



Mobile Edge Computing

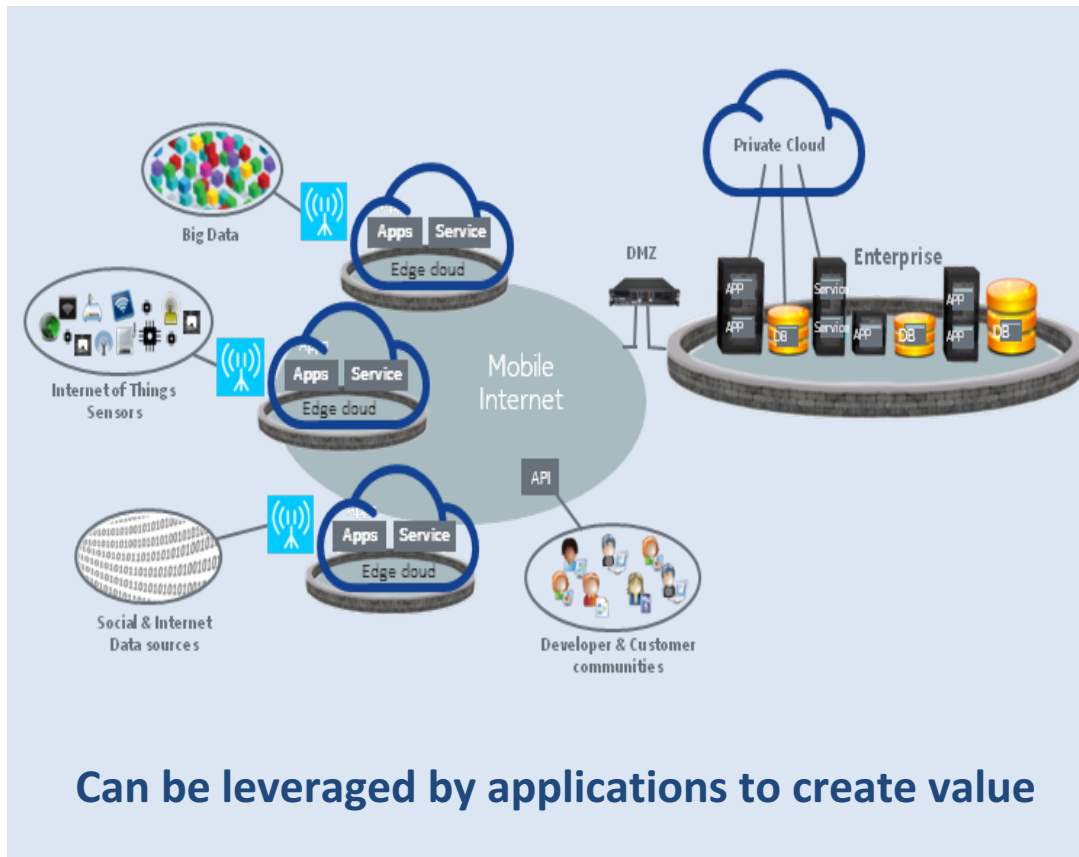
The story so far...

Nurit Sprecher (Chair of ETSI MEC ISG)

MEC Congress 2016, Munich, Germany

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.

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:



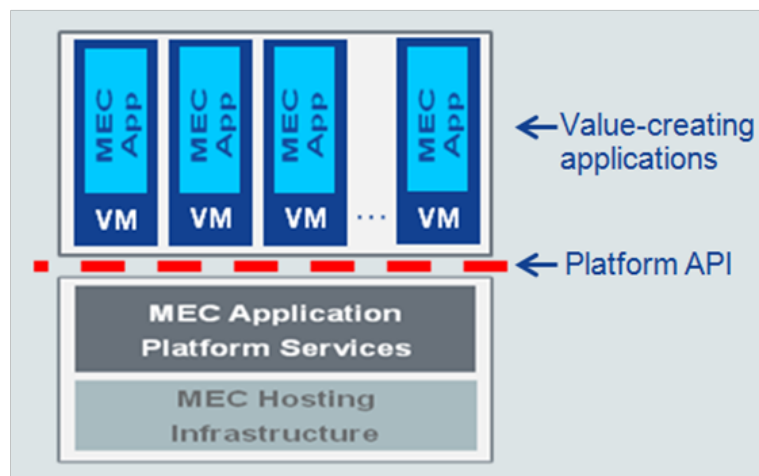
A NEW VALUE CHAIN: OPEARTORS *** VENDORS *** TECHNOLOGY PROVIDERS *** APPLICATION AND CONTENT PROVIDERS

ETSI MEC ISG: What Do We Specify?



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

Let's reflect on the work status...



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 ecosystems)



- 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

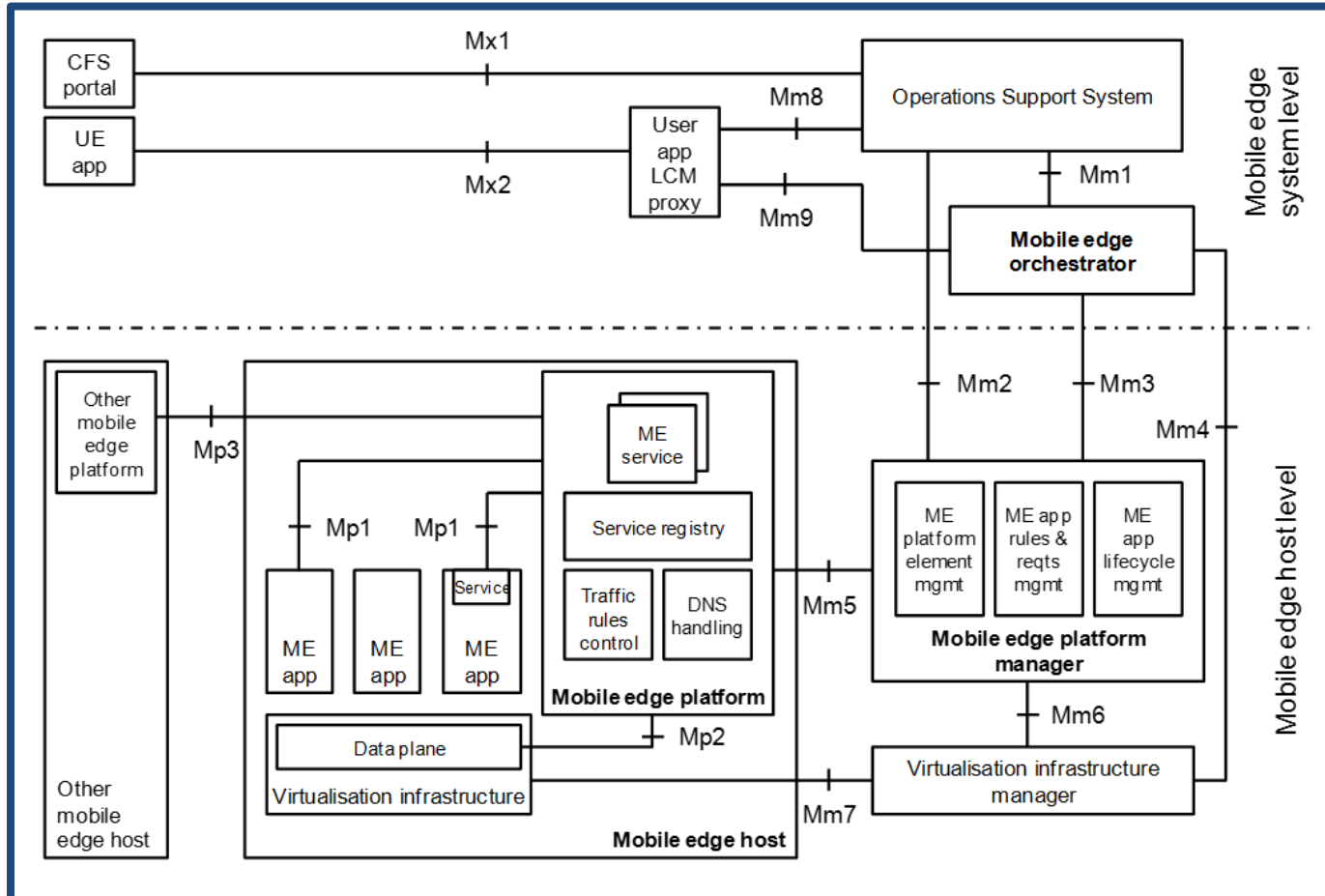
Third-party applications can be intelligently and flexibly deployed in a seamless manner on different MEC platforms (based on technical and business parameters).

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



Relationship to NFV

Complementary concepts which can exist independently



- Focused on porting network functions to virtual environments
- Enables migration from a proprietary, appliance-based setup to a standard, hardware and cloud-based infrastructure
- Virtual functions can be connected or chained together to create communication services.

RAN Virtualization

- Focused on creating an open environment in the RAN, allowing 3rd-party application/service integration (application-level enablers and APIs)
- Creates a new value chain and an energized ecosystem based on innovation and business value
- Enables a vast number of new use cases across multiple sectors

MEC

Notes

- MEC reuses the NFV virtualization infrastructure and NFV infrastructure management to the maximum extent possible.
- The scope of MEC is focused and its business objective differs from that of NFV.

MEC: Major Strides towards 5G Era



Complements SDN and NFV and advances the transformation of the mobile-broadband network into a programmable world

Programmability

Ensures highly efficient network operation and service delivery and ultimate personal experience

TCO and QoE

Enables a myriad of new use cases across multiple sectors.
Enables a new value-chain and fresh business operations

Business Opportunities

MEC helps satisfying 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 use cases can be enabled with Mobile Edge Computing prior to 5G.

MEC Proofs of Concept (PoCs)



- MEC PoCs demonstrate the viability of MEC implementations; the results and lessons learned from the MEC PoCs will be channeled to the MEC ISG specification activities.
- ETSI is pleased to announce that the first ETSI MEC PoC ZONE is an integral part of the MEC Congress 2016.

The ETSI MEC PoC ZONE, adjacent to the event's exhibition area, showcases MEC Proofs of Concept (MEC PoCs) which have been accepted by the ETSI MEC ISG.



MEC PoC ZONE

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

- For an updated list of the PoCs and further details, please see: [ETSI-MEC-PoC](#)



PoC #1

Video User Experience Optimization via MEC

A Service Aware RAN MEC PoC

Intel - China Mobile - iQiYi



PoC #2

Edge Video Orchestration and Video Clip Replay

Nokia - EE - Smart Mobile Labs



PoC #3

Radio-aware video optimization

in a Fully Virtualized Network

Telecom Italia - Intel - Eurecom -
Politecnico di Torino



PoC #4

Flexible IP-based services

InterDigital - Bristol is Open -
Intracom - CVTC - Essex University



PoC #5

Enterprise Services

Saguna - Adva Optical Networking -
Bezeq International



PoC #6

Healthcare

Dynamic Hospital User, IoT and
Alert Status Management

Quortus Ltd - Argela - Turk Telecom



PoC #7

Multi-Service MEC Platform

For Advanced Service Delivery

Brocade - Gigaspaces - Advantech -
Saguna - Vasona - Vodafone



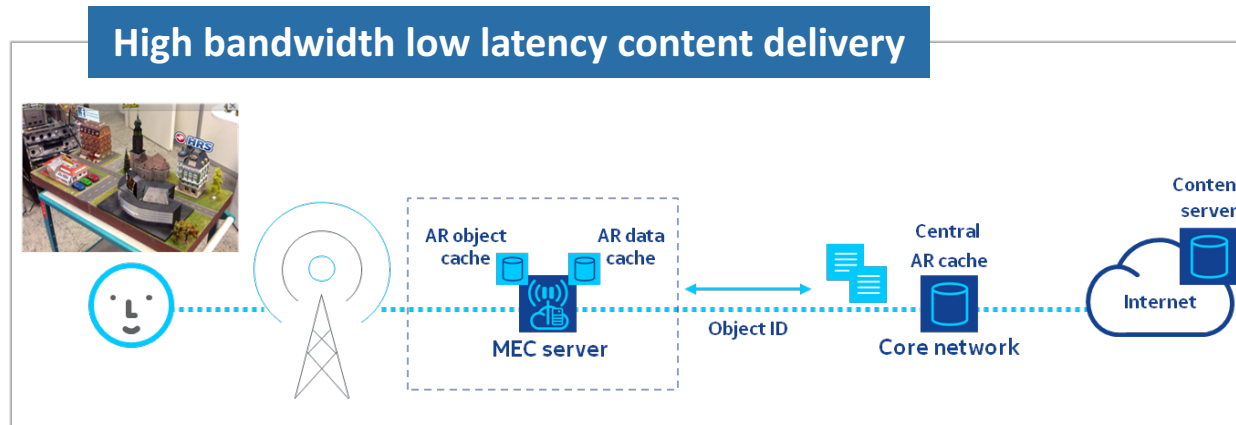
PoC #8

Video Analytics

Nokia - Vodafone Hutchison
Australia - SeeTec

Consumer-oriented Service Scenarios

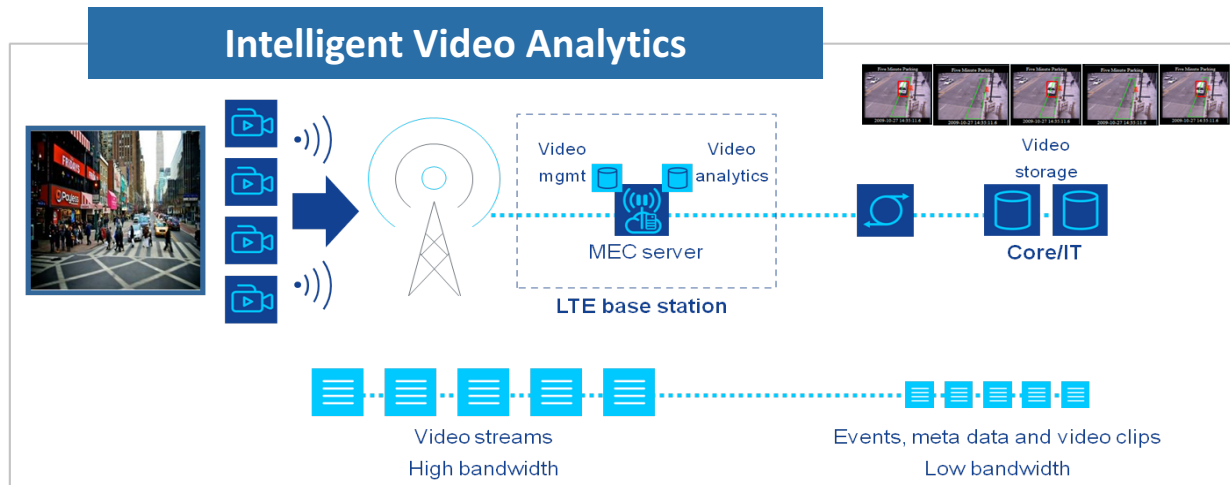
Augmented Reality



- 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

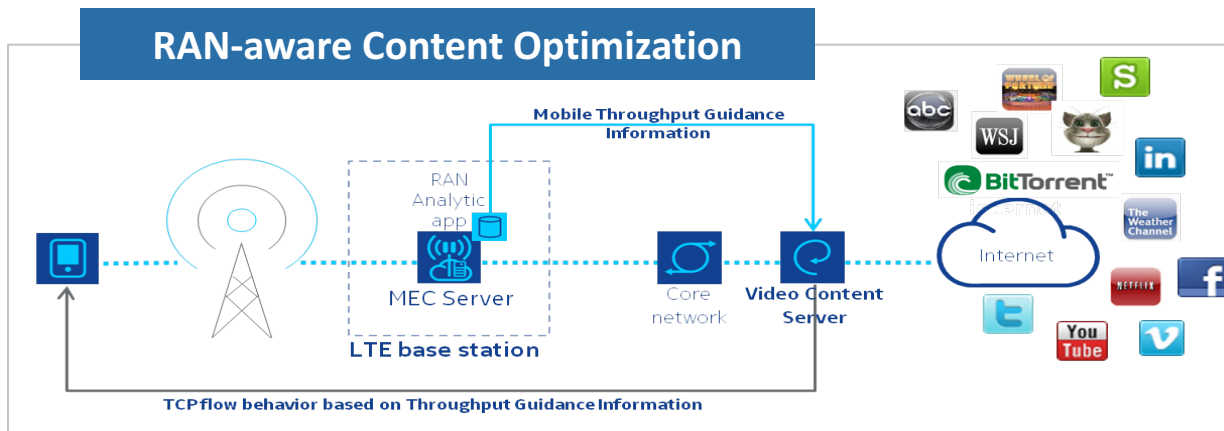
Video Analytics



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

Network-performance and QoE Improvements

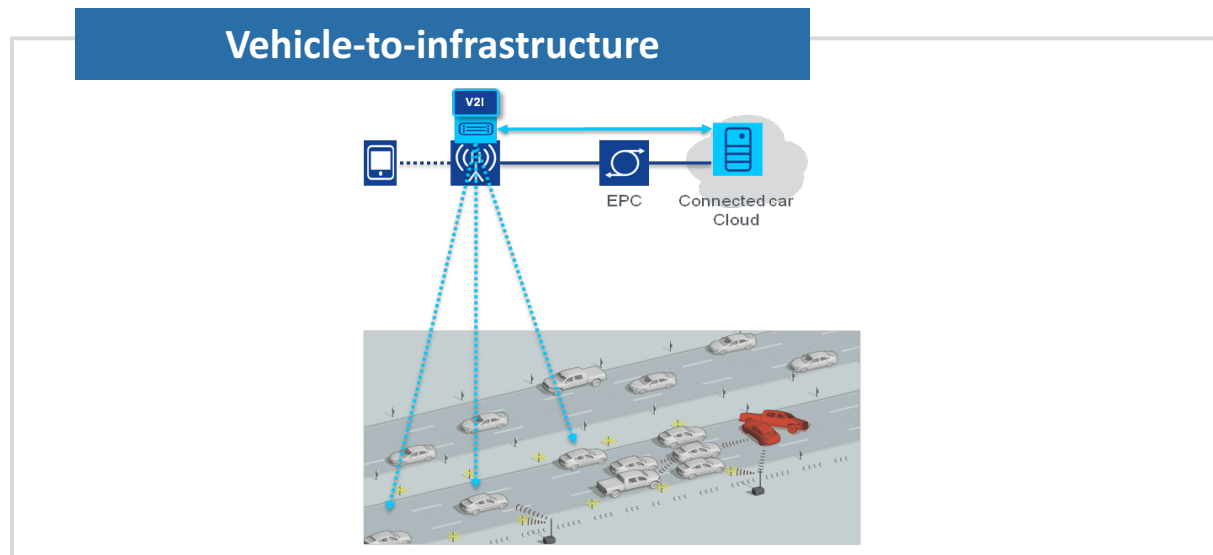
Intelligent Video Acceleration



- A Radio Analytics application provides the video server with an indication on the throughput estimated to be available at the radio downlink interface
- The information can be used to assist TCP congestion control decisions and also to ensure that the application-level coding matches the estimated capacity at the radio downlink.
- Enables improved video quality and throughput

Operator and Third-party Services

Connected Vehicles



- 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 vehicle-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 ETSI Director-General **approved** the **extension** of the ISG MEC for a two-year period.

Introducing the concept, establishing the community, laying the foundations and providing basic specifications

First term (2015-2016)

Building on the existing foundations:

- Finalize and maintain the 1st term work (Release 1)
- Work on future releases
- Maintain the overall ownership in ETSI MEC
- Strengthen collaboration with other organizations and orchestrate the MEC-related activities; encourage other industry organizations to build on our work rather than reinvent
- Work constructively with open-source communities

Second term (2017-2018)

Release 2 objectives



Support 3GPP and non-3GPP access technologies (WiFi and fixed)

Extend the virtualization support types (to render the environment as attractive as possible for third-parties)

Study possible new charging models which may be applicable to MEC

Fill gaps relating to lawful interception

Develop testing specifications and test methodologies;
Coordinate PlugTests

Coordinate experimentation and showcasing of MEC solutions

Expedite the development of innovative applications; ensure a low entry barrier

Disseminate the results of the work; strengthen collaboration with other organizations

Study new use cases

Enable MEC deployments in NFV environments

From
Mobile Edge Computing



To
Multi-access Edge Computing

MEC has created great momentum in the industry, adding a new dimension and paving the way towards new opportunities.

- MEC is evolving into a key building block in the evolution of mobile-broadband networks, complementing NFV and SDN.
- MEC is identified as a key enabler for IoT and mission-critical, vertical solutions.
- MEC is widely recognized as one of the key architectural concepts and technologies for 5G. Many of the use cases can be enabled with Mobile Edge Computing prior to 5G.
- MEC enables a myriad of new use cases across multiple sectors as well as innovative business opportunities.

The work on Release 2 will extend the applicability of the MEC technology and render the MEC environment even more attractive to third-party application developers.

THANK YOU



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Thank you!