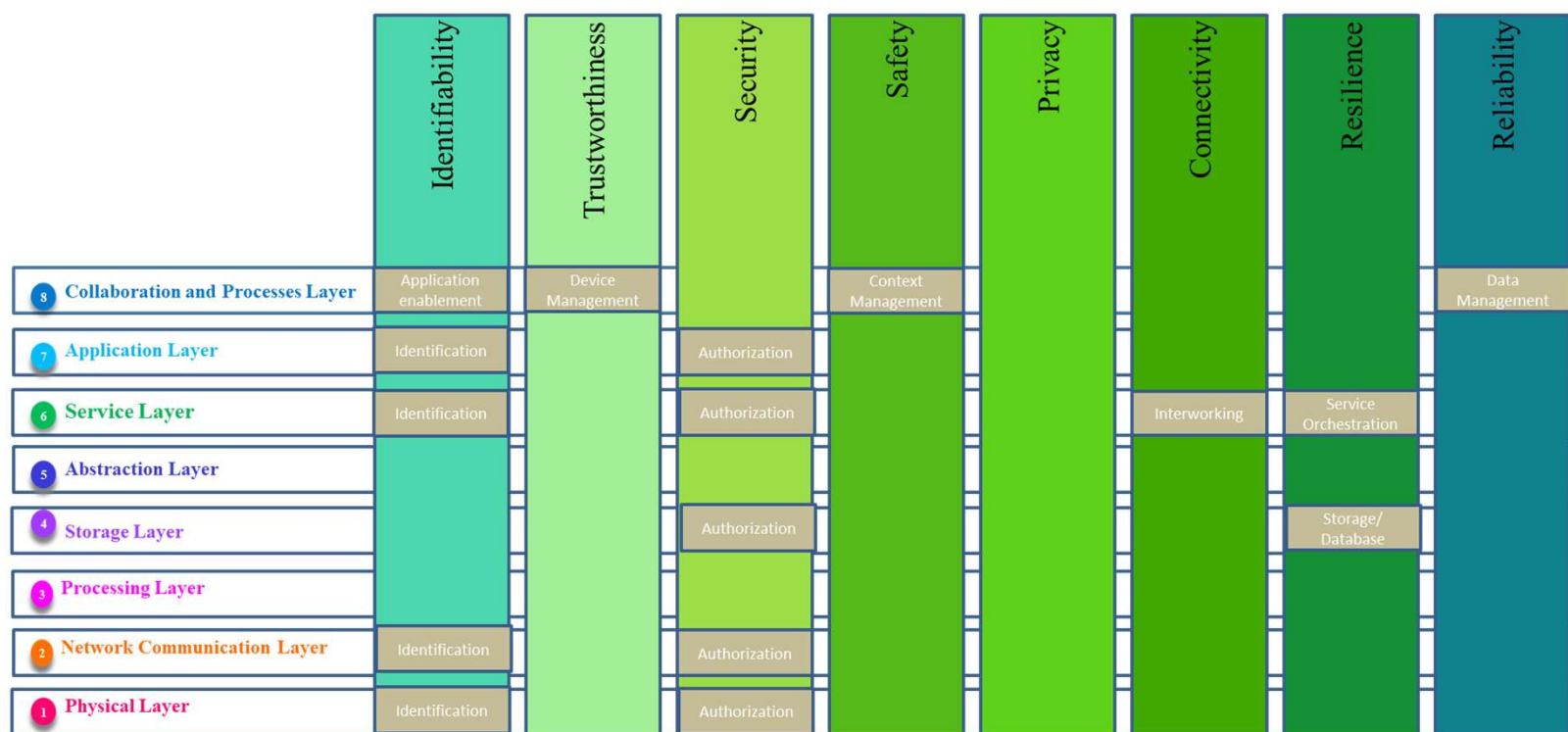
IoT Architectural Layers   **IoT Cross-cutting Functions**

Architecture Approach
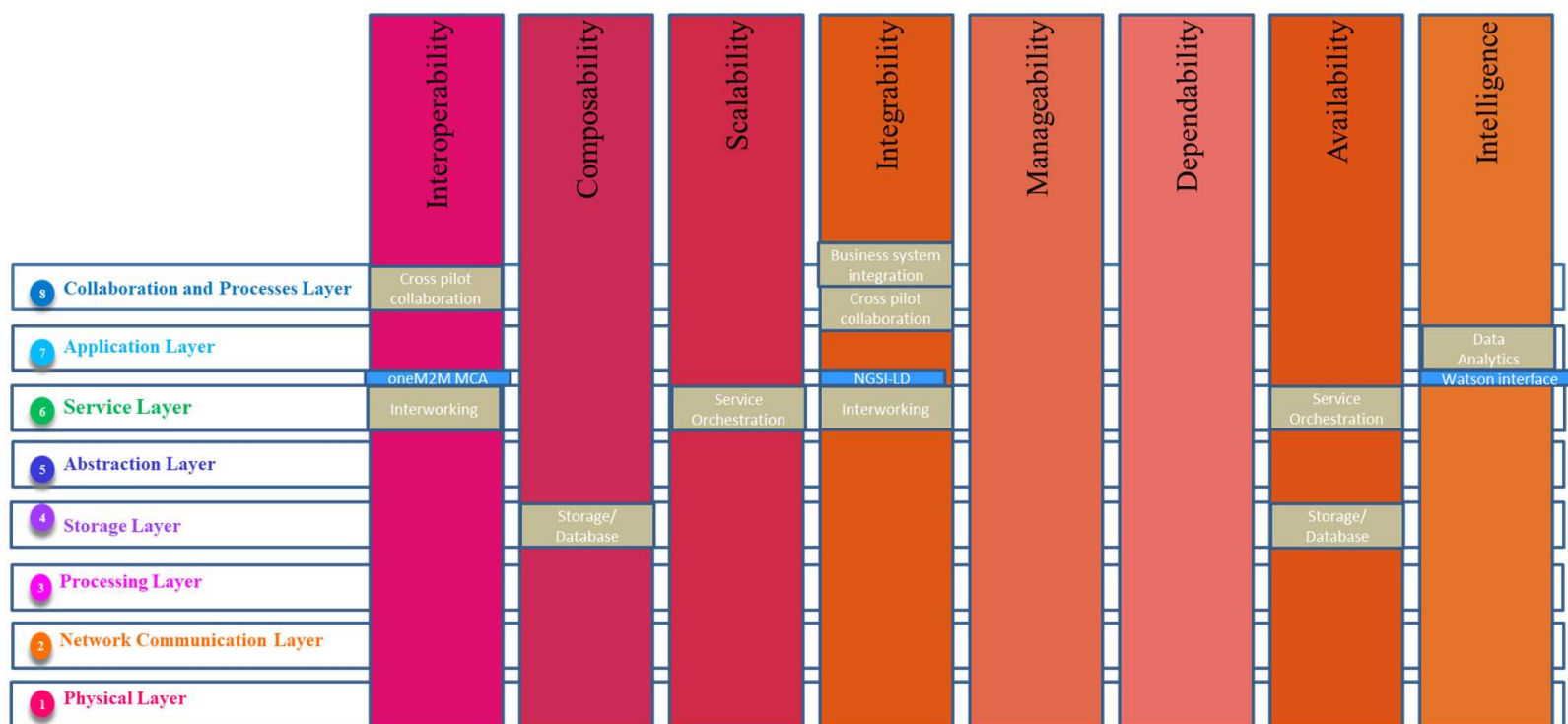
IoT Architectural Layers   **IoT System Properties**

Versailles pilot site – Urban driving
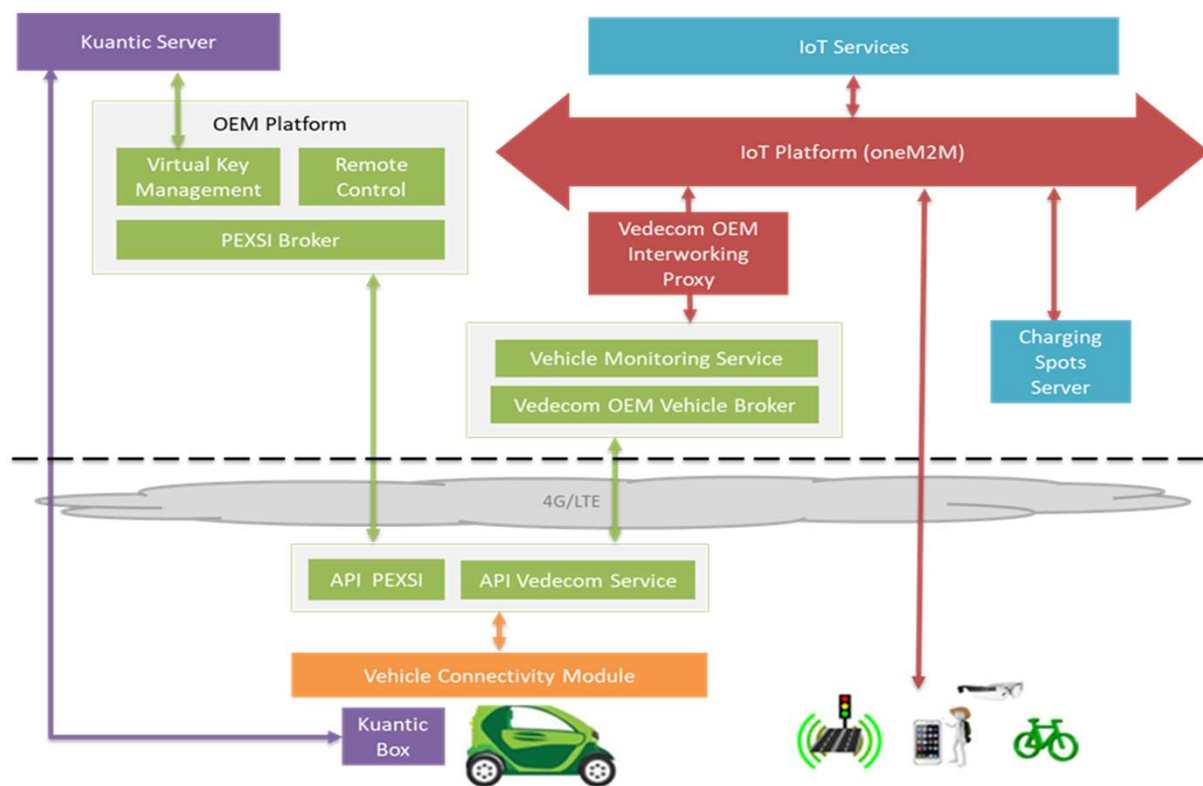
IoT Applications
Connected and automated driving with point of interest notifications (audio/video) and VRU detection (collaborative perception).
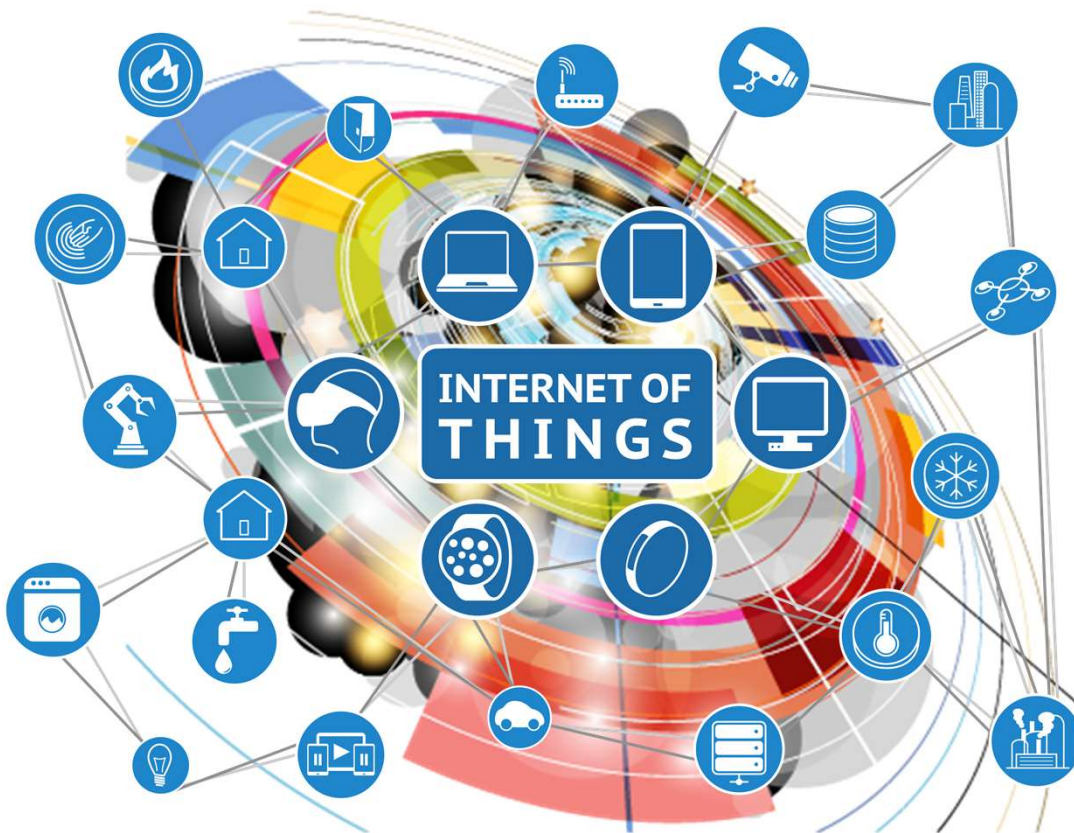
IoT Platforms and Software
oneM2M.

IoT Technologies and Standards
oneM2M; 4G/LTE; PEXSI Broker; Kuantic Server

IoT Devices
IoT-enabled vehicles w/sensors;
IoT enabled traffic lights (presence detectors 79GHz)