



The Standards People

MEC support for V2X

use cases and automotive perspective

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V2X use cases in ETSI-MEC specifications

- V2X (Vehicle-to-Everything) use cases were considered in ETSI MEC in multiple studies and specifications.
- In the study [ETSI GR MEC 022 v2.1.1](#) published in September 2018, ETSI ISG MEC studied the MEC support for the following different V2X use cases groups
 - V2X use case group safety
 - V2X use case group convenience
 - V2X use case group advanced driving assistance
 - V2X use case group vulnerable road user (VRU)
- The conclusions of ETSI GR MEC 022 were integrated in the specification ETSI GS MEC 002 both as a set of requirements on the MEC system to support the V2X service and a high-level description of the V2X use cases.

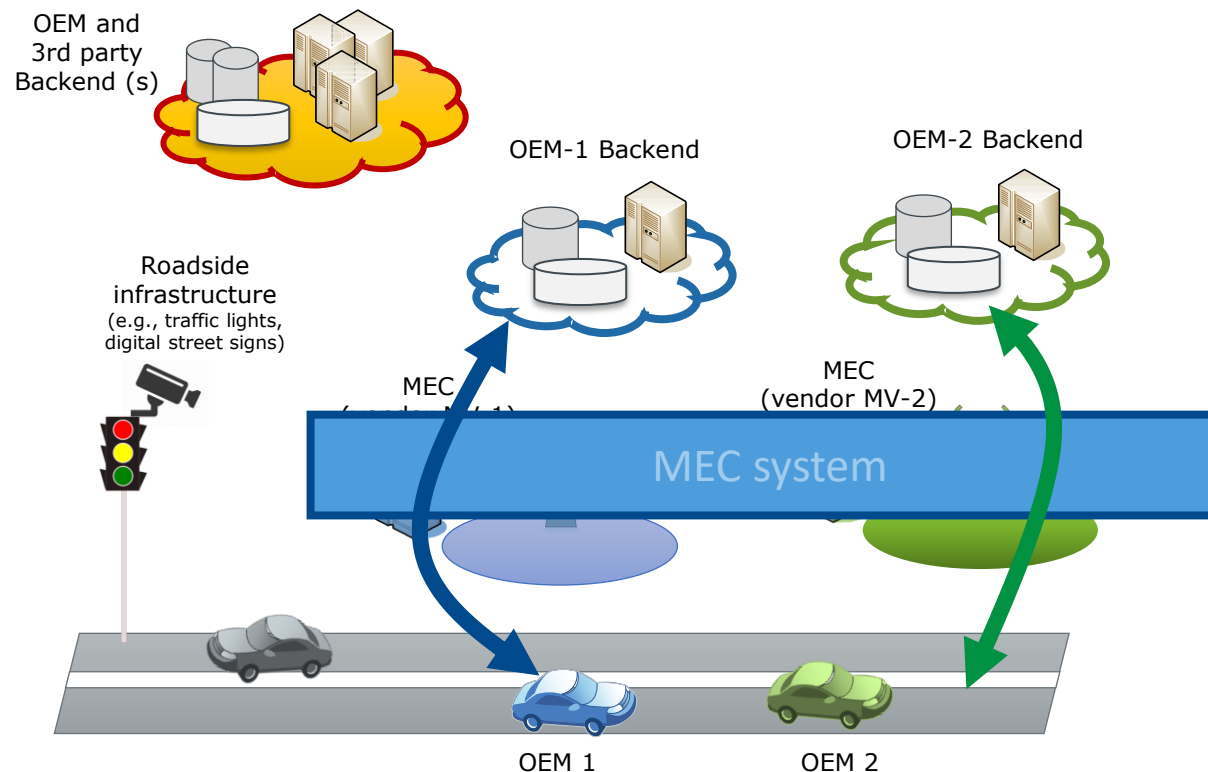
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A top-down diagram of a four-way intersection. Four vehicles are positioned at the corners: a yellow car at the top, a blue car at the right, a yellow car at the bottom, and a yellow car at the left. Each vehicle is facing the center of the intersection. Blue wavy lines emanate from each vehicle, representing a signal or advisory. The text "Greenlight time advisory" is written in blue in the top-right and bottom-left quadrants of the intersection.

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ETSI GR MEC 022 ("Study on MEC Support for V2X Use Cases")

- **V2X use case group convenience:**
 - Software updates and telematics use cases are included in this group. These use cases are considering the communication between the vehicles and the original equipment manufacturer (OEM) cloud. MEC can help When MEC system is enabling multi mobile network operator (MNO) operation for V2X mobiles to provide service continuity across multiple MNOs networks.



**MEC Enables
Multi-MNO
service
continuity**

ETSI GR MEC 022 ("Study on MEC Support for V2X Use Cases")

- **V2X use case group advanced driving assistance :**
 - Advanced driving assistance group is requiring the distribution of a relatively large amount of data with high reliability and low latency to the involved vehicles/agents.
 - Advanced driving use cases can benefit from prediction of the V2X communication link reliability for example vehicles moving along should have the possibility to receive a prediction of the network availability to plan ahead during its path.
- Advanced driving assistance use cases:
 - **Real Time Situational Awareness (High-Definition Local Maps)**
 - Real time situational awareness is essential for autonomous vehicles especially at critical road segments or in cases of changing road conditions. In addition, the relevant high-definition local maps need to be made available via downloading from a backend server.
 - **See-Through (High-Definition Sensor Sharing)**
 - vehicles such as trucks, minivans, cars in platoons are required to share camera images of road conditions ahead of them to vehicles behind them.
- MEC system is required to provide local aggregation/distribution of real time information from the vehicles and to provide prediction of the quality of service (latency, throughput, etc.) for the use case optimization.

ETSI GR MEC 022 ("Study on MEC Support for V2X Use Cases")

- **V2X use case group vulnerable road user (VRU) :**
- The vulnerable road user (VRU) use case is including the pedestrians and cyclists in the V2X system. The VRU warning is disseminated to avoid collision with the vehicles.
 - A critical requirement for the VRU use cases is the accuracy of the positioning information of the VRUs.
- Communication between the vehicles and vulnerable road are enabled by using VRU awareness messages (VAM), considered in ETSI ITS specifications⁽¹⁾ and that can be used by the MEC system
- The High-level recommendations for the MEC system to optimize the VRU use case :
 - MEC system enables the support for timely accurate positioning assisted by available positioning technologies, including network positioning capabilities
 - MEC system provides interoperability by supporting V2X information exchange among road users connected through different access technologies or networks or mobile operators, i.e. multi- access and multi- operator service continuity between VRUs and vehicles
 - MEC system enables multi-operator operation for V2X mobiles/users to provide service continuity across multiple operator network coverage

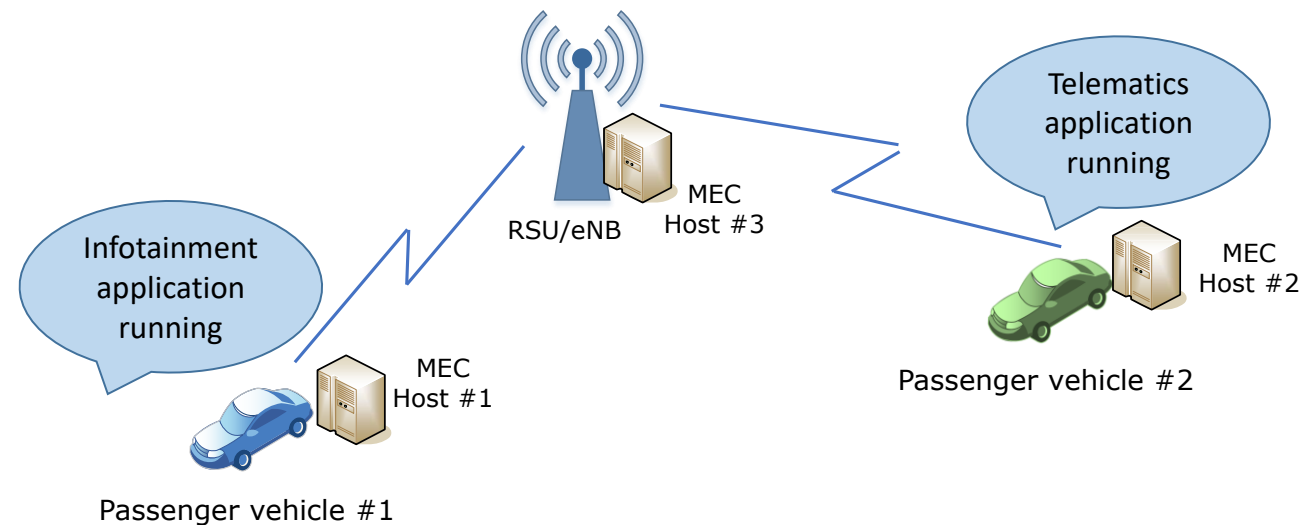
(1) ETSI TS 103 300-2 V2.1.1, " Intelligent Transport System (ITS); Vulnerable Road Users (VRU) awareness; Part 2: Functional Architecture and Requirements definition"

ETSI GS MEC 002 (“Use Cases and Requirements”)

- The requirements on the MEC systems that resulted from the ETSI GR MEC 022 study are summarized in the ETSI GS MEC 002 specification as :
 - When the MEC system supports the feature *V2XService*, the MEC system shall support the capability to provide feedback information from the network to the vehicle in support of V2X functions. This feedback is enhanced with information about the prediction of channel availability.
 - When the MEC system supports the feature *V2XService*, the MEC system shall support the capability to provide quality of service (QoS) change at the V2X application layer .
 - When the MEC system supports the feature *V2XService*, the MEC system shall be able to provide interoperability by supporting V2X information exchange among road users connected through different access technologies/networks and different mobile operators.
 - When the MEC system supports the feature *V2XService*, the MEC system shall enable multi-operator operation for V2X mobiles/users to provide service continuity across access network coverage nationwide and across borders of different operators' networks.
 - When the MEC system supports the feature *V2XService*, the MEC system shall be able to provide interoperability in a multi-operator scenario, enabling MEC apps in different systems to communicate securely with each other, in order to enable synchronization in multi-operator systems also in absence of cellular coverage.
 - When the MEC system supports the feature *V2XService*, the MEC system shall be able to provide interoperability in a multi-operator scenario, enabling MEC apps to communicate securely with the V2X-related 3GPP core network logical functions (e.g. V2X application function) and gathering sidelink V2X relevant information (e.g. sidelink configuration parameters) from 3GPP network.
 - When the MEC system supports the feature *V2XService*, the MEC system shall be able to provide information about available sensor data sources to the MEC applications.

ETSI GS MEC 002 (“Use Cases and Requirements”)

- ETSI GS MEC 002 presented 41 industrial use cases that can benefit from the deployment of MEC systems among which use cases **A.36** and **A.39** are directly related to automotive vertical industry.
- UC A.36: In-vehicle MEC hosts supporting automotive workloads**
- Availability of in-vehicle MEC hosts supporting automotive workloads tailored to several functions (e.g. relevant to safety, telematics, high resolution maps for navigation, as well as video and other infotainment applications)



- The MEC is used for offloading processing-demanding tasks from vehicles to the network as well as providing a common application framework for independent deployment across service providers.

ETSI GS MEC 002 (“Use Cases and Requirements”)

- **UC A.39: V2X multi-stakeholder scenario**
- V2X application client instances may be running on vehicular UEs connected to MNO's network which is equipped with a MEC system. Such V2X application client instances, hosted by Vehicular UEs connected to different MNOs' networks, may communicate with each other via MEC application instances hosted in the MEC system.

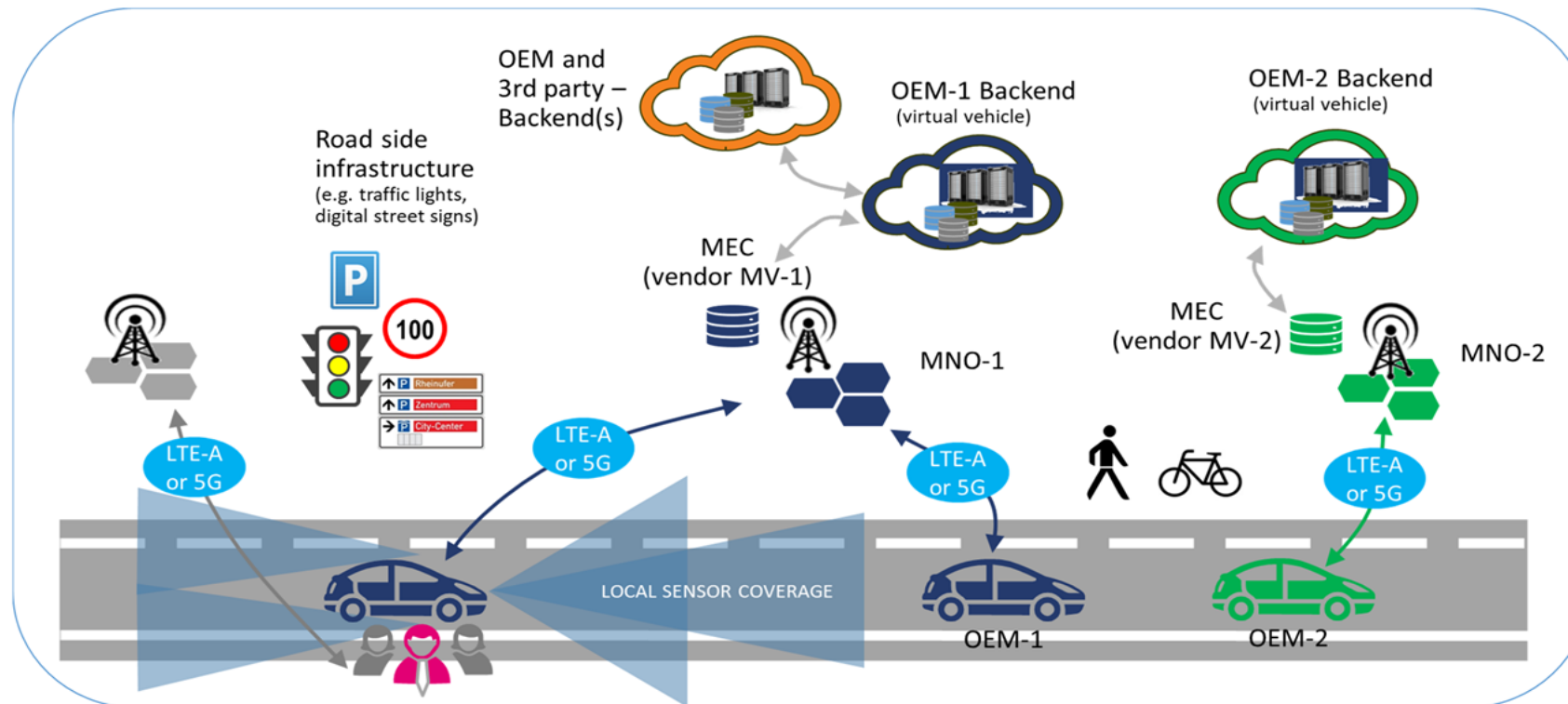


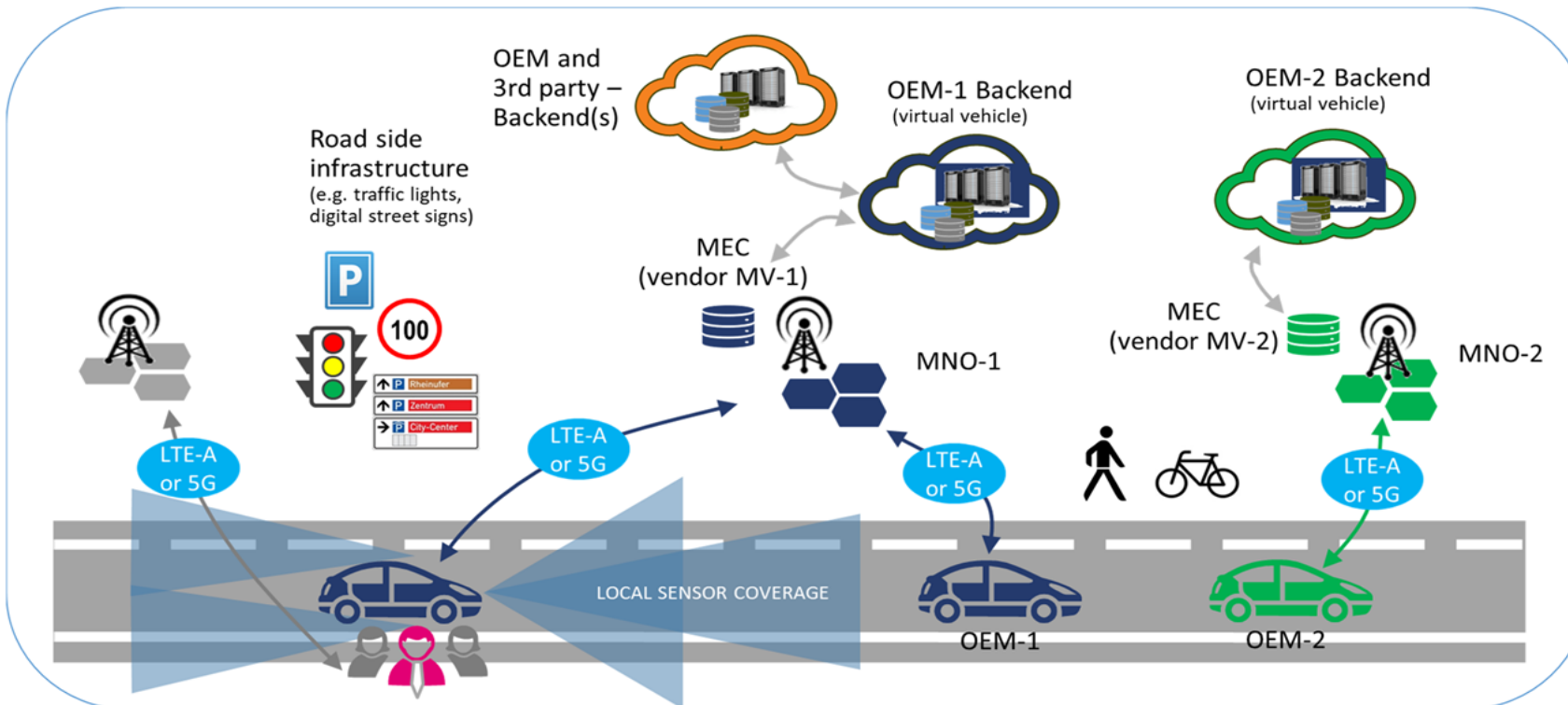
Figure A.39.1: Typical V2X multi-stakeholder scenario
(source: 5GAA member's symposium in Turin, November 2019)

ETSI GS MEC 002 (“Use Cases and Requirements”)

- The deployment of the use case UC A.39 can be considered in the framework of MEC federation studied in the specification ETSI GR MEC 035 and specified in ETSI GS MEC 040
- One way to describe this MEC federated V2X high level view is provided below :
- An application developer has a commercial relationship with MNO#1. Through the federation agreements, it is possible to also deploy the application developer's App in the MEC systems of MNO#2, MNO#3 to access their respective subscribers. Through its existing federation agreements, MNO#1 provides capabilities to allow the App developer to use an appropriate deployment approach based upon their commercial strategy.
- A possible use case for MEC federation can be associated to a national roaming like scenario where vehicular UEs of MNO#1 could utilize the resources/ services offered by the MEC system of MNO#2 if this operator has a complementary coverage footprint.
- A vehicular UE is the subscriber of MNO#1 but the "best" edge location (e.g., in terms of latency) for the MEC App to be used is in the MEC system of MNO#2.
- The MEC system of MNO#1, through its federation agreement, identifies that the best edge location is in MNO#2.
- Then, the MEC system of MNO#1 redirects the App to the MEC system of MNO#2 to ensure the best possible service.

ETSI GR MEC 035: «MEC Study on Inter-MEC systems and MEC-Cloud systems coordination»

V2X services are a key use case for MEC Federation, as these scenarios are natively characterized by multi-MNO, multi-OEM and multi-MEC system environments.



1. Interop. between MNOs
2. Interop. between MEC vendors/suppliers
3. Interop. between OEMs (applications)

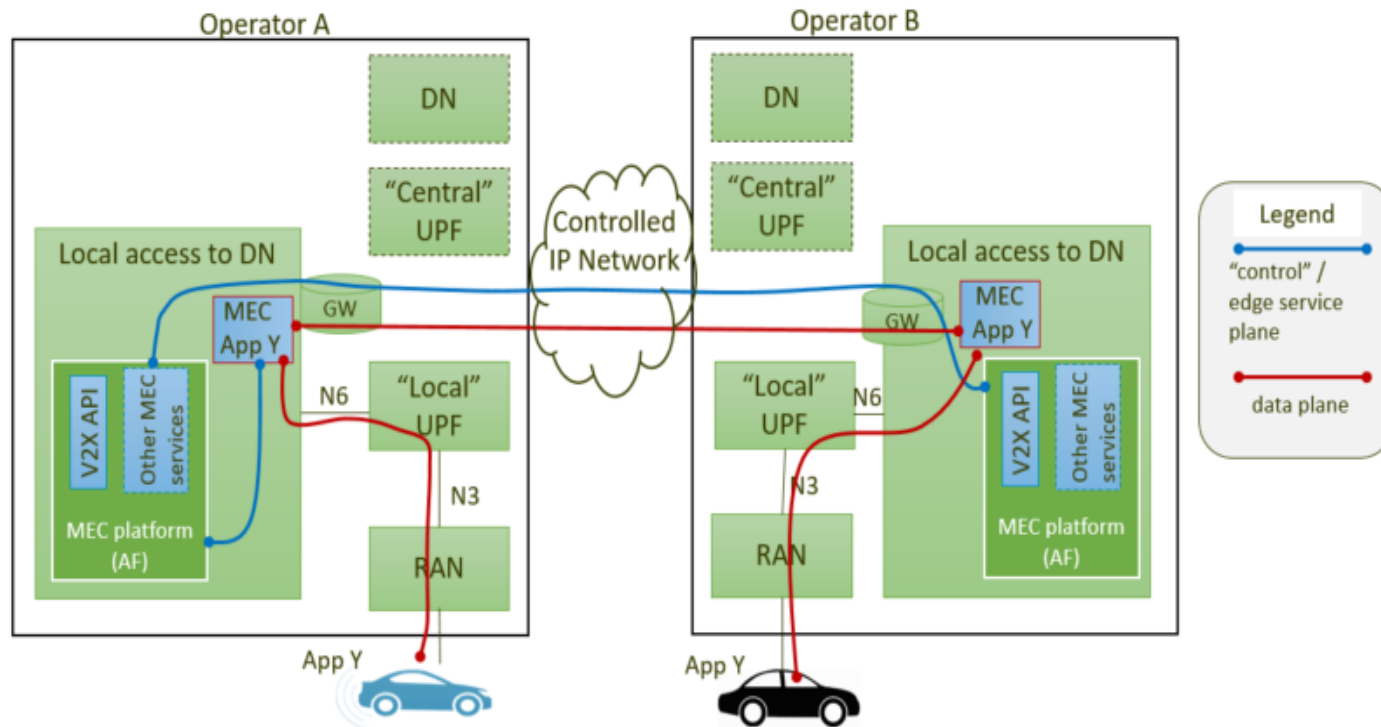
Inspired by 5GAA use cases including multi-MNO, multi-OEM, multi-MEC

Requirements for MEC:

- MEC system discovery
- MEC platform discovery
- MEC platform level information exchange

ETSI GR MEC 035: «MEC Study on Inter-MEC systems and MEC-Cloud systems coordination»

Some federation use cases are related to multi-operator agreements enabling MEC Federation for V2X services



- **Type-1** use case - national roaming like scenario: customers of operator A could access the edge infrastructure of operator B to ensure the best possible service.
- **Type-2** use case: An app developer has a commercial relationship with operator A. Federation agreements could allow the app developer to deploy its App in operator B's MEC system.
- **Type-3** use case - federation broker: a federation broker has a set of agreements with several MNOs.

V2X and automotive perspective (MEC 030 “MEC V2X API”)

- **5GAA contribution to MEC standards :**
- ETSI MEC is collaborating with 5GAA since 2018 thanks to common member contributions.
- In 2019, a Memorandum of Understanding (MoU) was signed between ETSI MEC and 5GAA in order to facilitate this collaboration
- In 2021, 5GAA joined the ETSI MEC membership in order to further facilitate the collaboration
- In 2022, ETSI-MEC elected liaison officer for automotive verticals that facilitate this collaboration with 5GAA and other vehicular associations i.e., AECC.
- In 2022-2023, 5GAA contributed directly to the MEC 030 specification on “MEC V2X API”
 - Joint contribution from car OEMs, Tier-1 suppliers and network equipment manufacturers that describe the additional information needed from VIS
 - Stage 2 description, i.e. overall signalling and use case description, and stage 3, i.e. actual VIS API description was proposed by common 5GAA and ETSI MEC members and were integrated to the MEC 030 specification on “MEC V2X Information Services API”.

Summary on V2X use cases in the perspective of V2X information services API



- We presented in the previous slides a high-level overview of the V2X use cases that can benefit from ETSI-MEC system deployment and the requirements on MEC systems.
 - The key use case is V2X multi- stakeholder scenario of the ETSI MEC GS 002 that encompass multiple V2X use cases
- The requirements on the MEC system deployment are recalled below :
 - MEC system should provide interoperability by supporting V2X information exchange among road users connected through different access technologies or networks or mobile operators.
 - MEC system should enable multi-operator operation for V2X system to ensure service continuity over multiple operator networks domains.
 - MEC system should enable the support for locally aggregating the real-time information from the vehicles/networks with very low latency.
 - MEC system should enable the support for locally distributing the real-time information to the connected nodes with very low latency.
 - MEC system should provide prediction of the quality related information to the vehicle when the various connectivity parameters (like Latency, PER, signal-strength,...) are going to change i.e., predictive QoS information
 - MEC system should enable the support for timely accurate positioning assisted by available positioning technologies including radio network positioning functions.
- MEC federation is a framework that is used to enable the multi-MNO, multi-OEM interoperability and V2X service continuity.
 - Details on the improvements proposed by 5GAA for V2X information services API will be presented in the next presentation

Thank you!



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