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# Mobile-Edge Computing Architecture: The role of MEC in the Internet of Things

Dario Sabella et al.,  
IEEE Consumer Electronics Magazine, 2016.10

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# 목 차

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- Background
- MEC Framework and Architecture
- Key use cases for MEC and IoT
- Challenges

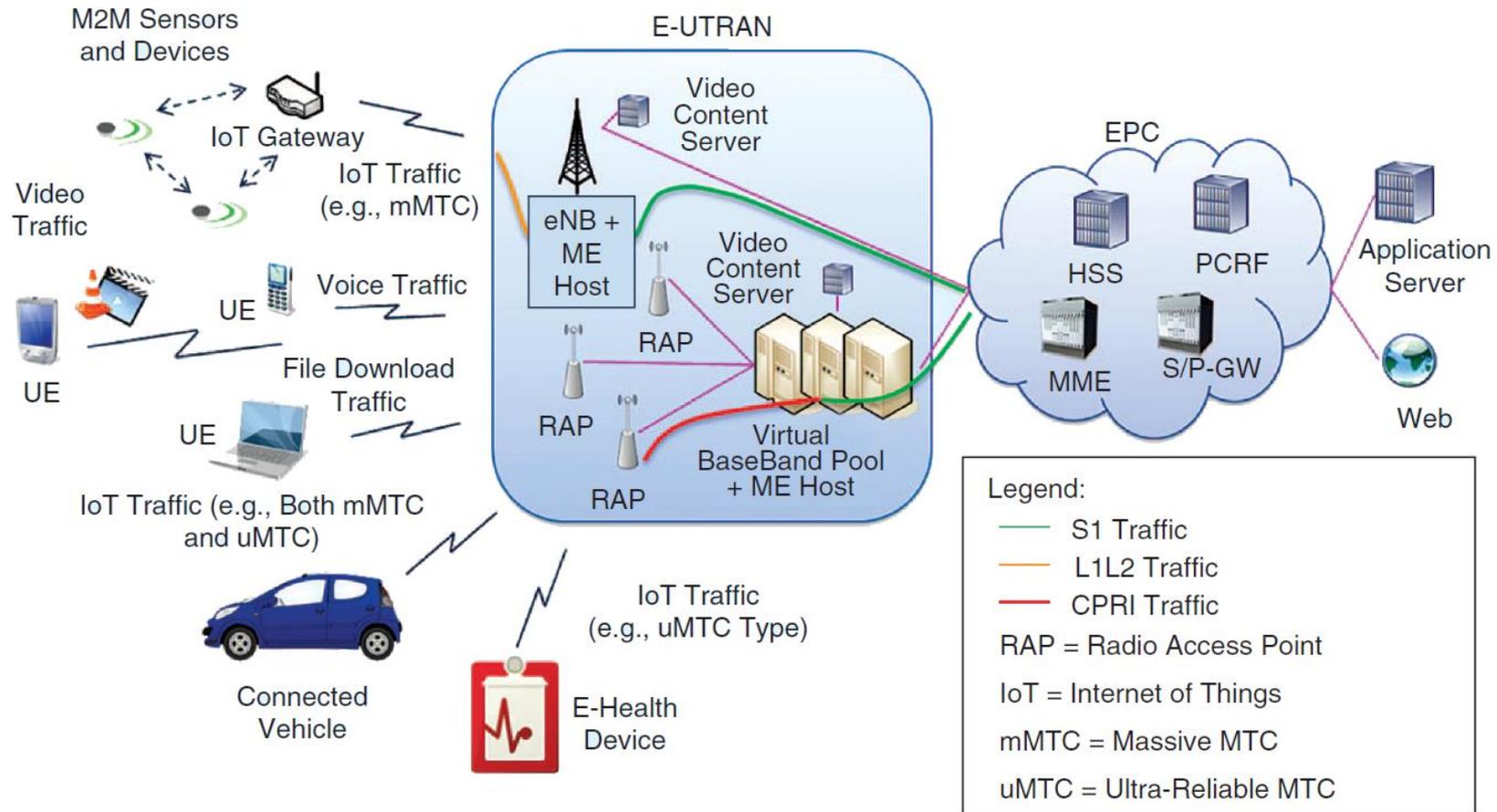
# Background

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- 5G system of requirement
  - Ultra low latency
  - High-bandwidth
  - Localization
  - Resource virtualization and container technique
- MEC(Multi-access Edge Computing)
  - MEC ISG(Industry Specification Group) within ETSI is creating standardized
    - Official ITU-R terminology on the 5G generic services
      - Enhanced mobile broadband (eMBB)
      - Massive machine-type communications (mMTC)
      - Ultra-reliable and low-latency communications (URLLC)

# Background

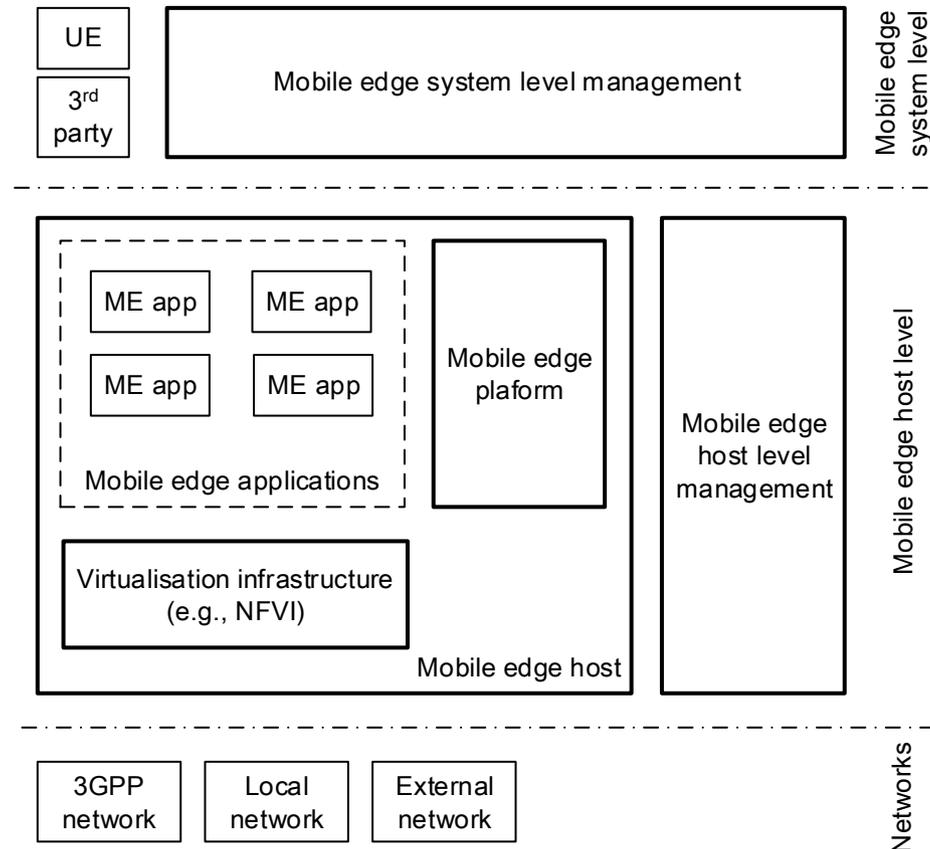
- The MEC and the 5G scenario



# MEC Framework and Architecture

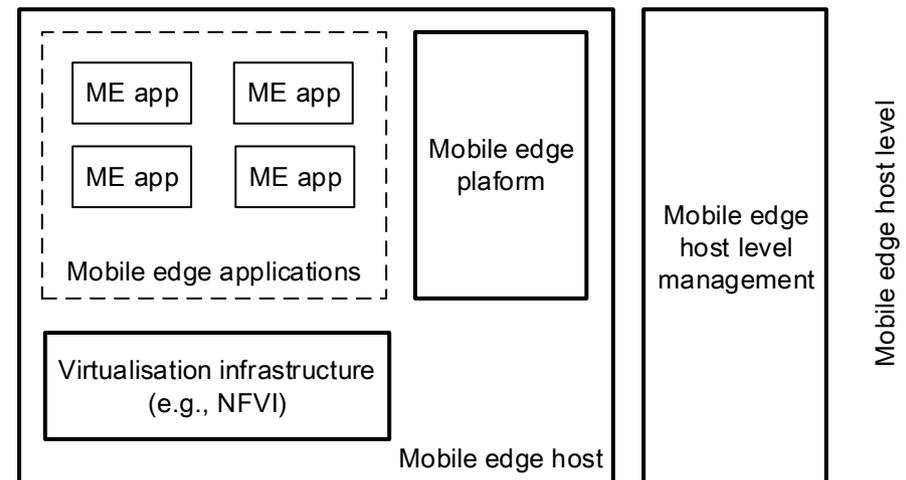
- ESTI MEC ISG specification
  - Launched in December 2014
  - Define the framework and reference architecture

- Framework



# MEC Framework and Architecture

- Framework – ME host level
  - ME Host level management
    - ME platform management
    - Virtualization Infrastructure management
- ME Host
  - ME platform
    - Provide compute, storage and network resources for the ME app
- ME app(Application)
- Virtualization infrastructure



# MEC Framework and Architecture

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- Framework – Networks

- 3GPP(3<sup>rd</sup> Generation Partnership Project) network

- Cellular network



Networks

- Local / External network

- Framework – ME System level

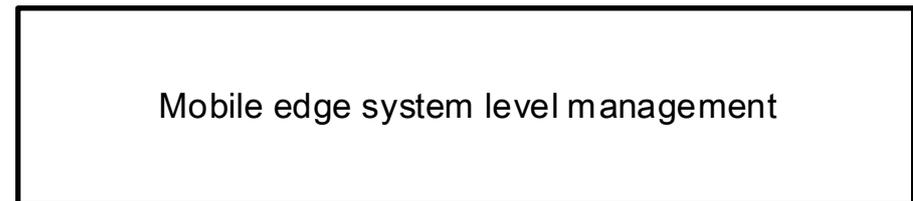
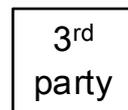
- ME System level management

- Overall visibility to the whole ME System

- UE(User Equipment)



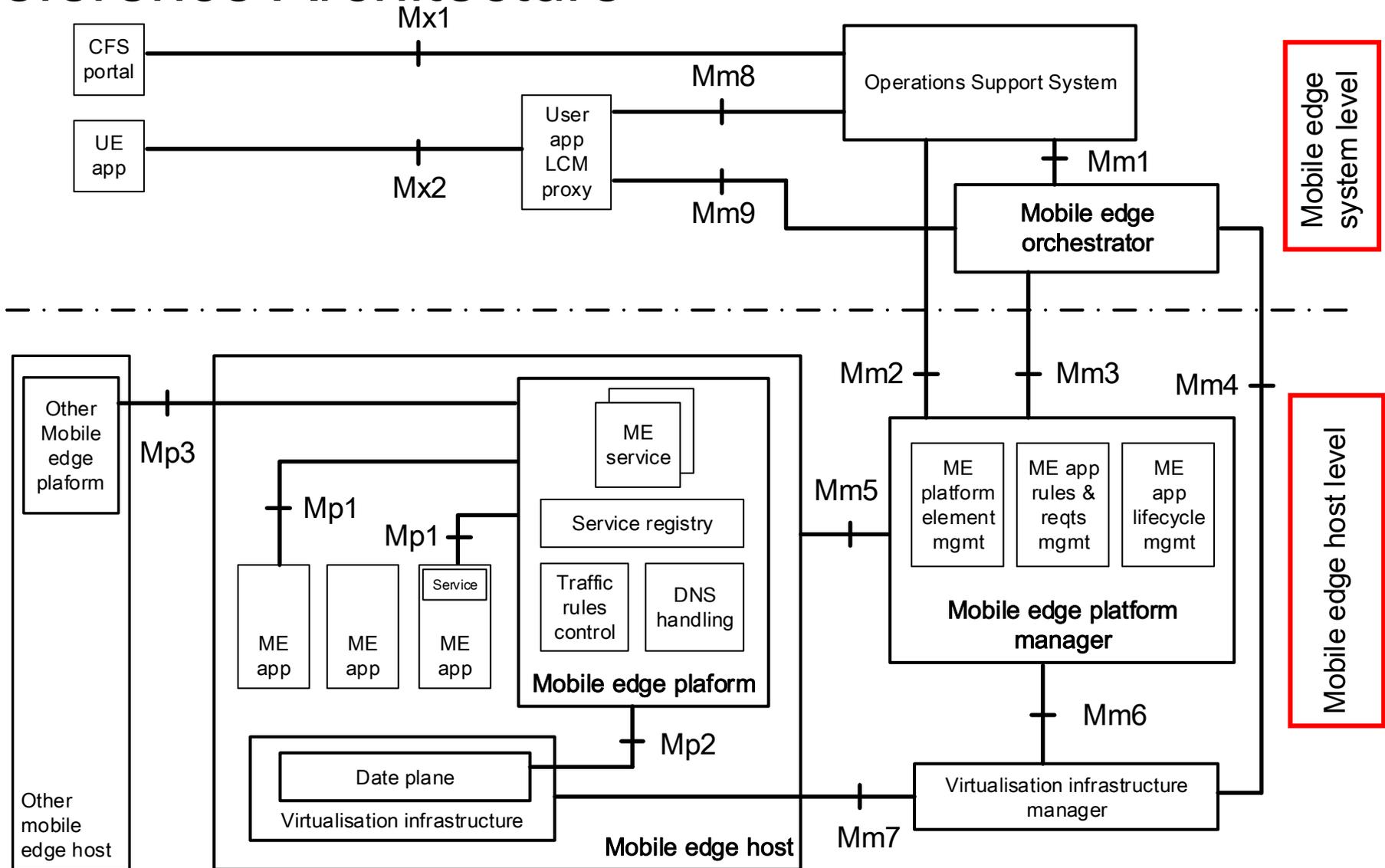
- Third party



Mobile edge system level

# MEC Framework and Architecture

## • Reference Architecture



# MEC Framework and Architecture

- Reference Architecture

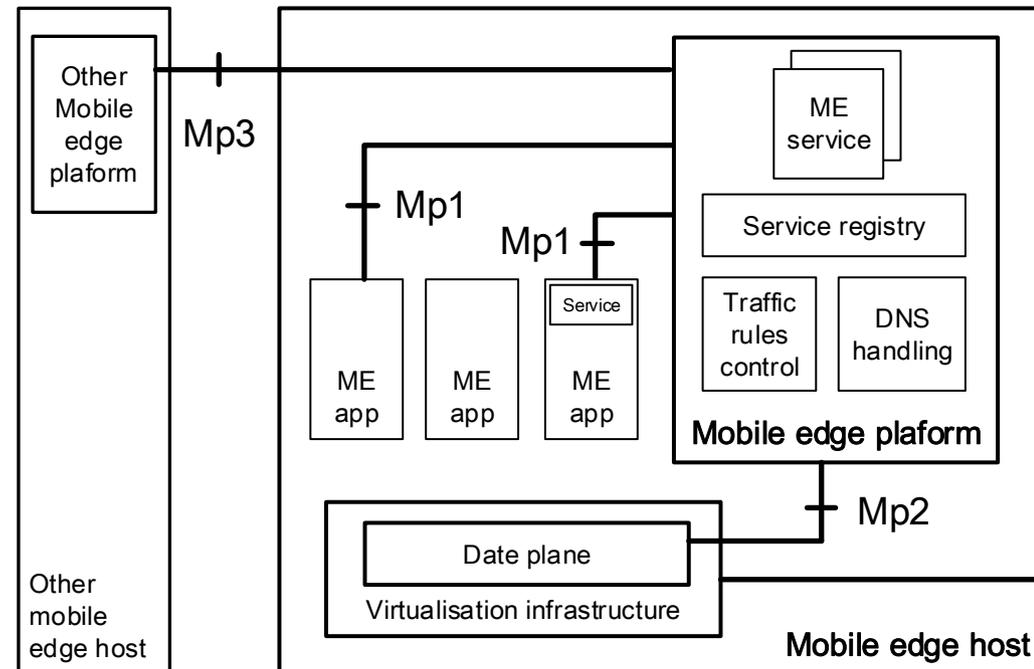
- Host level

- ME Host

- can provide persistent storage and time of day information for the applications

- Elements

1. Virtualization Infrastructure
2. ME app
3. ME service
4. ME platform



# MEC Framework and Architecture

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- Reference Architecture

- ME Host elements

1. Virtualization Infrastructure

- executes the forwarding rules received by the ME platform
- routes the traffic between the applications, services, and networks

2. ME app

- running as virtual machines on virtualization infrastructure
- indicate their constraints on maximum allowed latency
  - these requirements are validated in the system level
- interact with the ME platform
- relocate the application state for the user in case of handover events
- indicate the application availability

# MEC Framework and Architecture

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- Reference Architecture

- ME Host elements

- 3. ME service

- can be provided by the platform and by the applications
    - both the platform and applications may consume ME services

- 4. ME platform (1/2)

- represent a collection of baseline functionalities
      - run applications on a particular ME host
      - ME applications can use discover, advertise, offer and consume the ME services
      - provides the instructions to the forwarding plane
        - based on traffic forwarding rules from received ME platform manager, ME applications and ME services
      - can communicate with other ME platforms

# MEC Framework and Architecture

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- Reference Architecture

- ME Host elements

- 4. ME platform (2/2)

- Essential baseline functionalities

- steer the traffic between the applications, services, and networks
      - supports configuring the local domain name system (DNS) proxy/server
        - to send the user traffic to desired ME applications

- Host level

- Virtualization Infrastructure Manager

- allocating, managing and releasing virtualized resources of the virtualization infrastructure

# MEC Framework and Architecture

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- Reference Architecture

- Host level

- ME platform manager

- Functions

- ME application lifecycle management

- providing indication to the ME orchestrator (MEO) on application related events

- application instantiation and termination procedures

- ME application rules and requirements management

- Authorization

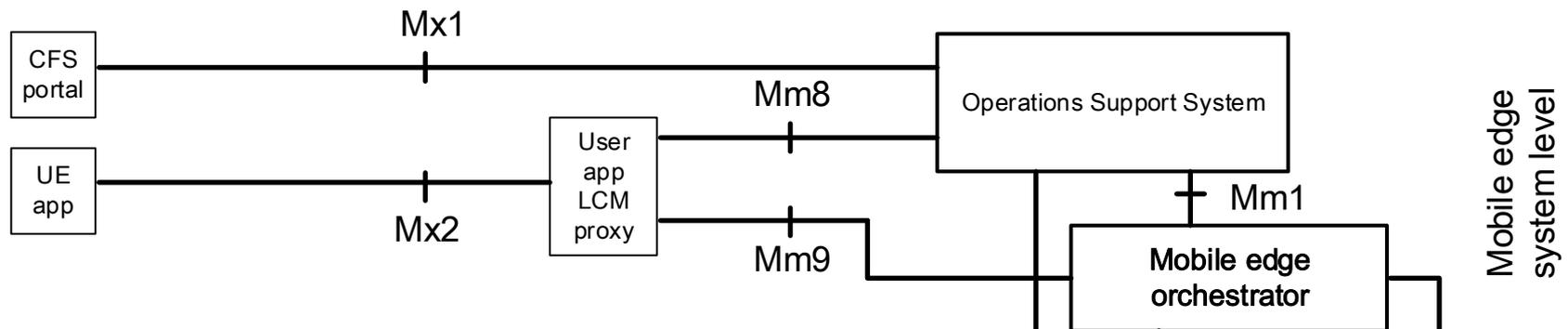
- Traffic rule

- DNS configuration

- resolving issues when a set of rules is in conflict

# MEC Framework and Architecture

- Reference Architecture
  - System level
    - User Interface
      - CFS Portal
      - UE App
    - User App LCM proxy
    - Operations Support Systems
    - ME Orchestrator



# MEC Framework and Architecture

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- Reference Architecture
  - System level
    - ME Orchestrator
      - Maintaining an overall view of the ME system based on deployed ME hosts
      - Know all the deployed ME hosts, the services and resources available in each host, the applications that are instantiated and the topology of the network
      - is also responsible for managing the ME application
    - User App LCM proxy(User Application LifeCycle Management proxy)
      - can only be accessed from the mobile network
      - client can use to request services related to on-boarding, instantiation, and termination of the applications

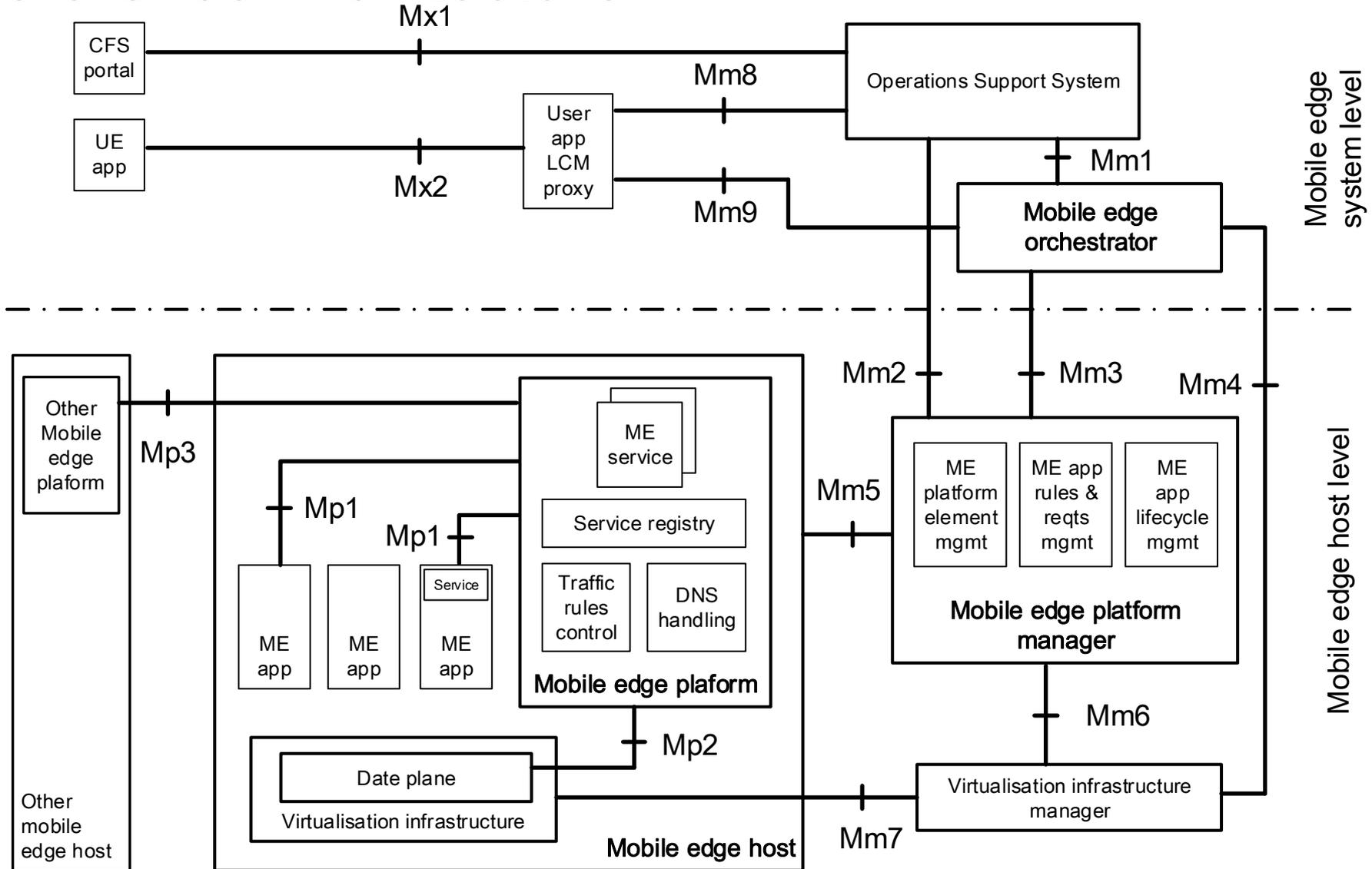
# MEC Framework and Architecture

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- Reference Architecture
  - System level
    - Operations Support Systems
      - on the boundary between the external world and operators' network
      - checks the integrity and authenticity of the application package and authorizes the request
      - requests granted by the OSS are forwarded to the MEO
    - CFS Portal(Customer Facing Service Portal)
      - an entry point for the third parties
      - operations to manage the provisioning, selection, and ordering of the ME applications
      - Developer parties can use the portal to make their created ME applications available in the operators' ME system

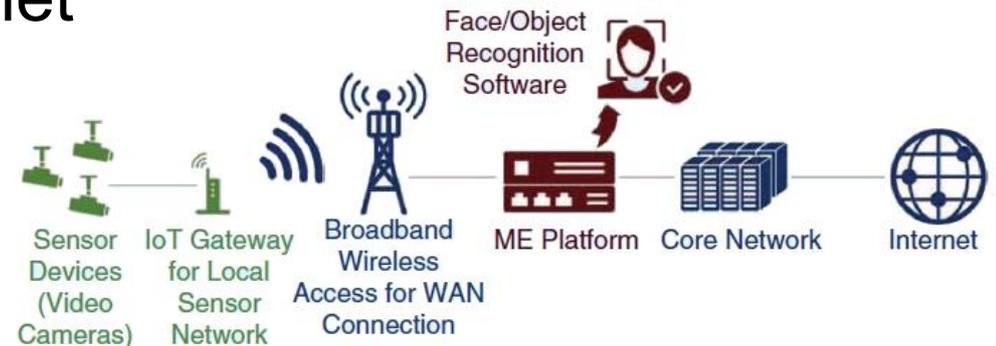
# MEC Framework and Architecture

## • Reference Architecture



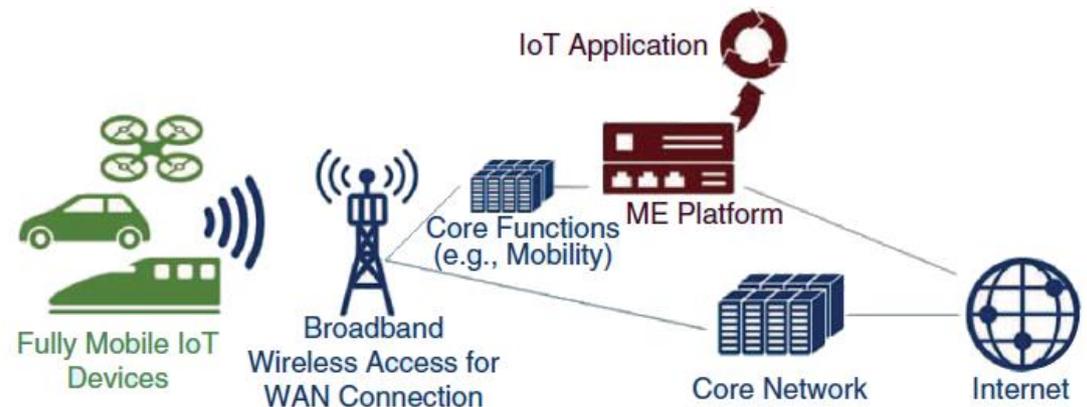
# Key use cases for MEC and IoT

- Case 1: MEC in an IoT deployment for surveillance and safety
  - Video surveillance and object recognition
    - IoT sensor devices(e.g., video camera) connected broadband mobile network through local gateway
      - video streams are conveyed to the ME host
        - ME host have ME IoT app for video surveillance is running
    - when an anomaly in the recorded video is detected, the IoT surveillance application sends a trigger to the central station located in the Internet



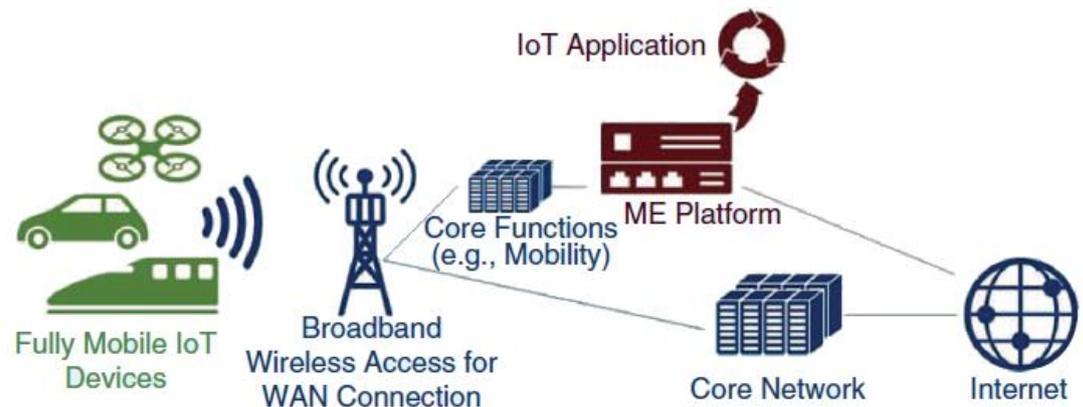
# Key use cases for MEC and IoT

- Case 2: MEC for IoT devices' capabilities offload
  - The constrained capabilities of IoT device
    - The data processing and controllers are deployed on the ME host
      - IoT device can use service by leveraging features offered by the mobile-edge management system
        - easily instantiated, relocated, and upgraded when necessary



# Key use cases for MEC and IoT

- Case 3: MEC for connected vehicles and moving IoT devices
  - The ME host near eNB receives messages directly from the vehicle and road sensors and analyzes messages
- Example
  - Danger warning, real-time traffic situation
  - Connected cars, trains, drones, etc.



# Challenges

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- Challenges
  - Factors to be reflected in applying MEC to 5G environment
    - Virtualization
      - Provide an individual virtualization environment for ME App
      - Support for sharing virtualization resources
    - Mobility
      - provide service continuously when the UE moves
        - UE mobility support
        - Support for handoff for ME host

# Challenges

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- Challenges
  - Factors to be reflected in applying MEC to 5G environment
    - API
      - Provide a simple interface for use in the ME App
      - Optimization of implemented APIs
    - Secure
      - Must check Access control provided in ME Platform
    - Traffic Routing
      - ME host enable to efficient routing
    - Situation awareness
      - can make intelligent decisions using context information

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감사합니다!