



Collaboration between ETSI MEC and CAMARA

Dario Sabella (Intel, ETSI ISG MEC Chairman)

MEC talk at CAMARA Steering Committee

July 13th, 2023



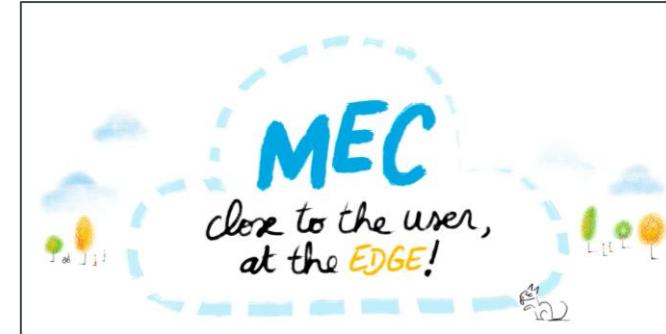
ETSI MEC: Enabling *Edge* through Standardization

Foundation for Edge Computing – Fully standardized solution to enable applications in distributed cloud created by ETSI MEC + 3GPP



Watch the new video on MEC

<https://www.youtube.com/watch?v=crnPWql-0oo>



ETSI: The Standards People
producing globally applicable standards for
ICT-enabled systems

ETSI ISG MEC

ISG: Industry Specification Group
open to all of industry, regardless of
ETSI membership and focused on all
industry needs

ETSI MEC
The Standards People

ETSI NFV
The Standards People

MEC Application Development Community
Interaction & Information Exposure

MEC: Multi-access Edge Computing
Cloud Computing at the Edge of the
network.



- Continuously growing MEC **membership**: 145 (in June 2023); e.g. in June 2021 it was 114
- **Diverse ecosystem**: Operators - Technology Providers - IT players - Application developers - Startups - ...



Renewed webpage: **ISG MEC Leadership Team, LS officers for Vertical Industries and MEC Support Team**: <https://portal.etsi.org/TB-SiteMap/MEC/MEC-Leaders-and-Support-Team>

ETSI MEC – Foundation for Edge Computing



MEC offers to application developers and content providers cloud-computing capabilities and an IT service environment at the edge of the network

Basic principles:

- **Open standard** → allowing multiple implementations and ensuring interoperability
- MEC exploiting ETSI **NFV framework** and definitions → enabling MEC in NFV deployments
- Alignment with **3GPP** based on fruitful collaboration of common member companies → enabling MEC in 5G
- **Access-agnostic nature** (as per MEC acronym - Multi-access Edge Computing) → enabling other accesses
- Addressing the needs of a **wide ecosystem** → enable multiple verticals (e.g. automotive), federations

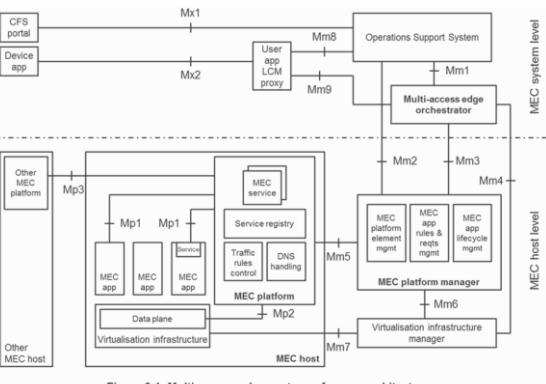
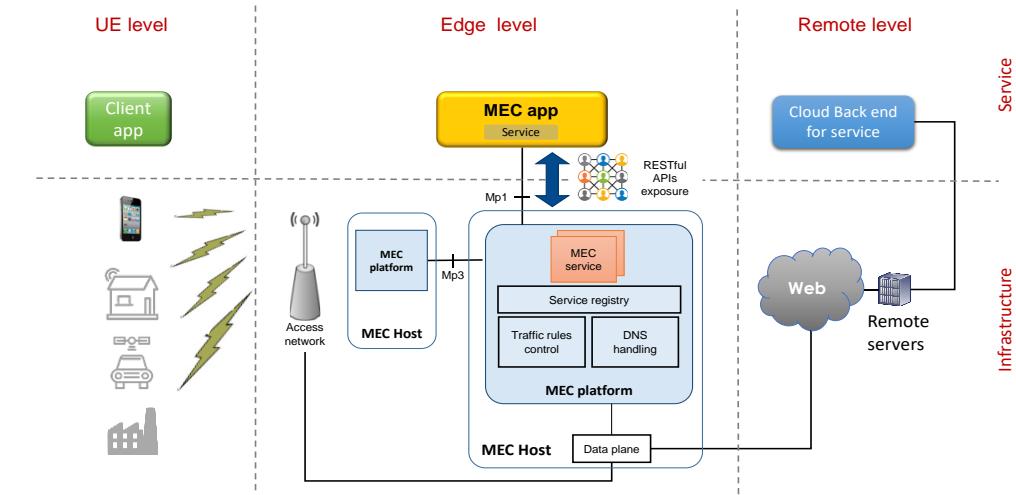
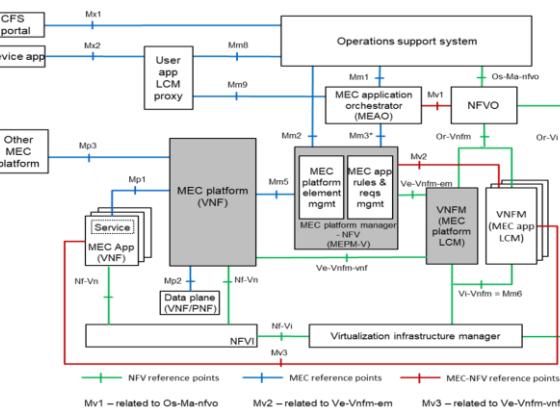
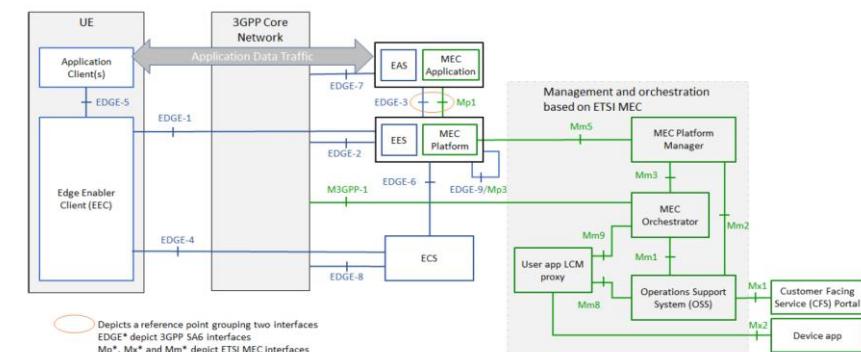


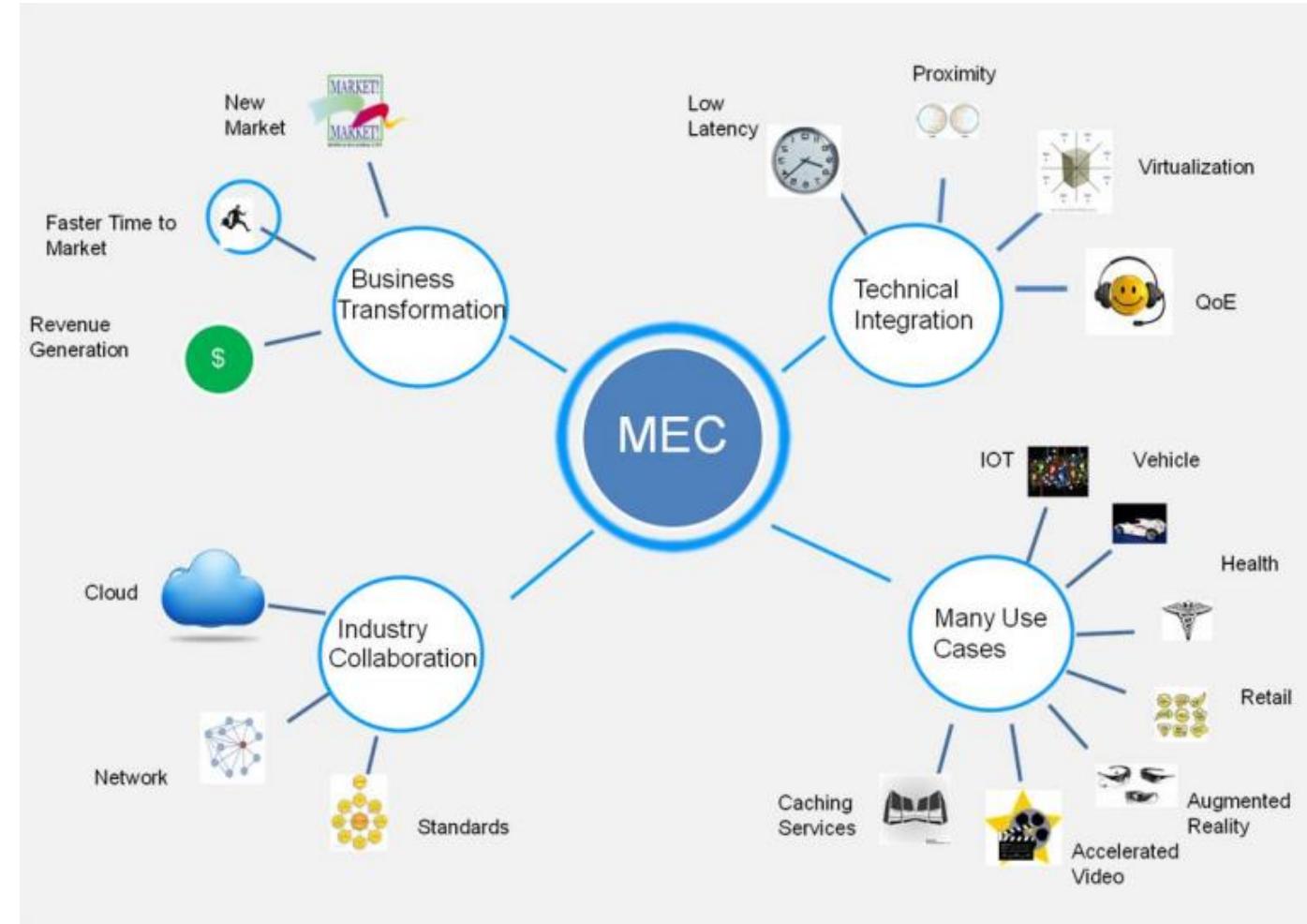
Figure 6-1: Multi-access edge system reference architecture



MEC is focused on *existential* questions of applications “on the edge”



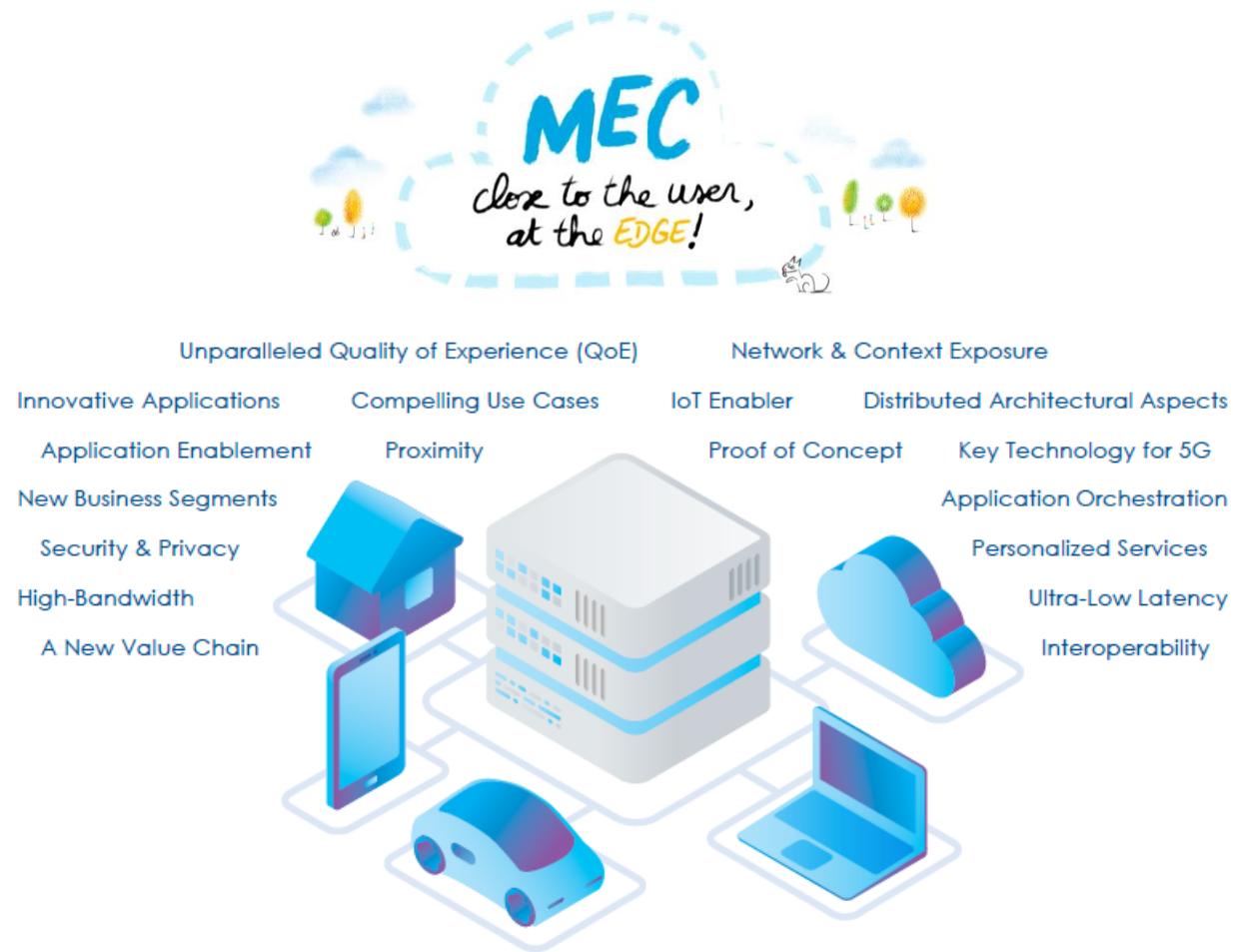
MEC supports many 5G use cases and market segments



More info at this ETSI White Paper on MEC

https://www.etsi.org/images/files/ETSIWhitePapers/etsi_wp11_mec_a_key_technology_towards_5g.pdf

MEC and vertical industries



MEC is a key enabler for many vertical market segments.

Several (specialized) use cases driven by different verticals:

- automotive,
- industrial automation,
- VR/AR,
- Videostreaming,
- Gaming,
- e-health,
- Smart Cities,
- Etc ...



Edge Exposure Day (Sept 18th, 2022, Kfar Saba, Israel) supported by ETSI

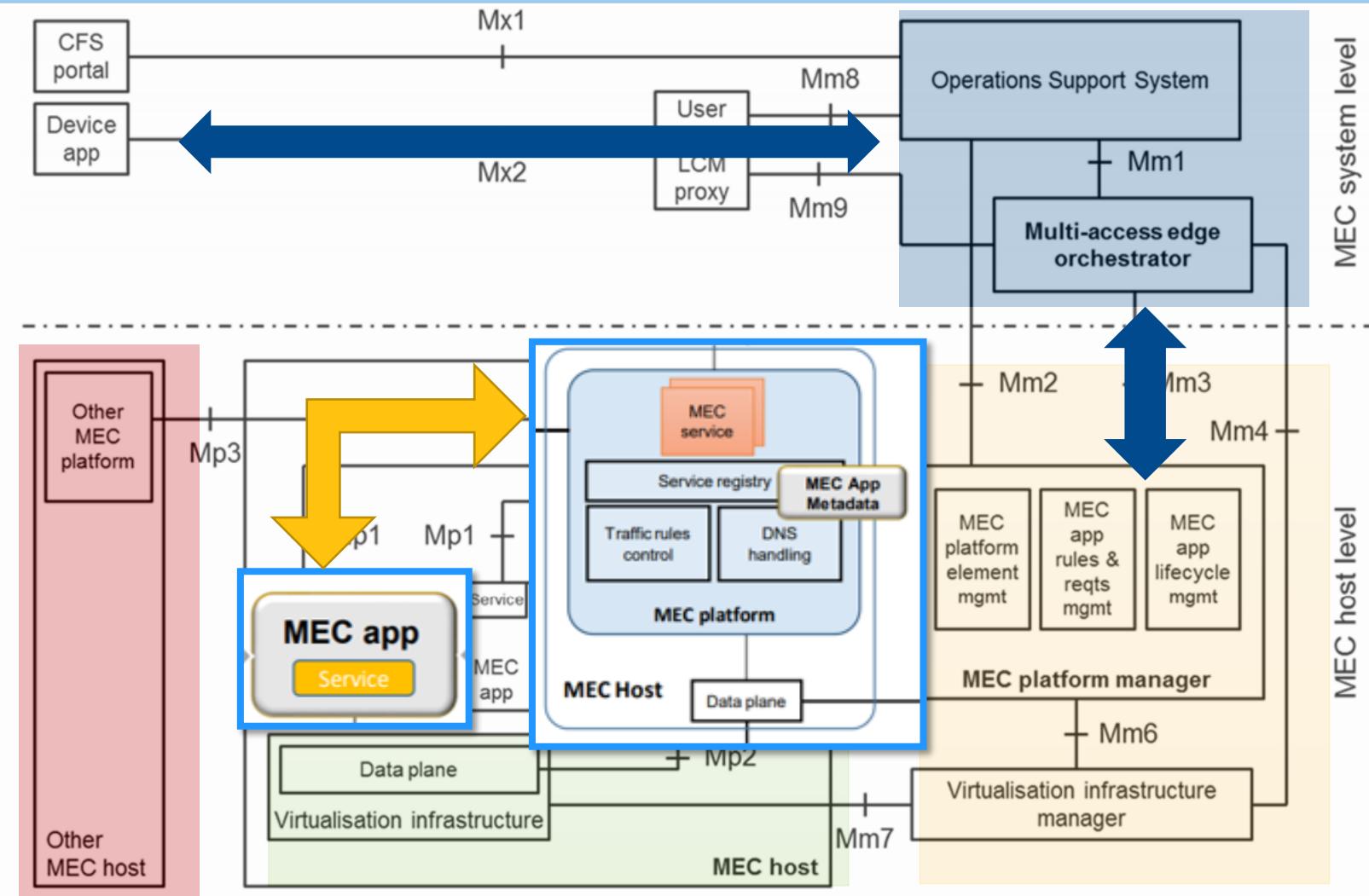
Attendance from diverse people, e.g., local companies, MEC participants, representatives from 5GAA and AECC, ...

MEC reference architecture

APIs

- Application Support
- Service Management
- Radio Network Information
- Location
- UE Identity
- Bandwidth Management
- Fixed Access Information
- WLAN Information
- V2X Information Service

- Application Package lifecycle and operation granting
- Device application interface



MEC Standard work: from Phase 1 to Phase 3



- Key overall specification
 - Technical Requirements (MEC 002)
 - Framework and Ref. Arch. (MEC 003)
 - MEC PoC Process (MEC-IEG 005)
 - API Framework (MEC 009)
- IaaS Management APIs
 - Platform mgmt. (MEC 010-1)
 - Application mgmt. (MEC 010-2)
 - Device-triggered LCM operations (MEC 016)
- PaaS Service Exposure
 - Required Platform Svcs / App. Enablement (MEC 011)
 - Service APIs (MEC 012, 013, 014, 015)
- Key Studies for Future Work
 - Study on MEC in NFV (MEC 017)
 - Study on Mobility Support (MEC 018)
- Evolution of Phase 1 and closing open items
 - Application Mobility (MEC 021 – published)
 - Lawful Intercept (MEC 026 – published)
- Addressing key Industry Segments
 - V2X (MEC 022 – published; MEC 030 – published)
 - Industrial Automation, VR/AR
- Key use-cases and new requirement
 - Network Slicing (MEC 024 – published)
 - Container Support (MEC 027 – published)
- Normative work for integration with NFV
 - Incorporate in v2 of existing specs as needed
- From “Mobile” to “Multi-Access”
 - Wi-Fi (MEC 028 – published)
 - Fixed Access (MEC 029 – published)
- MEC integration in 5G networks (MEC 031)
- Developer community engagement
 - API publication through ETSI Forge (more overleaf)
 - Hackathons, MEC Deployment Trials
- Testing and Compliance (MEC-DEC 025 – published; multipart specification MEC-DEC 032-x)
- Full Phase 3 work ongoing (just completing some outstanding Phase 2 work).
- MEC as heterogeneous clouds
 - Expanding traditional cloud and NFV LCM approaches
 - Inter-MEC systems and MEC-Cloud systems coordination: “MEC Federation” (MEC 035 – published / MEC040 -- ongoing)
 - Mobile/internally connected and resource constrained devices (MEC 036), MEC IoT API (MEC 033)
- MEC Security (GR MEC 041)
- MEC deployments (MEC in Park enterprises: MEC 038)
- MEC Application Slices (MEC 044)
- Continuing emphasis on enabling developers
 - Application Package Format and Descriptor Specification (MEC 037)
 - API Serialization
 - MEC Sandbox development
 - Testing and compliance
- Continue to define services that meet industry demand (e.g. Abstracted Radio Network Info for Industries, GR MEC 043)
- Maintain and enhance existing APIs (e.g. MEC 013)

2015

ETSI MEC phase 1 (Completed)

2018

ETSI MEC phase 2 (Completed)

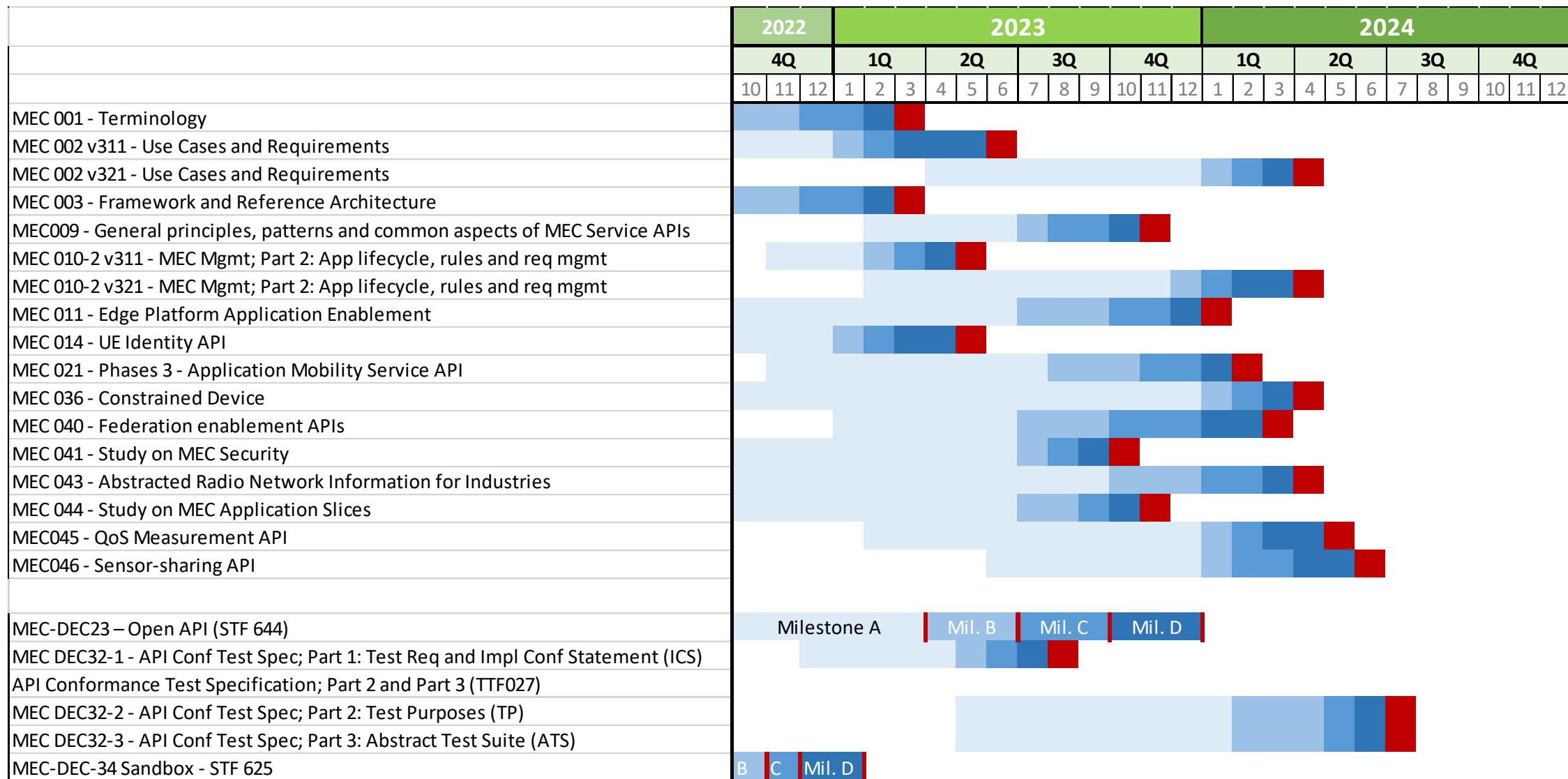
2021

ETSI MEC phase 3 (ongoing)

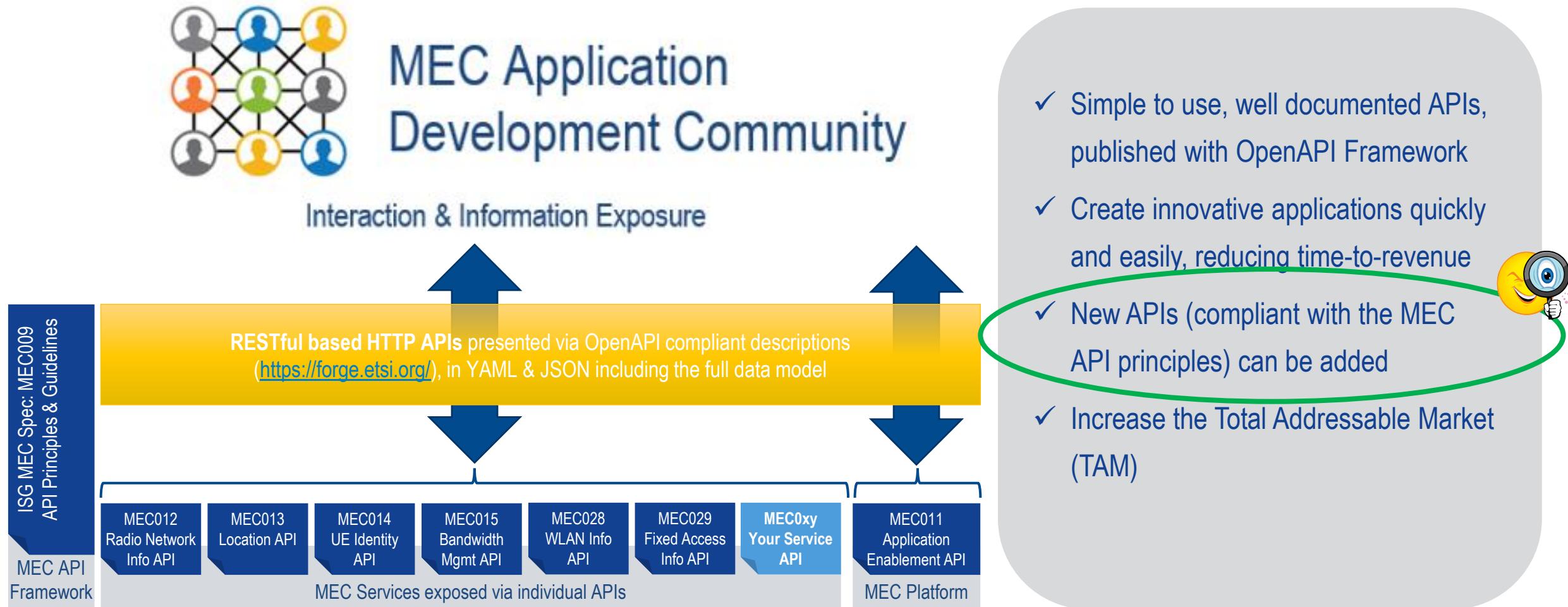
MEC Phase 3 Work Items



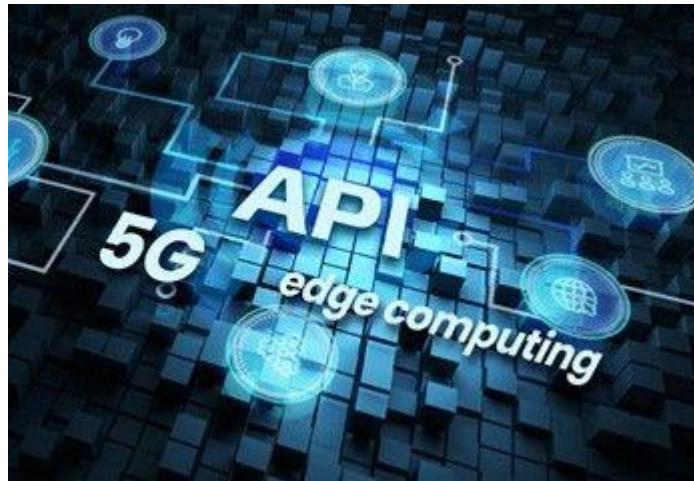
early draft	stable draft	final draft	TB approval	publication completion



Enabling Global Application Portability



MEC Support for Edge Native Design: an application developer perspective



- This White Paper provides an overview and vision about the Edge Native approach, as a natural evolution of Cloud Native. Edge Native was first introduced in 2020 by the Linux Foundation's Open Glossary of Edge Computing.
- It explains in detail the concept of "Edge Native", describes what Edge Native means for edge developers to build their applications and introduces how ETSI ISG MEC and other organizations support this Edge Native design paradigm. In particular, the White Paper guides developers in the principles and specific requirements of edge computing and how they can combine them with the modern architectural approach introduced by Cloud Native. It also gives insight into the general technical community interested in ETSI MEC solutions or Edge Native application design concepts.
- According to the White Paper conclusions, the ETSI MEC standard (synergized with 3GPP specifications) can offer a footprint for interoperability, API basic design principles to ensure universal adoption, and possibly also some guidelines for API abstraction, complementing the work of open-source projects. Therefore, to fully exploit edge capabilities and for the adoption of edge native design principles from application development communities, joint efforts from open source and standards will be needed.
- https://www.etsi.org/images/files/ETSIWhitePapers/ETSI-WP55-MEC_support_towards_Edge_native.pdf



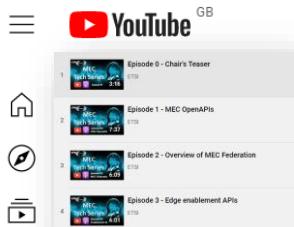
Suggested reading:
ETSI White Paper on
"MEC support towards
Edge Native Design"

WG DECODE: Enabling MEC Deployment and Ecosystem Development

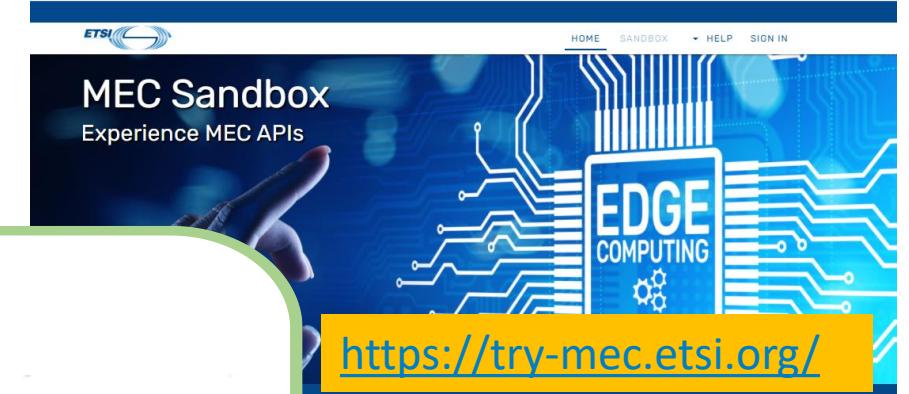
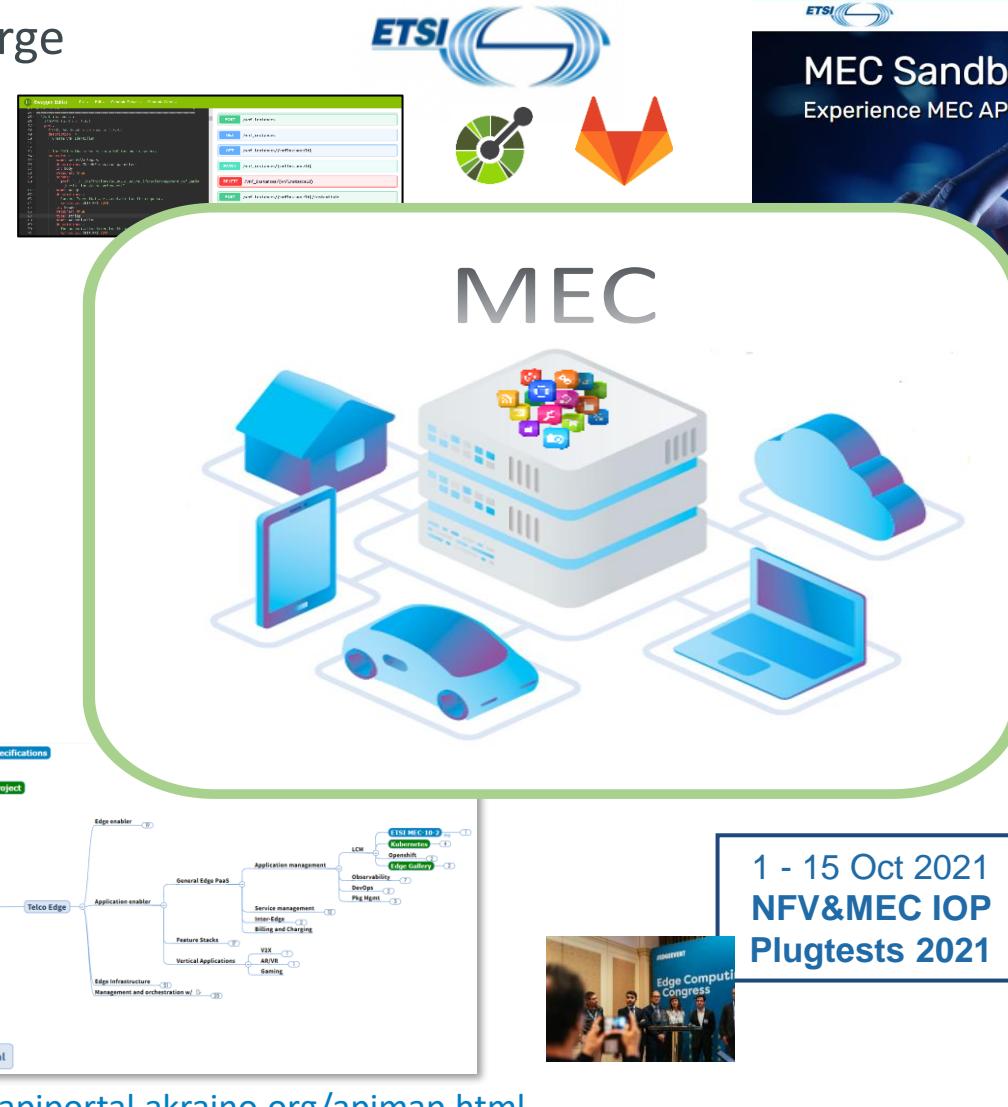
ETSI ISG MEC DECODE Working Group: MEC Deployment and Ecosystem engagement activities



- OpenAPI representations: ETSI Forge
- Testing and Conformance
- MEC Ecosystem wiki
- PoCs (proof-of-concepts)
- MDTs (MEC Deployment Trials)
- MEC Sandbox
- Collaborations: Akraino
- Hackathons
- Plugtests
- MEC Tech Series



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<https://try-mec.etsi.org/>



MEC Solutions	
List of project & partners involved in the development of MEC solutions. These services are delivered by various entities based on their specific requirements and capabilities. MEC is an open standard, allowing for multiple providers to offer different solutions.	
Alcatel-Lucent EDEN	MEC Platform
Akribo	MEC Platform
zenoh	MEC Platform
ITALTTEL	MEC Platform
LOCATION SIMULATOR	MEC Platform
Akraino	MEC Platform
OpenMec	MEC Platform
MEC IOP Simulator	MEC Platform
MEC IOP Device application	MEC Platform

1 - 15 Oct 2021
NFV&MEC IOP
Plugtests 2021

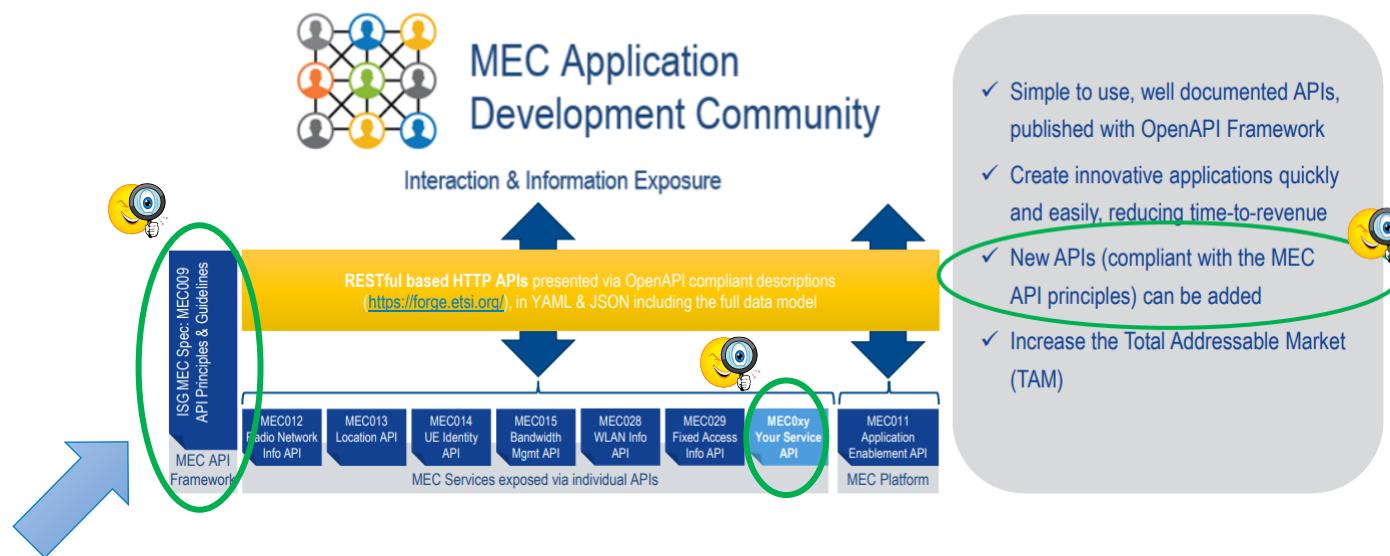
https://mecwiki.etsi.org/index.php?title=MEC_Ecosystem

ETSI MEC APIs, external APIs and API exposure

1 - Extending MEC with new MEC Service APIs

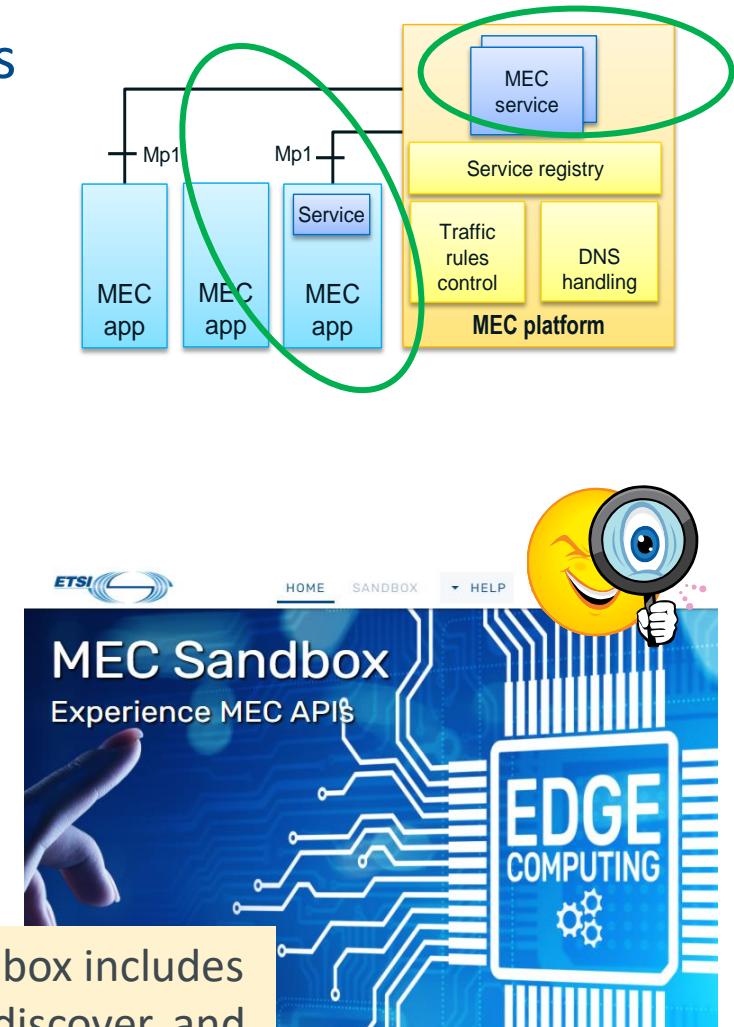
MEC Services: value-added capabilities to enable MEC applications

- “Built-in” MEC standardized services provided via the MEC Platform.
- **MEC applications can offer new MEC Services APIs, extending the MEC system**



NOTE: ETSI GS MEC 009 is defining General principles, patterns and common aspects of MEC Service APIs

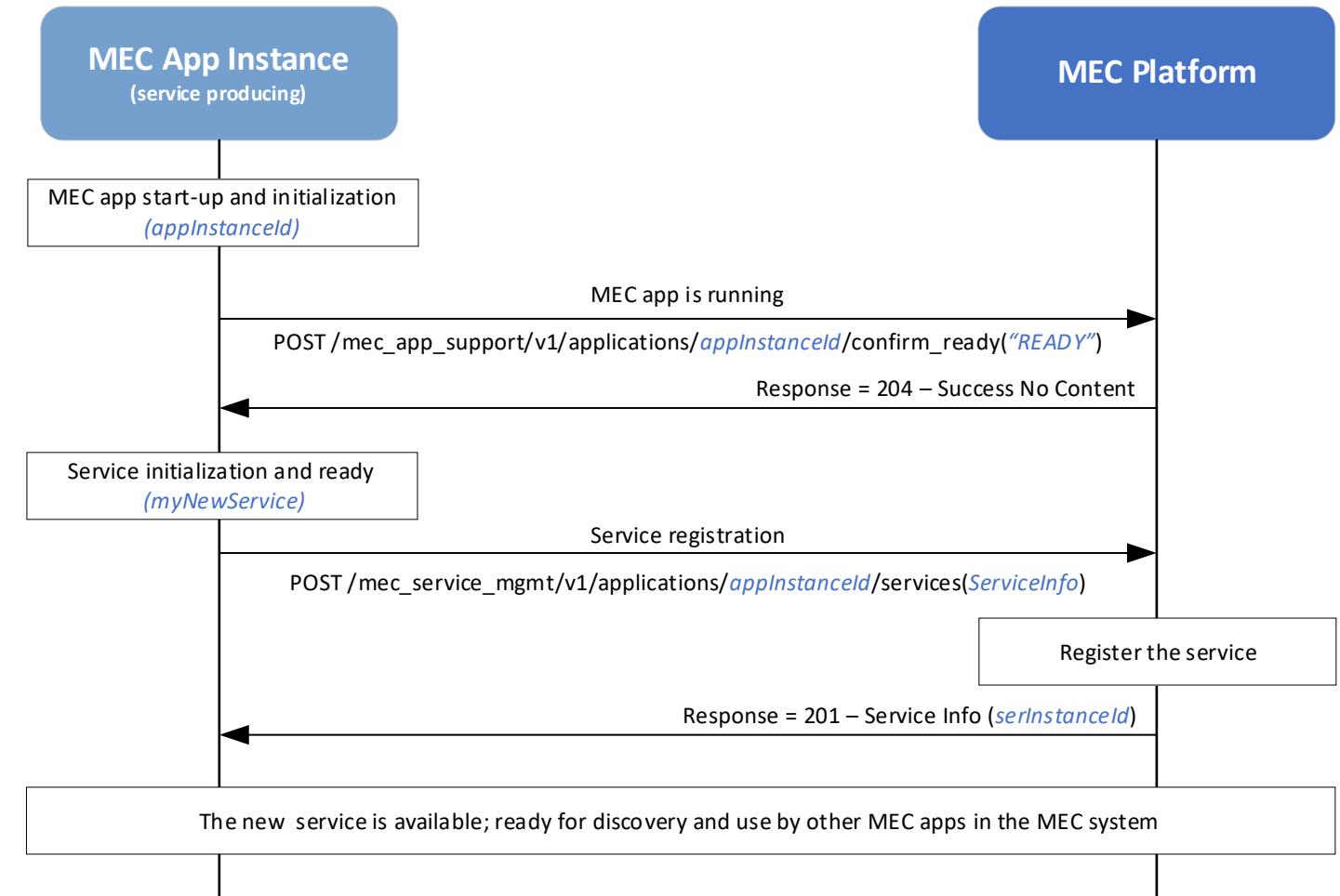
NOTE: also the MEC Sandbox includes capabilities to advertise, discover, and consume New MEC Services



2 – MEC App exposing a New MEC Service

New Service Registration:

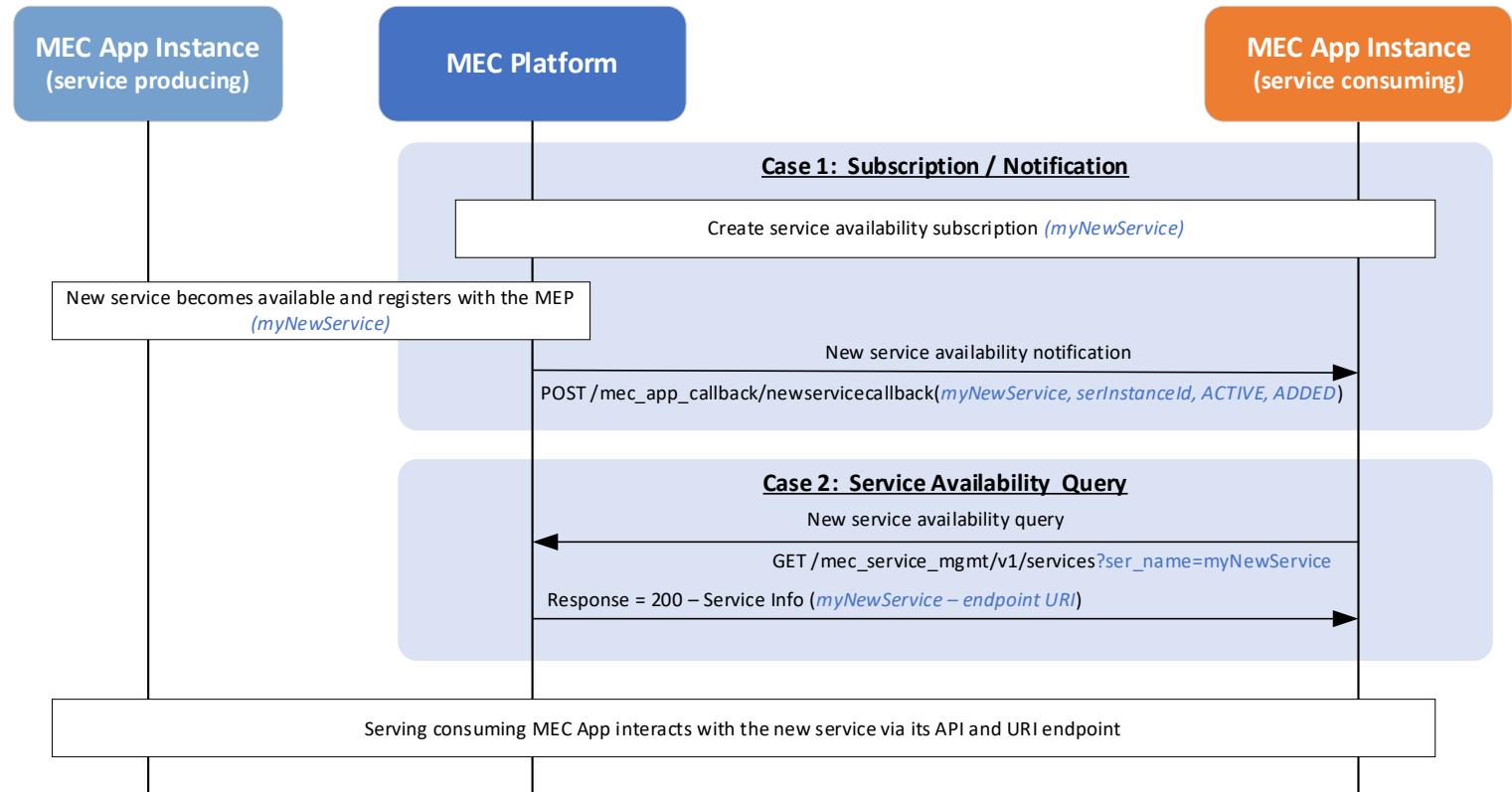
- MEC application initializes and confirms it is ready to the MEC Platform (MEP)
- MEC app prepares its new service API
- MEC app registers the new service with the MEP, providing Service Information
- MEP registers the service and allocates a service instance
- The New MEC Service is now available for other MEC Apps in the MEC system



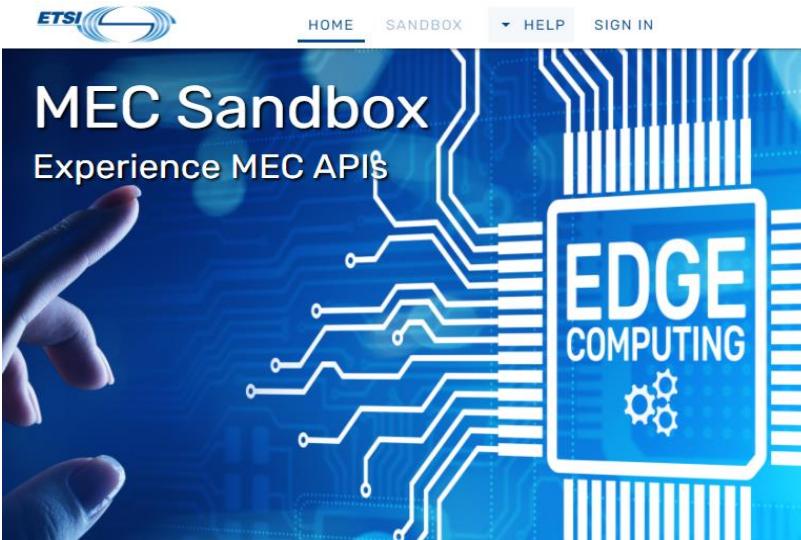
3 – MEC App discovering a new MEC Service

New MEC Service Discovery:

- Case 1: Subscription / Notification
 - Service consuming MEC App creates a Service Availability Subscription
 - When the new service registers and becomes available, the MEP issues a Service Availability Notification, indicating the New Service is available
- Case 2: Service Availability Query
 - Service consuming MEC App issues a service availability query to the MEP
 - MEP responds with the new service's information, including it's URI endpoint.
- MEC app utilises the New MEC Service via it's API and endpoint



MEC Sandbox – try new MEC Service APIs



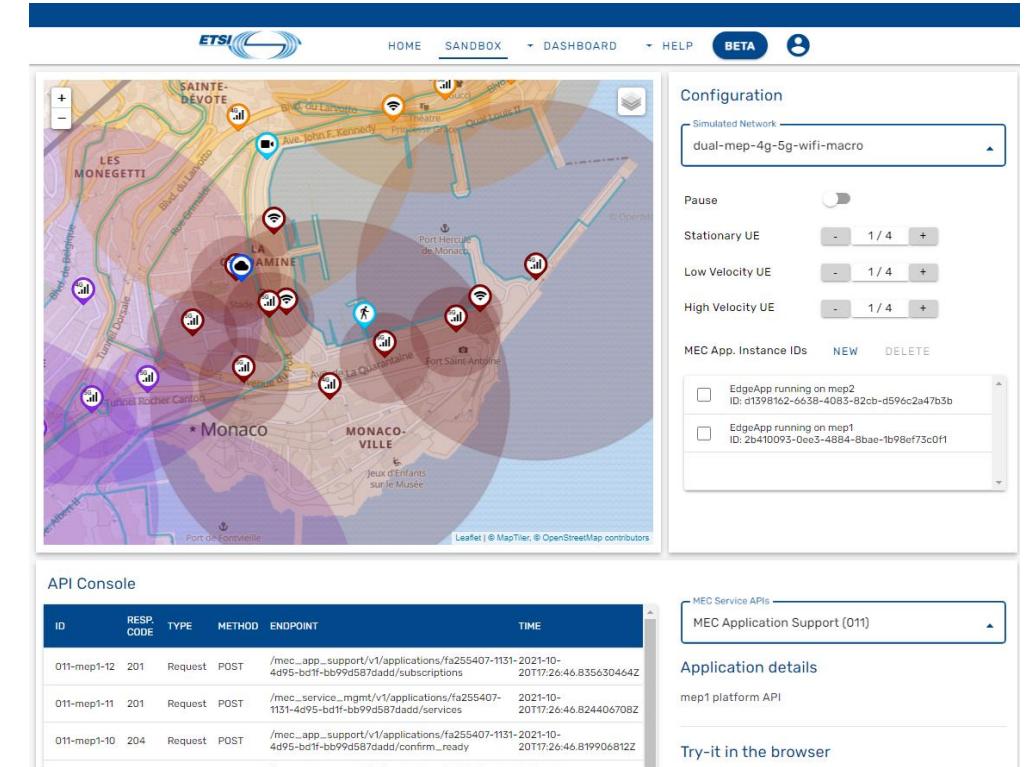
Available MEC Services:

- MEC Platform Application Enablement & Service Management APIs (MEC 011)
- Radio Network Information (MEC 012)
- Location Service (MEC 013)
- **New** Bandwidth Management and Traffic Steering (MEC 015)
- **New** Device Application Interface (MEC 016)
- Application Mobility Service (MEC 021)
- WLAN Access Information (MEC 028)
- V2X Information Service (MEC 030)

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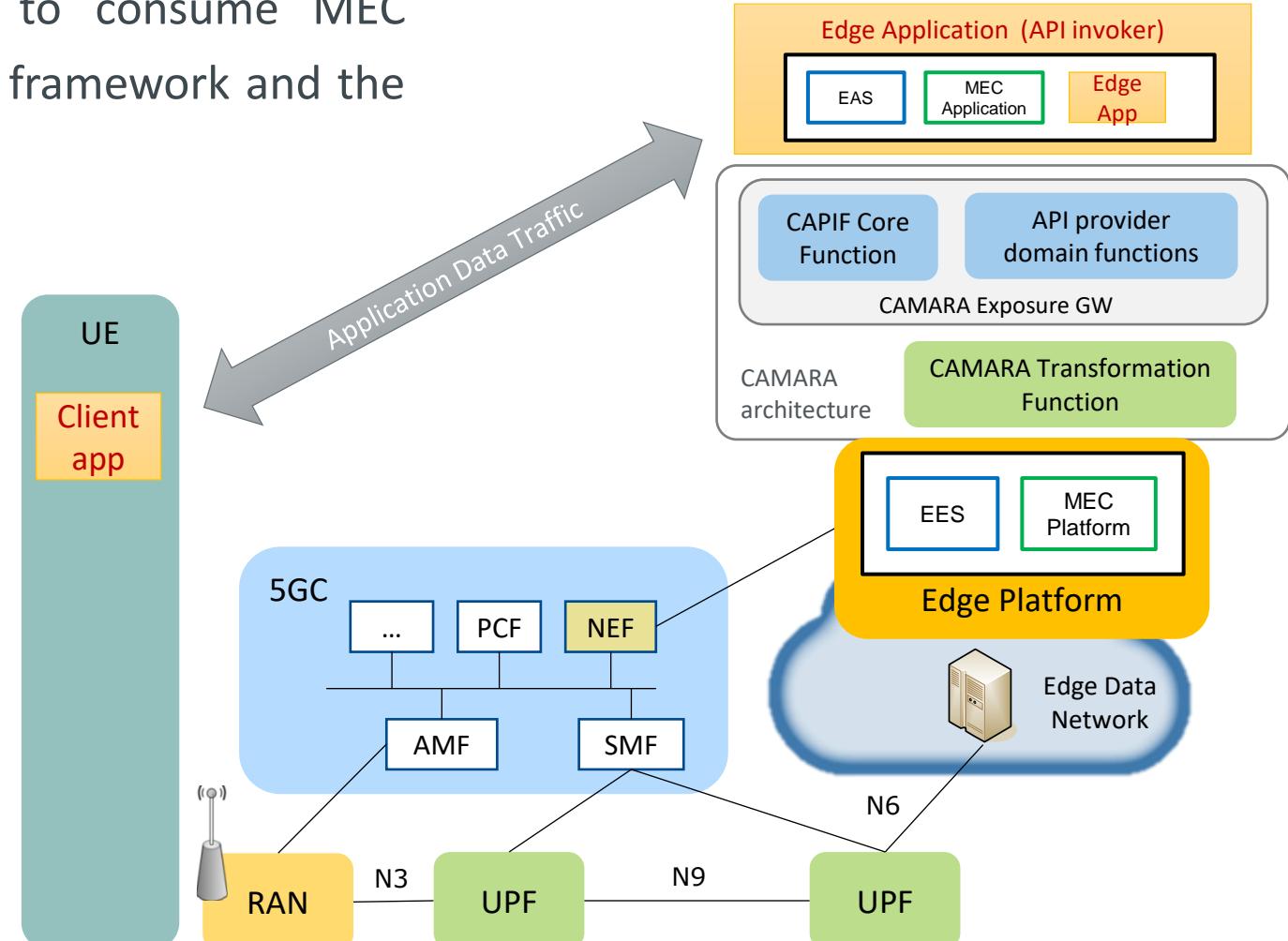
The ETSI MEC Sandbox is an interactive environment that enables developers to learn & experiment with “live” ETSI MEC Service APIs from anywhere in the world



ID	RESP_CODE	TYPE	METHOD	ENDPOINT	TIME
011-mep1-12	201	Request	POST	/mec_app_support/v1/applications/fa255407-1131-2021-10-4d95-bd1f-bb99d587dadd/subscriptions	2021-10-20T17:26:46.835630464Z
011-mep1-11	201	Request	POST	/mec_service_mgmt/v1/applications/fa255407-1131-4d95-bd1f-bb99d587dadd/services	2021-10-20T17:26:46.82446708Z
011-mep1-10	204	Request	POST	/mec_app_support/v1/applications/fa255407-1131-2021-10-4d95-bd1f-bb99d587dadd/confirm_ready	2021-10-20T17:26:46.819906812Z

4 - API Exposure and cross-consumption in a MEC Federation

- Option for Edge Native applications to consume MEC services in a MEC federation (via CAPIF framework and the CAMARA architecture)

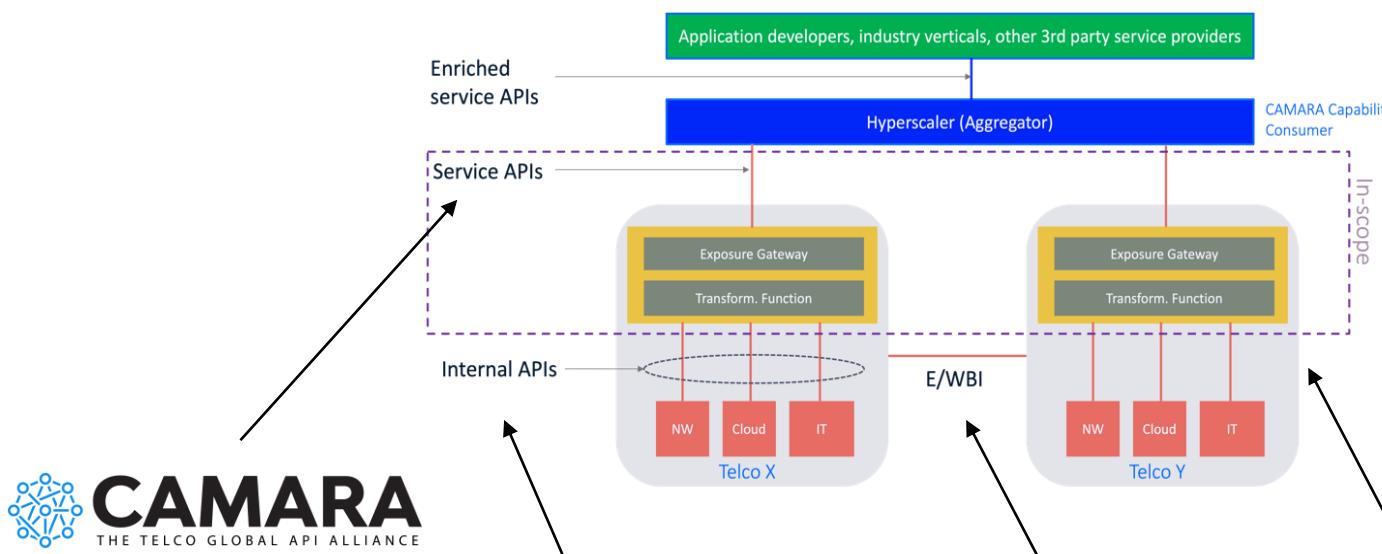


NOTE: this option also facilitates the synergies with ETSI MEC and GSMA OPG architecture, as API exposure can be exploited also in the MEC federation for edge native application development.

ETSI MEC & CAMARA: topics for collaboration

Technical highlights

- CAMARA is focused on NBI “Service APIs”, as abstractions from “Internal APIs”
 - Since CAMARA’s focus is “application developers” interface APIs, the assumption is for them to have limited or zero knowledge of the network and edge infrastructure.
- According to the figure below, ETSI MEC is standardizing some “Internal APIs”



REMARKS:

- ETSI MEC standardized APIs are “relevant for NBI”, i.e. can be abstracted in CAMARA, for the actual NBI exposure to app devs
- Also new APIs (i.e. not in need to be standardized in ETSI MEC) can be added, recognized by the MEC Platform, and exposed to authorized Applications
- CAPIF is a well recognized (and standard) reference for universal API exposure



e.g. MEC 003, MEC 040, ...

MEC 043 report on Abstracted API for Industries

ETSI MEC & CAMARA: collaboration establishment

MoU in place
between ETSI and LF

Topics of the collaboration:

- Technical work northbound interface and support for ubiquitous API exposure
 - ensuring complementary work on standards / API definitions (CAMARA NBI, SBI by ETSI MEC and cloud federation) and open-source implementations / tests guidelines for API exposure and interwork (e.g., joint white papers)
- Join forces to engage application development communities (e.g., to better attract application developers, increase the awareness on edge application and help creating API market demand)
- Other areas of collaboration (to be further elaborated) may include the work item MEC 043 on Abstracted API for Industries

The MEC Chair and Leadership Team are identifying a set of few common companies/delegates that can practically facilitate the joint work and collaboration with CAMARA.





Thank you for your attention



Backup:
background
on MEC
Federation

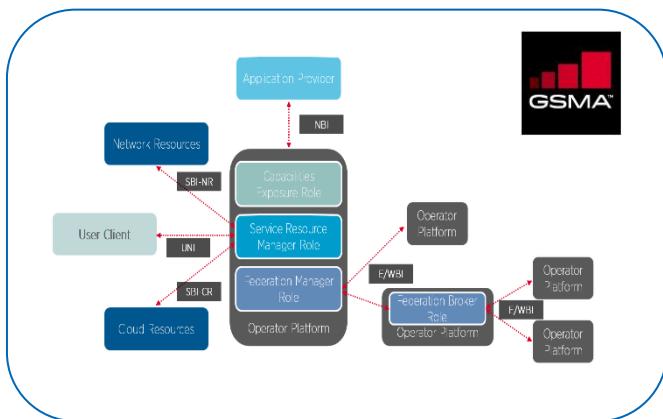
Alignment between GSMA OPG, ETSI MEC and 3GPP SA6



A possible relationship could consist in the following high-level steps:

1. GSMA asks SDOs to cover standards for the OP architecture (and OSCs to complement with open source)
2. Worksplit (ETSI, 3GPP, OSCs,..) and consequent std work, publication of standards etc..
3. Finally, GSMA will certify OP compliance

1.



GSMA PRD document
(requirements)

2.



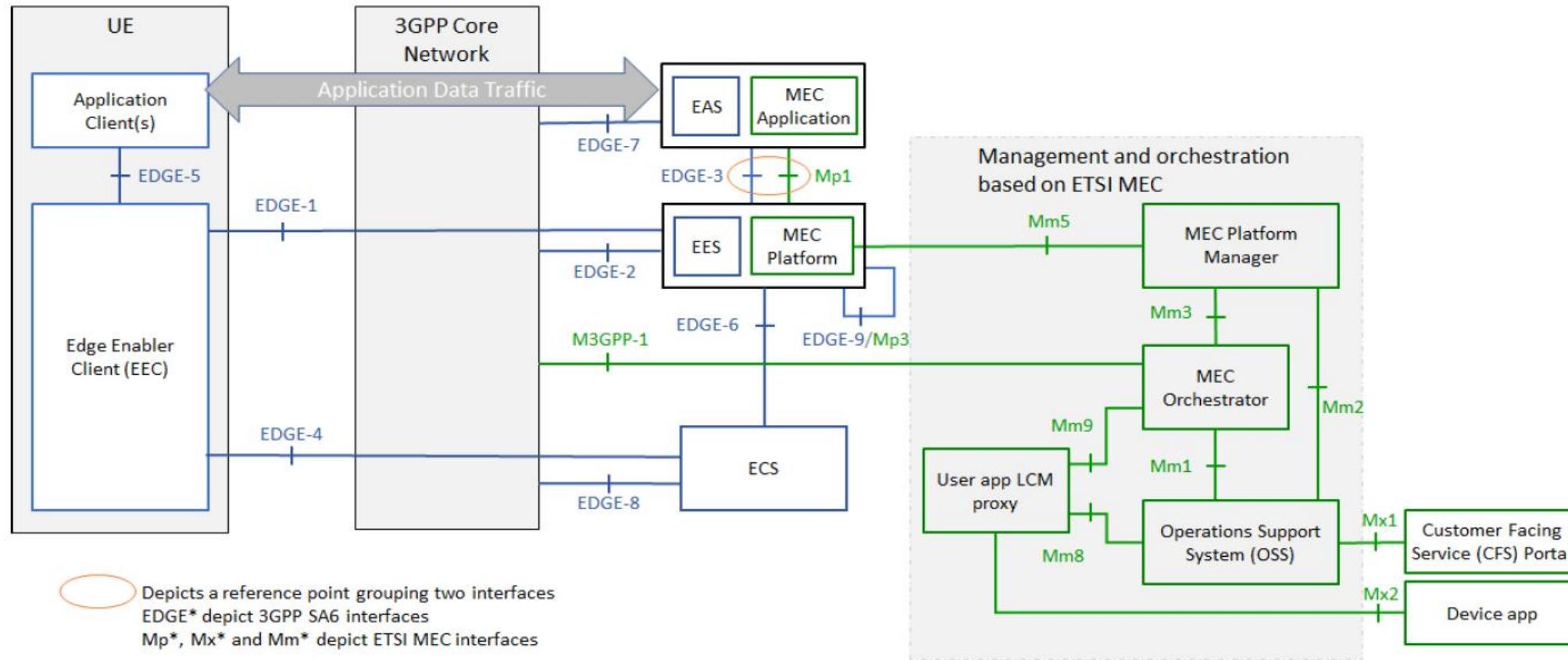
Work from SDOs and OSCs
(under the GSMA guidance)

3.



GSMA compliance & OP
certification

MEC harmonized architecture with SA6 EDGEAPP



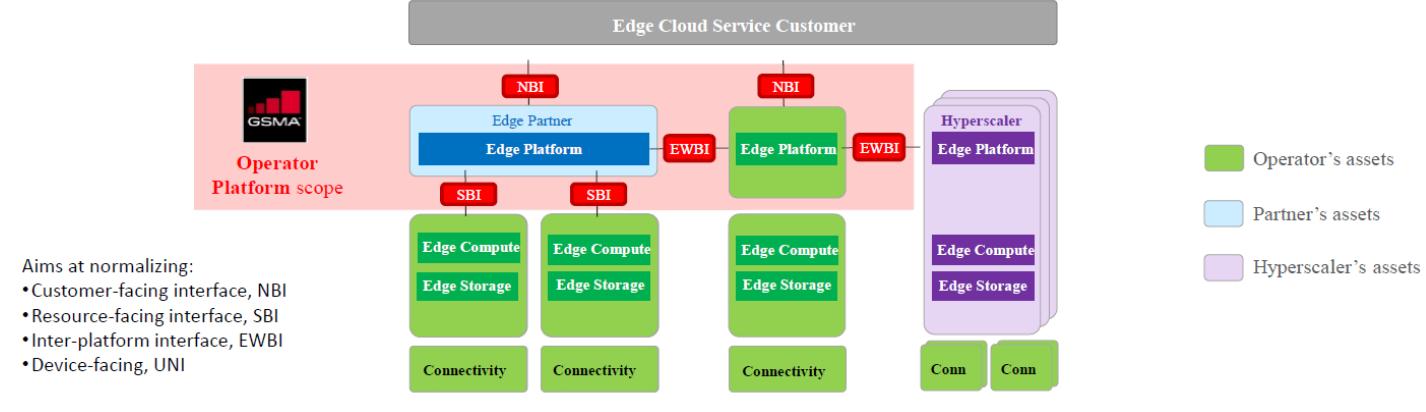
- Joint **white paper** (*) from both ETSI and 3GPP officials
- 3GPP TS **23.558** “Architecture for enabling Edge Applications; (Release 17)” v1.1.0, Oct. 2021 (informative Annex C)
- Alignment between 3GPP and ETSI MEC is currently in scope of eEDGEAPP in 3GPP SA6 (ref. [S6-211858](#)).



MEC Phase 3: expanding the scope to MEC Federation



Starting from
Industry requirements ...



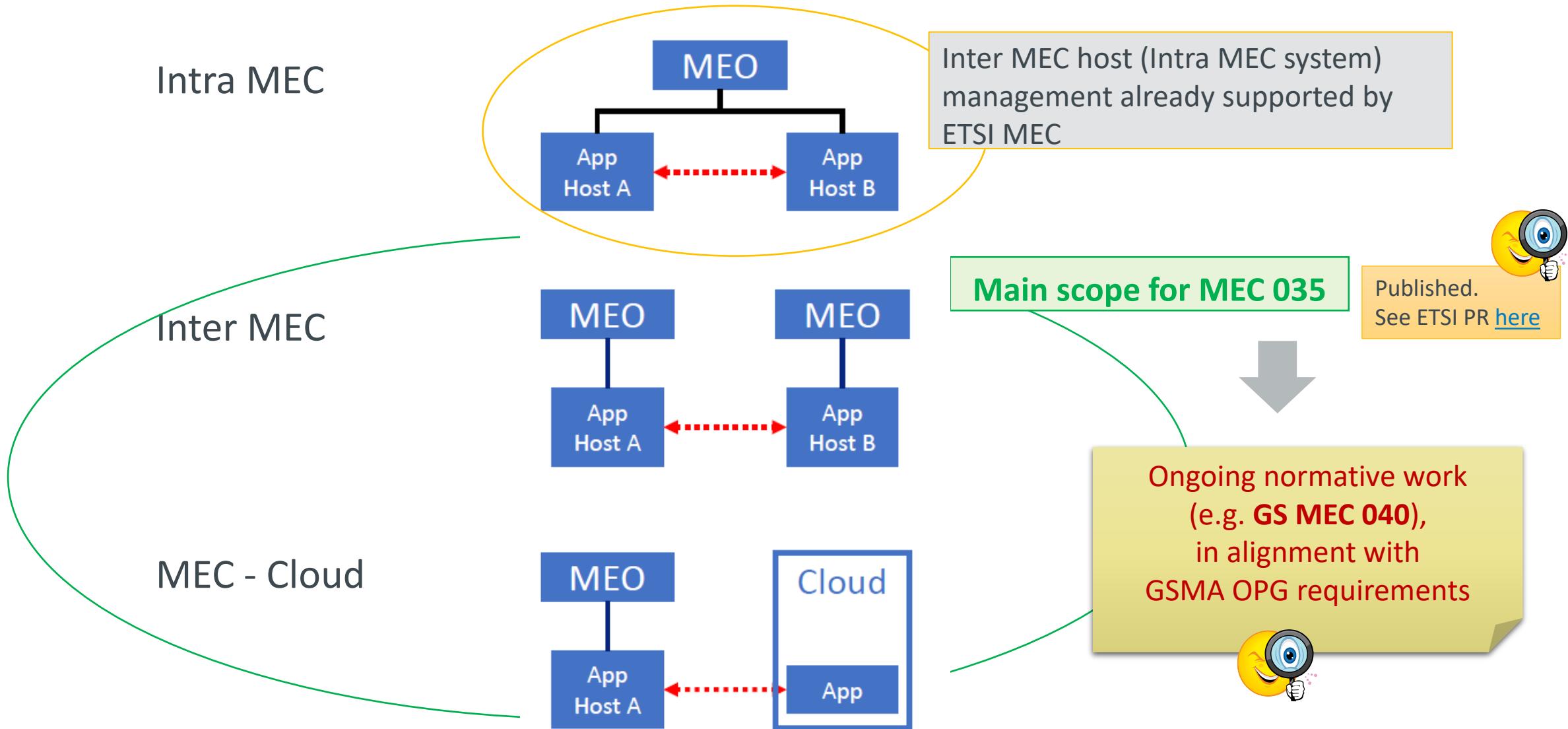
Ref: GSMA White paper: "Telco Edge Cloud: Edge Service Description and Commercial Principles", Oct 2020

... ETSI MEC published a very first work on **MEC federation**

ETSI GR **MEC 035** v3.1.1: "Multi-access Edge Computing (MEC); Study on Inter-MEC systems and MEC-Cloud systems coordination ", June 2021,
https://www.etsi.org/deliver/etsi_gr/MEC/001_099/035/03.01.01_60/gr_mec035v030101p.pdf

 **MEC Federation:**
"federated model of MEC systems enabling shared usage of MEC services and applications"

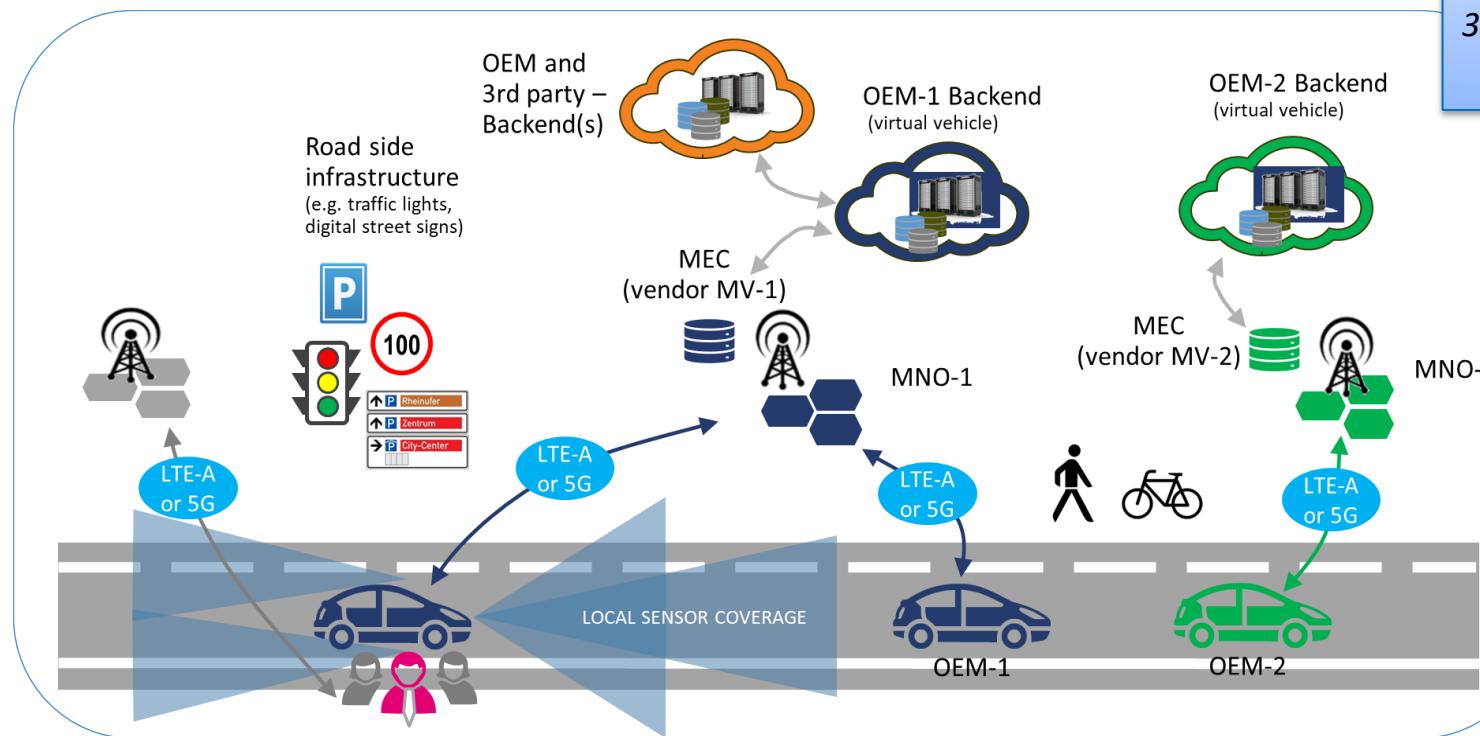
Phase 3: expanding the scope to MEC Federation



MEC Study on Inter-MEC systems and MEC-Cloud systems coordination (MEC 035)

Many Use cases

#1: MEC federation scenario of V2X services



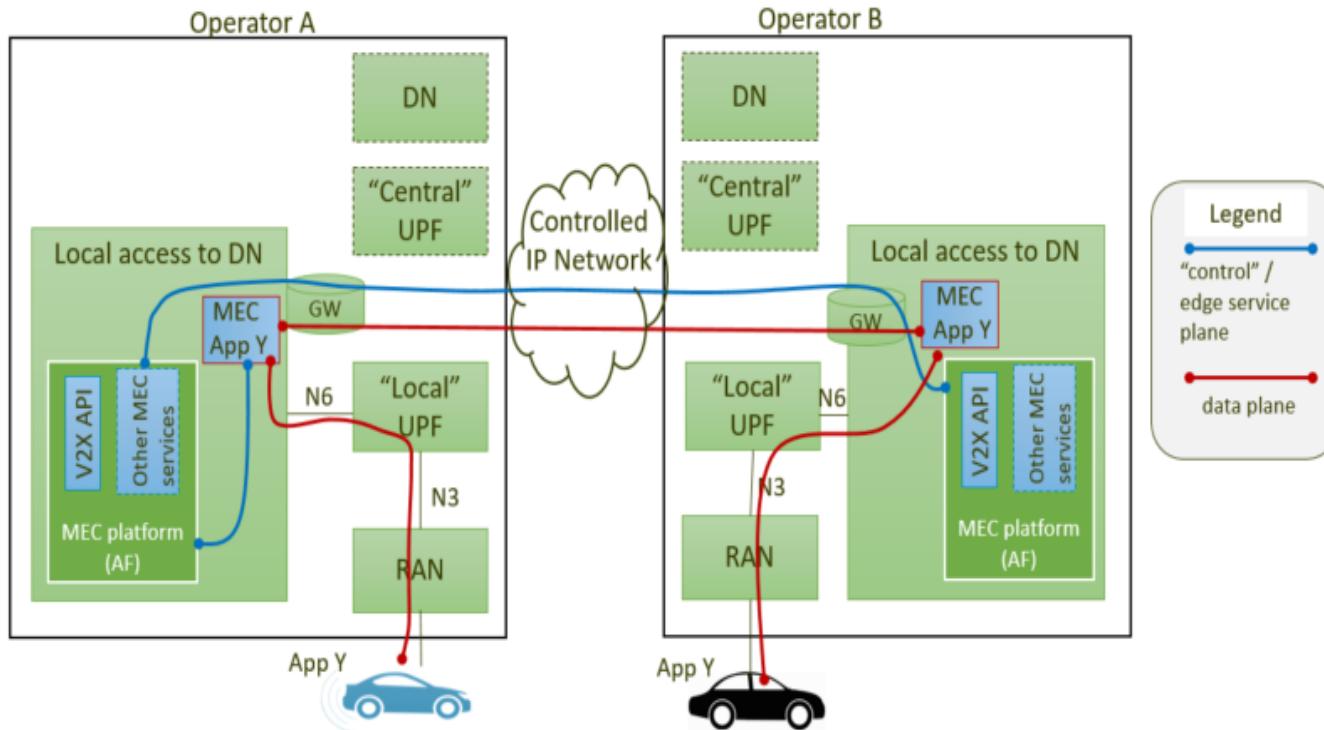
1. *Interop. between MNOs*
2. *Interop. between MEC vendors/suppliers*
3. *Interop between OEMs (applications)*

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

Study (MEC 035) on inter-MEC system and Cloud-MEC system coordination

Multi-operator agreements enabling MEC Federation for V2X services



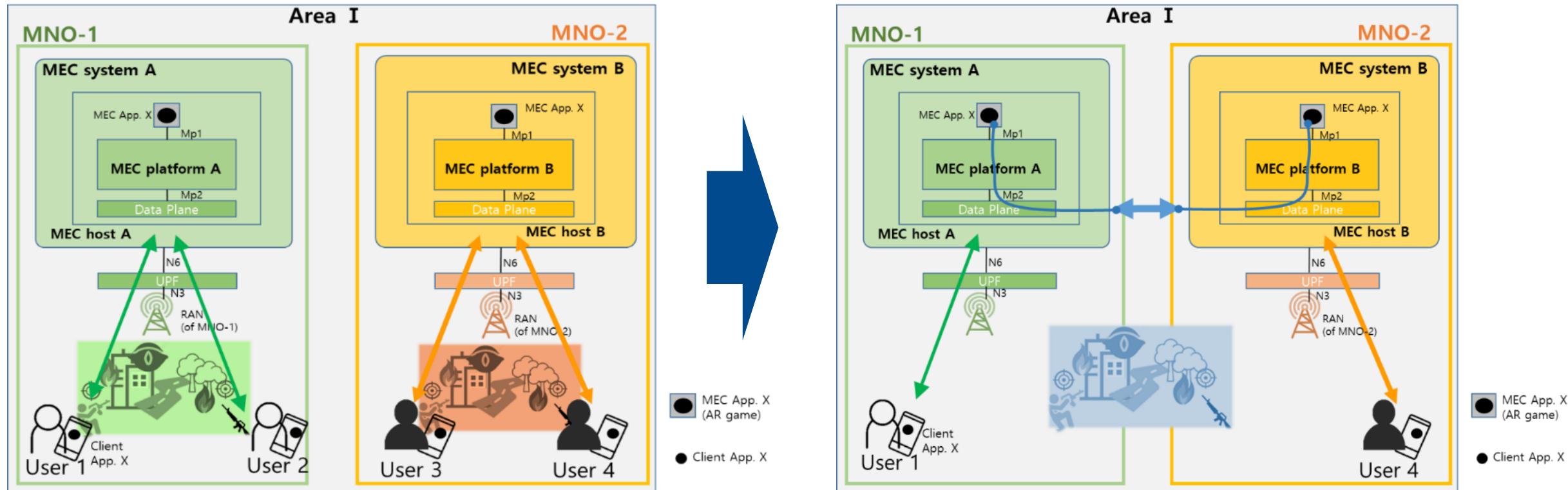
- Type-1 use case - national roaming like scenario: customers of operator A could access the edge infrastructure of operator B to ensure the best possible service.
- Type-2 use case: An app developer has a commercial relationship with operator A. Federation agreements could allow the app developer to 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.

MEC Study on Inter-MEC systems and MEC-Cloud systems coordination (MEC 035)

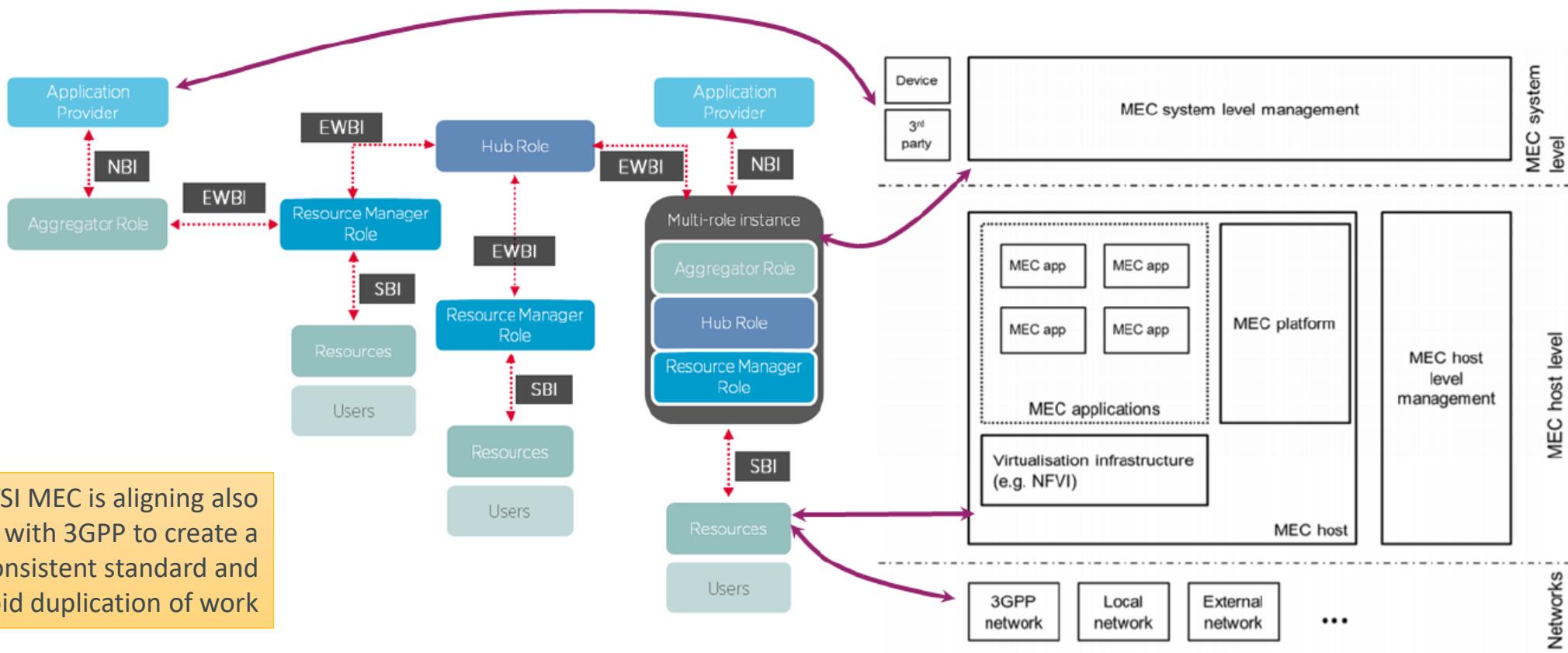


Many Use cases

#6: MEC federation scenario for immersive AR game



GSMA OPG (Operator Platform Group) mapping with ETSI MEC



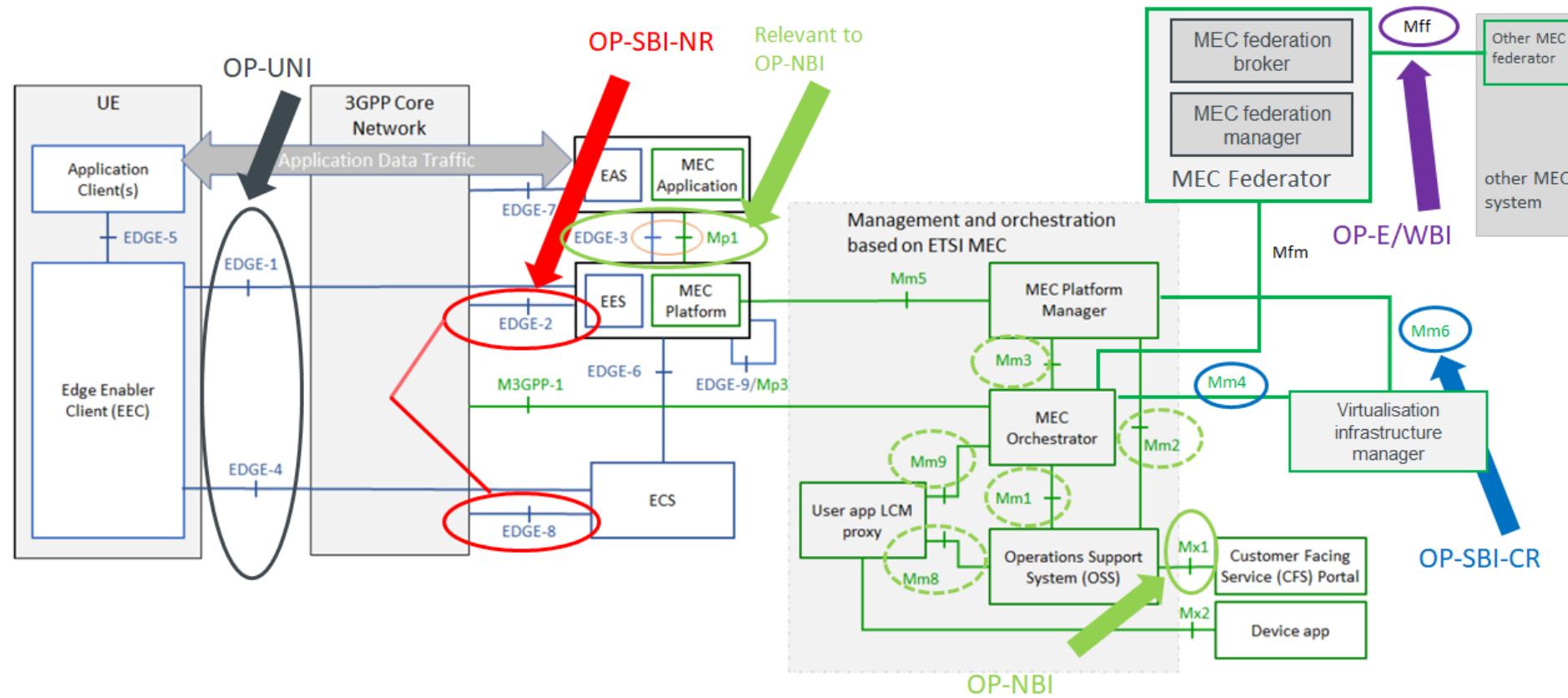
Note: GSMA is listed as a MEC Participant, can submit contributions to ISG MEC for Discussion or Decision, and not only for Information. Dually, ETSI MEC nominated 2 observers, to represent the ISG in GSMA OPG.

Ref: GSMA Permanent Reference Document, "Operator Platform Telco Edge Requirements", v2.0, April 2022.

Link: <https://www.gsma.com/futurenetworks/wp-content/uploads/2022/04/GSMA-Operator-Platform-Telco-Edge-Requirements-2022-v2.0.pdf>

MEC Federation: the ETSI MEC view

- Tentative standards mapping presented at the joint GSMA OPG workshop, on 21/01/2022 (*)
- A common view on SDO mapping and worksplit is the first step for the collaboration
 - Alignment with 3GPP is also needed to create consistent standards and avoid duplication of work

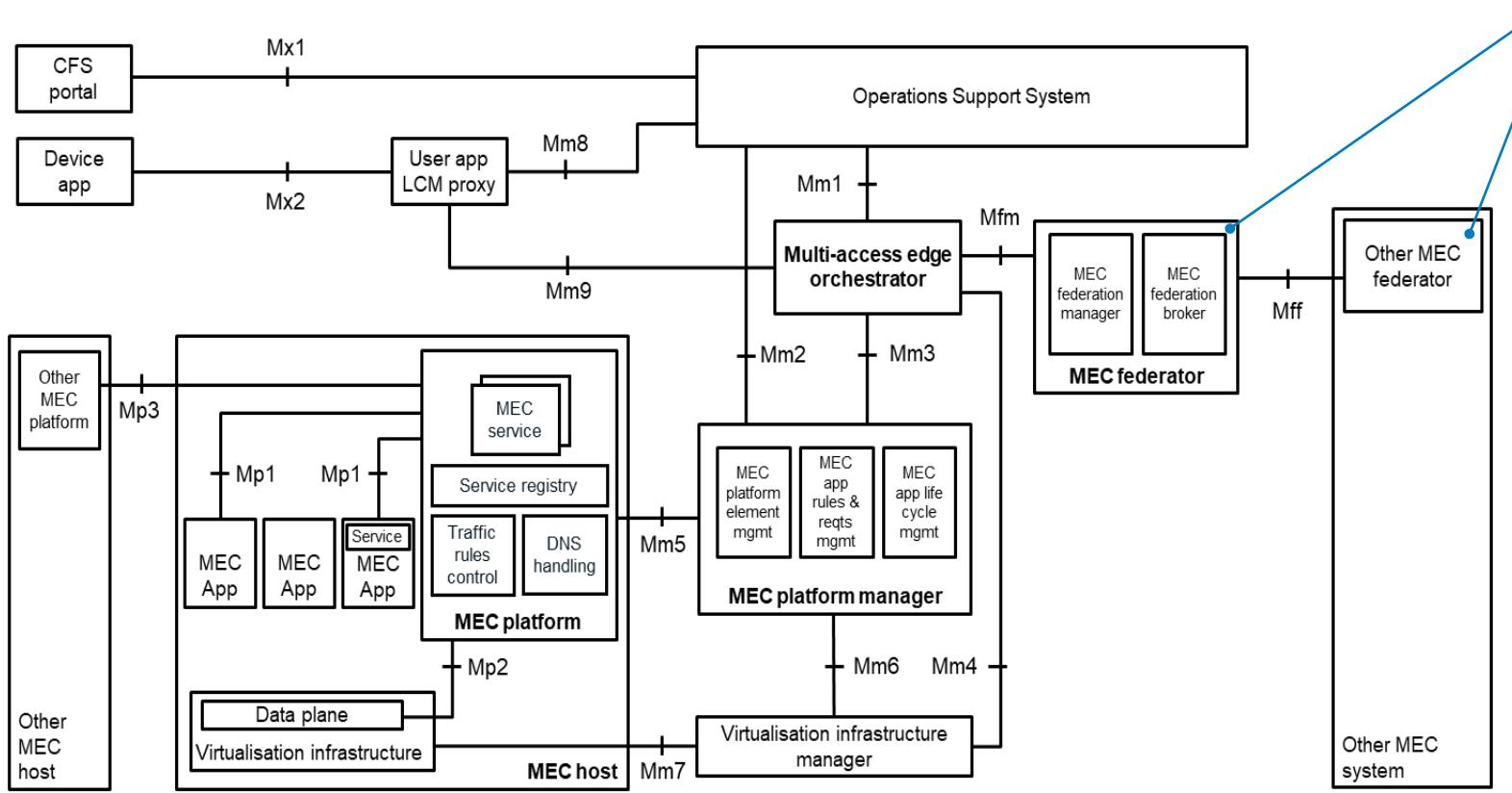


Note: finalization of this mapping is currently WIP

MEC 003 – introducing Architecture variant for MEC federation



Phase 3 deliverable published in March 2022



MEC federator (MEF): enables a MEC federation between MEC systems

- A MEF interfaces to at least one MEO
- Each MEF enables information exchange with at least one other MEF
- A MEF may serve as a single point of contact for multiple MEFs in the MEC federation

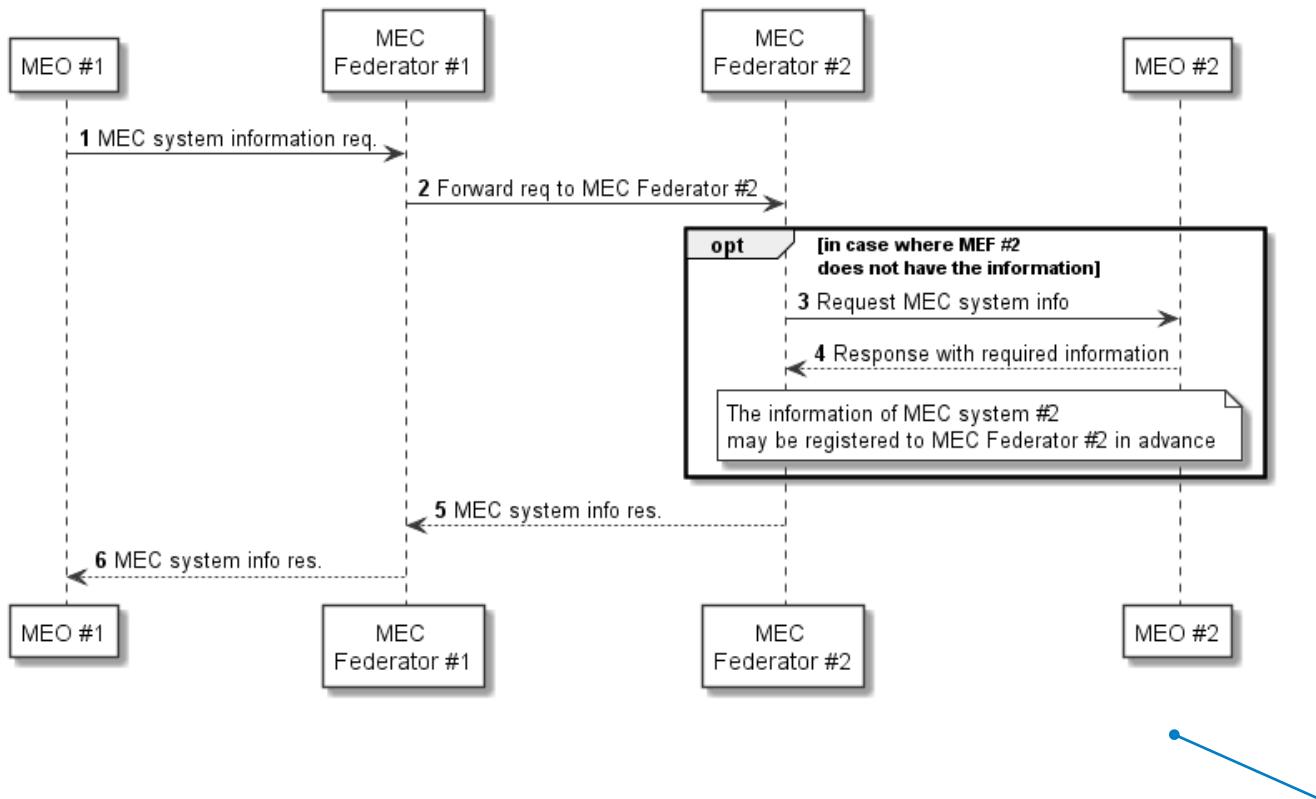
MEF may support the following functionality:

- registration of MEC system information by a MEO;
- MEC system discovery;
- broker capability acting as a one to many intermediary between MEFs;
- information (e.g. MEC system information) exchange;
- application lifecycle management (e.g. on-boarding/instantiation/termination) across different MEC systems;
- application monitoring across different MEC systems.

MEC 040 – introducing MEC Federation Enablement APIs



Phase 3 deliverable v311 ongoing (stable draft @Oct 2022)



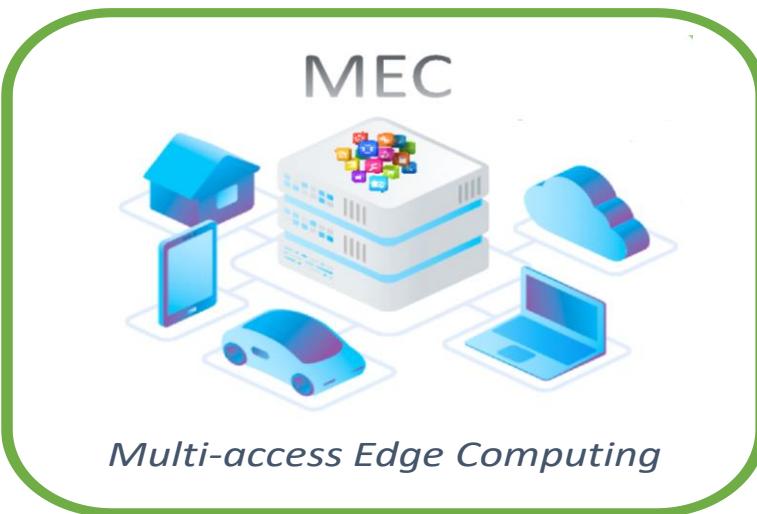
Federation Enablement APIs offer services such as discovery, information exchange and application life cycle management to enable the inter-work of one MEC system with another MEC system:

- Registration/Update/Deregistration of MEC system(s) to the federation
- MEC system discovery
- MEC application instance discovery
- MEC service discovery
- Application package mgmt and App instance LCM
- Providing/updating MEC system-wide MEC App instance information updates to MEF

Example (MEC System Discovery) :

- Information flow used for enabling MEO to be aware of another MEC system
- The MEC system discovery is the primitive and essential procedure for enabling the other functionalities relating to the Feature MEC Federation

ETSI White paper on MEC Federation: deployment considerations



- This White Paper focuses on the deployment options related to **MEC federation**, especially from an architectural point of view, and with a key focus on ETSI MEC implementations, but also with the aim to provide an open approach considering other standards and technologies.
- For this purpose, the White Paper firstly analyzes the recent publications of GSMA OPG and recent updates in ETSI MEC and 3GPP specifications, then introduces the **synergized architecture** supported by both standards organizations, which indicates the background information for the deployment of MEC federation.

Key considerations in the paper:

- Introduces the business stories that enable readers to understand how MEC federation is beneficial for MEC system providers
- Based on these business stories, corresponding deployment options are introduced.
- Provide insights for edge stakeholders, and all readers in general, to better understand how to choose the appropriate deployment options



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