



Mobile Edge Computing

An enabler for enhanced Car2X communication

Nurit Sprecher (Chair of ETSI MEC ISG)

Connected Cars, London, UK

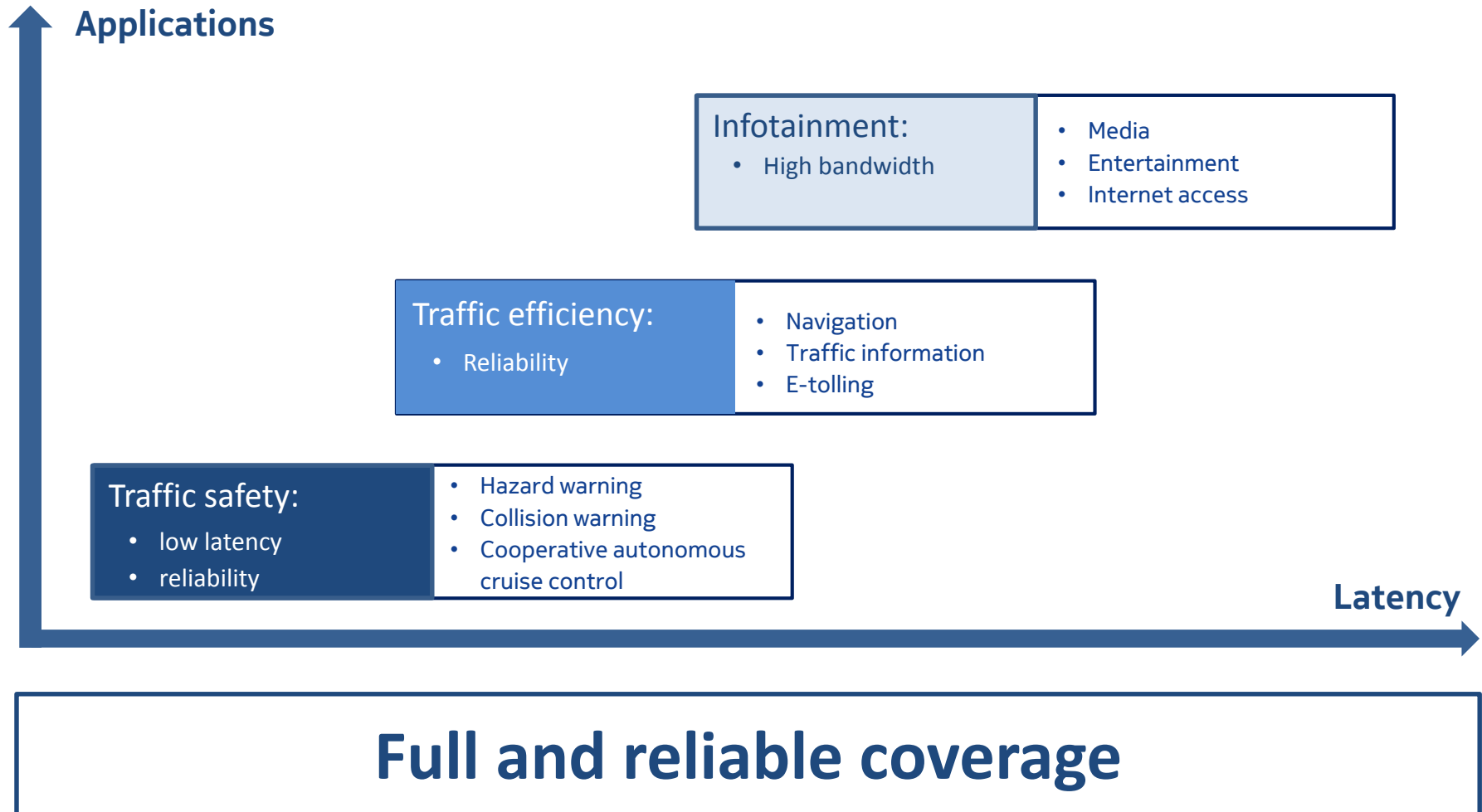
The number of connected cars is rapidly growing.

Majority of the fatalities in car accidents are caused by human error and could be avoided with assisted driving and connected cars.

Car connectivity can contribute to the optimization of the infrastructure investment and the transportation planning.

Car connectivity opens up new revenue streams and business opportunities.

Automotive: Communications-related Requirements



LTE complements ITS G5

ITS G5 communication
Direct car-to-car

Proximity, path prediction and collision anticipation/warning:

- Intersection
- Lane change
- Rear end

ITS G5 communication
Short range vehicle-to-infrastructure

Broader road conditions:

- Incidents
- Dynamic traffic signs
- Alerts

LTE communication
Mid and long range vehicle-to-X

Electronic horizon far ahead of the vehicle:

- Weather and road conditions
- Traffic efficiency
- Infotainment

Mobile Edge Computing

Paves the path to 5G and enables enhanced Car2X communication



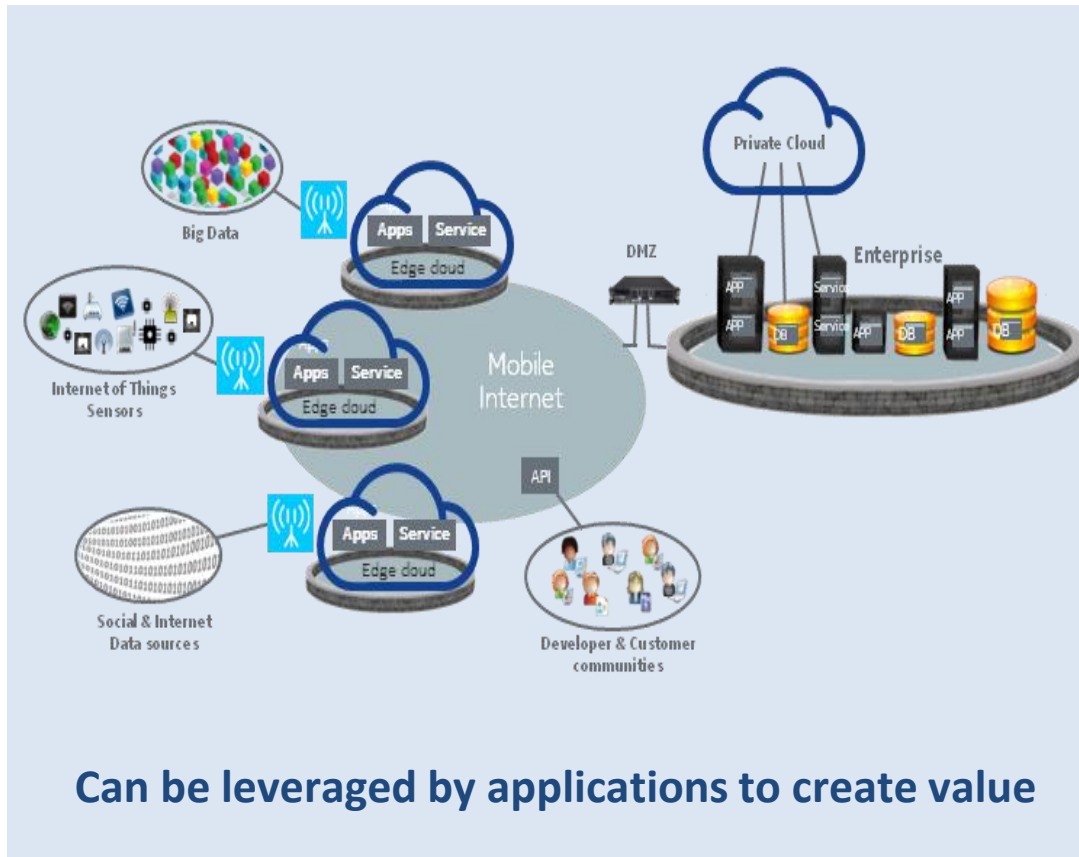
Mobile Edge Computing paves the path to 5G; it can enable enhanced Car2X communication and automated driving already in LTE environment, and help to:

- increase road safety
- optimize infrastructure investment
- increase traffic efficiency and comfort
- deliver value-added services



Mobile Edge Computing

An Environment for Innovation and Value Creation



Offers applications and content providers **cloud-computing capabilities** and an **IT service environment at the edge of the mobile network**

This environment is characterized by:

- Proximity
- Ultra-low latency
- High bandwidth
- Real-time access to radio network and context information
- Location awareness

Why Mobile Edge Computing?



- Unparalleled Quality of Experience
- Contextualized services, tailored to individual needs and preferences
- Efficient utilization of the Radio and the network resources
- Innovative applications and services towards mobile subscribers, enterprises and vertical segments

Real time

Interactive

Analytical

**Security and
privacy**

Distributed

Mobile Edge Computing Business Benefits



A new value chain and an energized ecosystem, based on Innovation and business value

Wider collaboration can help to drive favorable market conditions for sustainable business for all players in the value chain.

Business transformation

New market segments (enterprises, verticals and subscribers);
short innovation cycle;
revenue generation and differentiation

A myriad of new use cases

Video acceleration, augmented reality, connected vehicles, IoT analytics, enterprise services, network performance and utilization optimization, retail, eHealth, etc.

Mobile Edge Computing Service Scenario Categories



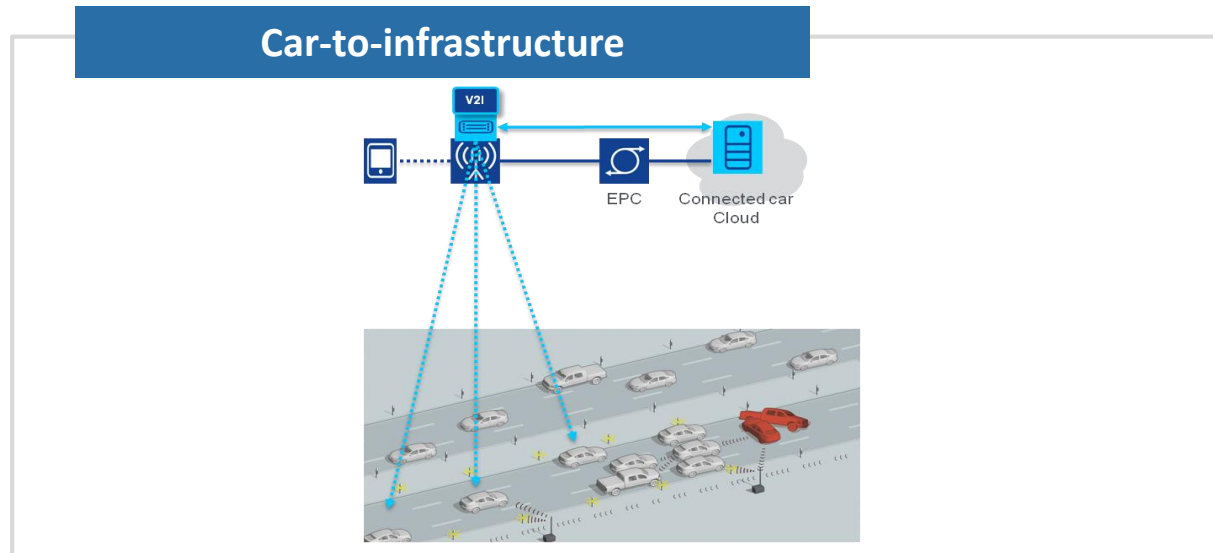
Operator and third-party services

Consumer-oriented Services

Network-performance and QoE improvements

Operator and Third-party Services

Connected Cars



- Existing cloud services are extended into the highly distributed mobile base station environment, leveraging the existing LTE connectivity.
- The MEC application operates as a roadside unit for car-to-infrastructure (V2I).
- Road hazards can be recognized and warnings can be sent to nearby cars with extremely low latency.
- Enables a nearby car to receive data in a matter of milliseconds, and the driver to react instantly.

The first public showcase of safety applications at the "Digital A9 Motorway Test Bed" (November 2015)

Demonstration of real-time communication between cars via the LTE cellular network

Use cases:

- Co-operative passing assistance
- Electronic brake light

Contribution to road safety improvement was demonstrated

Mobile Edge Computing (MEC) used as the enabling technology

MEC enabled near-5G communication (< 20ms latency)

 **Fraunhofer**
ESK

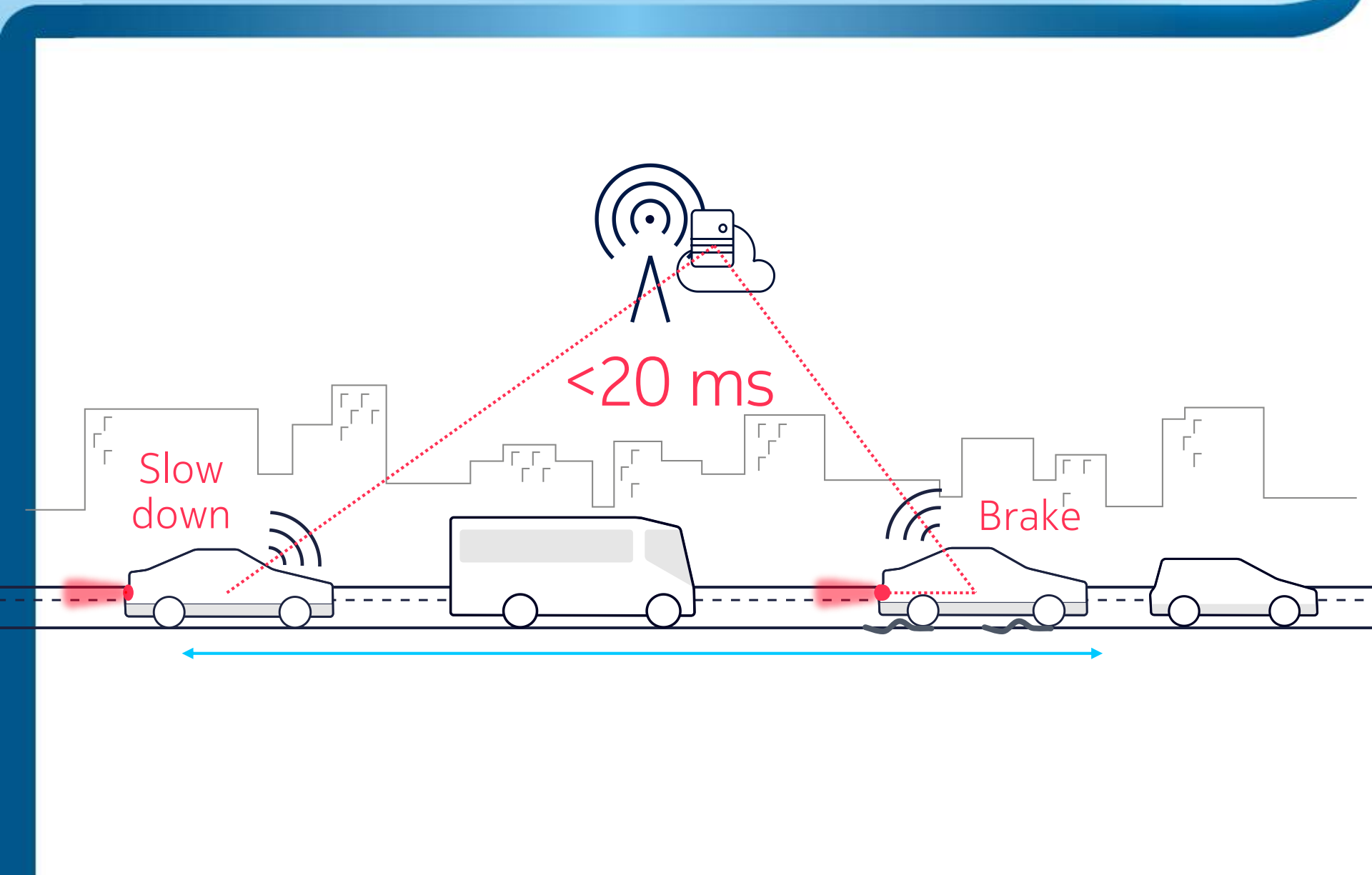
 **Continental** 

 **NOKIA**

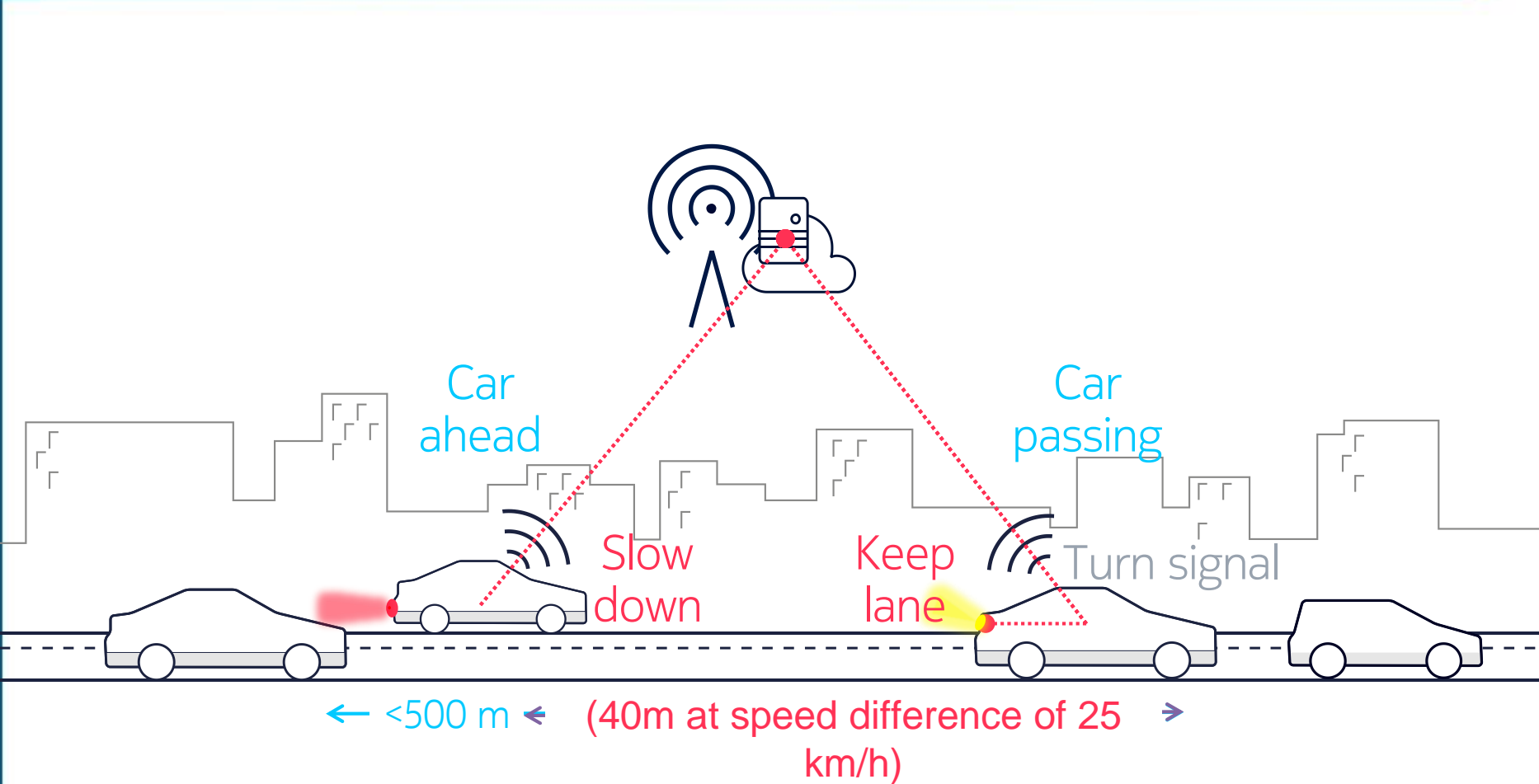
[Link to PR](#)

[link to Deutsche Telekom clip](#)

Use Case 1: Emergency electronic brake lights

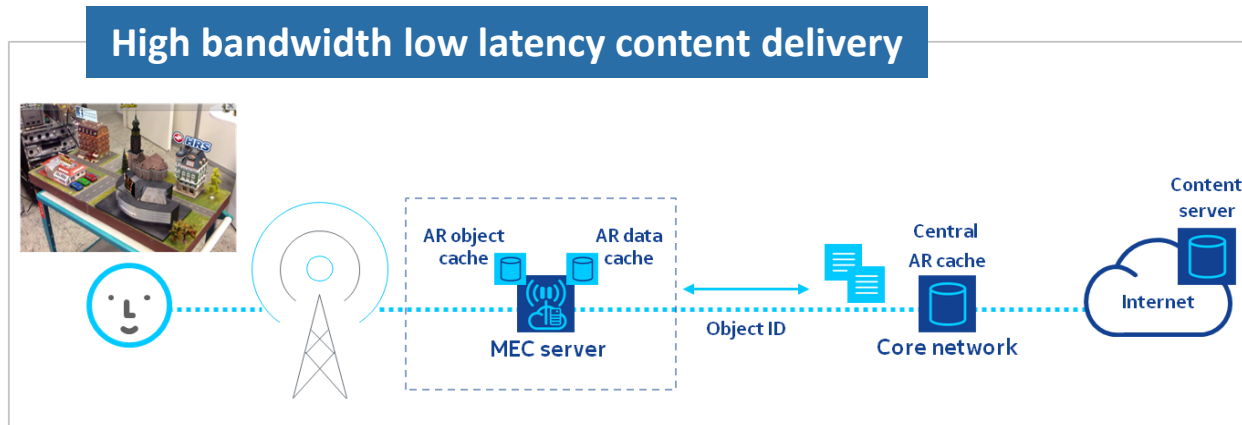


Use Case 2: Cooperative Passing Assistant



Consumer-oriented Service Scenarios

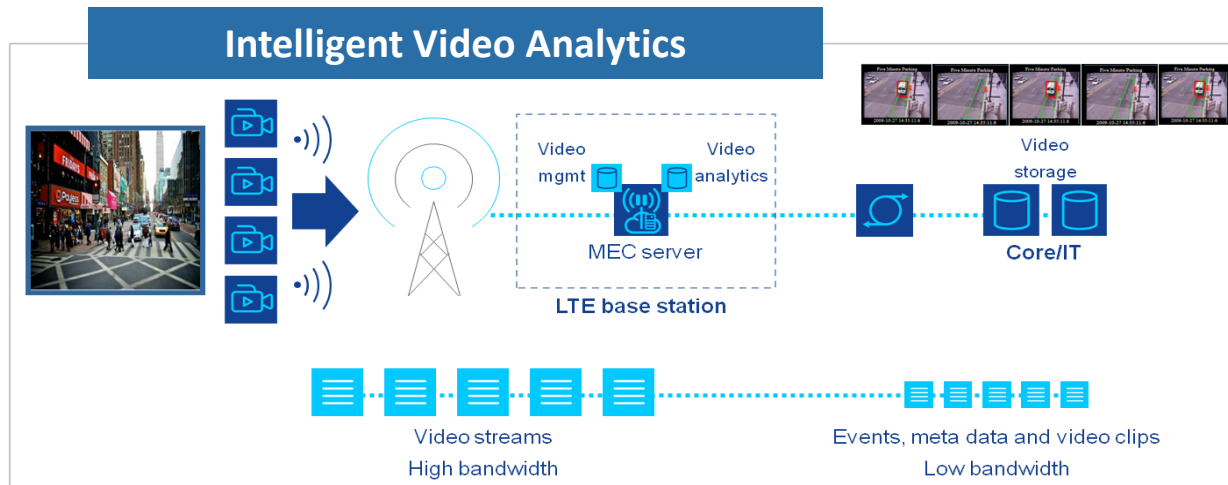
Augmented Reality



- The MEC application analyses the output from a device's camera and the precise location; objects viewed on the the device camera are overlaid with local augmented reality content.
- Enables unique experience of a visitor to a museum or other (indoors or outdoors) points of interest
- Ensures low latency and high rate of data processing

Operator and Third-party Services

Video Analytics



- Distributed live video streams analytics at the mobile edge
- Events are triggered automatically (e.g. movement, missing objects, crowds, etc.); enables fast detection and action triggering
- Optimizes backhaul and transport capacity
- Applicable to public safety, smart cities

ETSI MEC ISG

Formed in September 2014; first meeting in December 2014



Founding members

Creates an open and standardized IT service environment

Hosts third-party applications at the edge of the mobile network

Compliance with regulatory and legal requirements

Formed under the auspices of the ETSI ISG

Exposes real-time radio network and context information

Enables a new value-chain, fresh business segments

Stimulates innovation

ETSI MEC ISG Members/Participants



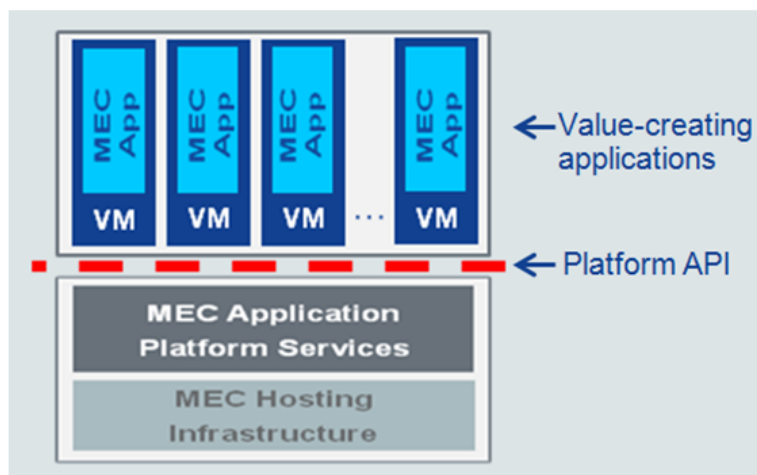
A multi-stakeholder industry initiative:



A NEW VALUE CHAIN: MOBILE OPEARTORS *** BASE STATION VENDORS *** TECHNOLOGY PROVIDERS *** APPLICATION AND CONTENT PROVIDERS

The MEC ISG work to produce normative Group Specifications that will allow the efficient and seamless integration of applications from vendors, service providers, and third-parties across multi-vendor MEC platforms.

Mobile-edge Computing platform API



Application agnostic, providing the opportunity to revolutionize, differentiate and create value

Promotes interoperability and mass deployment; the vast majority of the population can be served

Allows smooth porting of value-creating applications on every mobile-edge server, with guaranteed SLA

Published

- Technical Requirements, including use cases ([GS MEC 002](#))
- Framework and Reference Architecture ([GS MEC 003](#))
- Terminology ([GS MEC 001](#))
- MEC Proof of Concept (PoC) ([GS MEC-IEG 005](#))
- Service Scenario ([GS MEC-IEG 004](#))
- ETSI White Paper “Mobile Edge Computing - a key technology towards 5G “ ([Link](#))
- Webinar on “Boosting user experience by innovating at the mobile network edge” ([Link](#))

Work-in-progress

- Work Items relating to the MEC APIs, management interfaces and essential platform functionality:
 - API principles, mobile edge platform application enablement, radio network information API, Location API, UE identity API, bandwidth management API, system, server and platform management, application lifecycle and policies, and UE application interface
- Study items related to MEC integration in NFV environment and end-to-end mobility.
- Work Items which aim to increase MEC market acceleration (MEC metrics best practices, MEC business case examples, MEC requirements for multi-vendor eco-systems)

- MEC utilizes the NFV infrastructure.
The NFV infrastructure may be dedicated to MEC or shared with other network functions or applications.
- MEC uses (as far as possible) the NFV infrastructure management entity.

NFV

MEC is fully compliant with the 3GPP architecture

- MEC uses existing 3GPP functional elements and reference points.

3GPP

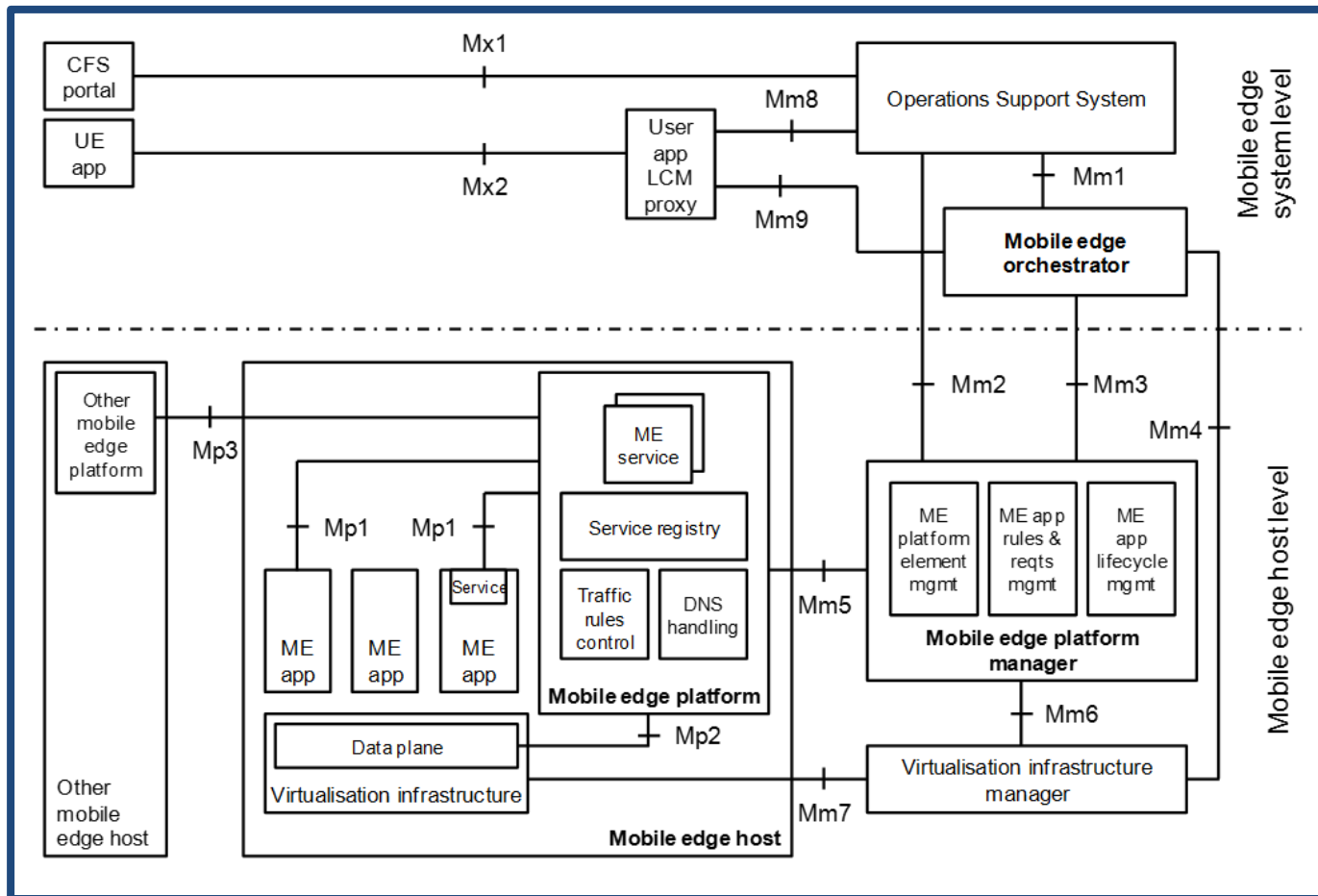
Third-party applications can be intelligently and flexibly deployed in a seamless manner on different MEC platforms (based on technical and business parameters).

Orchestration

MEC supports multiple deployment scenarios, including at a multi-Radio Access Technology (RAT) cell aggregation site, at an aggregation point, at the cloud RAN and at the edge of the core network.

Deployment scenarios

MEC Reference Architecture



MEC Proofs of Concept (PoC)



- MEC PoCs demonstrate the viability of MEC implementations; the results and lessons learnt from the MEC PoCs will be channeled to the MEC ISG specification activities.
- MEC PoCs address at least one of the PoC topics listed on the ETSI MEC WIKI page: <http://mecwiki.etsi.org/>.



MEC PoC ZONE

**@ MEC World Congress
21-22 September 2016 Munich, Germany**

• Mobile Edge Computing is as a key enabler for IoT and mission-critical, vertical solutions. It is one of the key architectural concepts and technologies for 5G, helping to satisfy the demanding requirements for the 5G era in terms of expected throughput, latency, scalability and automation. It also offers additional privacy and security and ensures significant cost savings.

• Many of the 5G use cases can be enabled with Mobile Edge Computing prior to 5G.

Mobile Edge Computing utilization in current LTE networks can satisfy the tight latency requirements of connected cars communication, helping to:

- improve road safety, efficiency and comfort
- optimize infrastructure investment
- deliver value-added services, with best experience for passengers

It can also complement ITS-G5 in forming a comprehensive communication infrastructure.

THANK YOU



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Thank you!