The Standards People

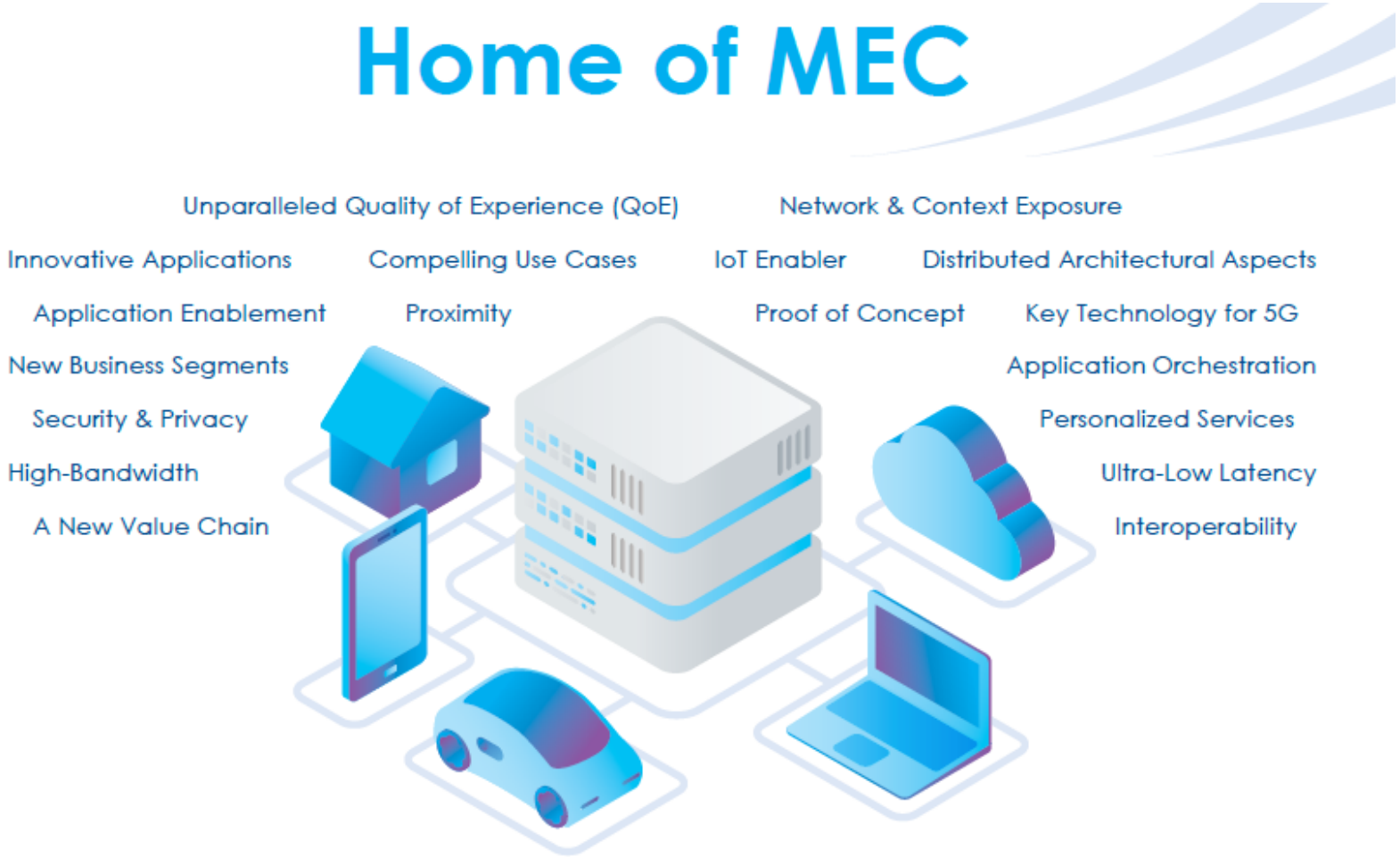
ETSI MEC: An Introduction

(almost) everything you want to know about ETSI MEC

Presented by: **ETSI MEC Leadership Team** For: **Public consumption**

Why Edge Computing?

… as in Real Estate, it's about just 3 things: **Location, Location, Location**



The Role of ETSI MEC

ETSI ISG MEC

ETSI: The Standards People
We produce globally applicable standards for ICT-enabled systems, applications and services deployed across all sectors of industry and society

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

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

Standards + **Industry Enablement +** **Telco Edge Focus**

ETSI MEC – What we do

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

- API Framework
- API Principles & Guidelines
- Service exposure via standardized APIs
- Management & Orchestration of Applications

+

- ection & re-location of UPF
- AF influence on traffic routing
- Mobility event notifications from SMF
- Concurrent access to local and central DN

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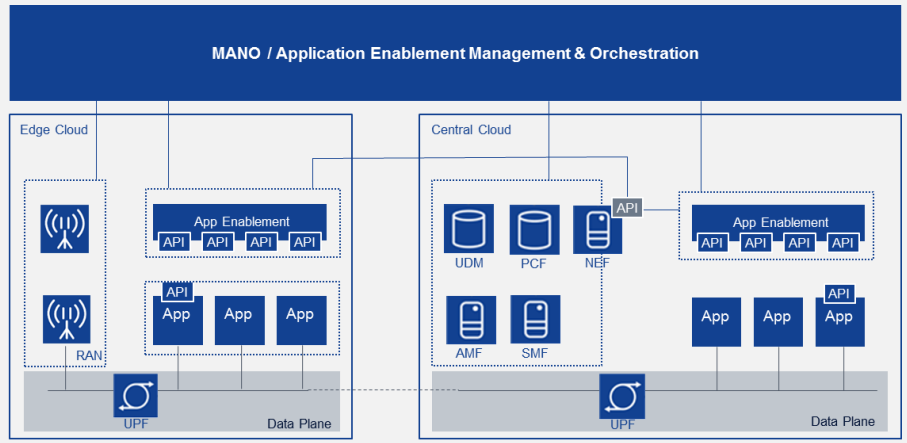
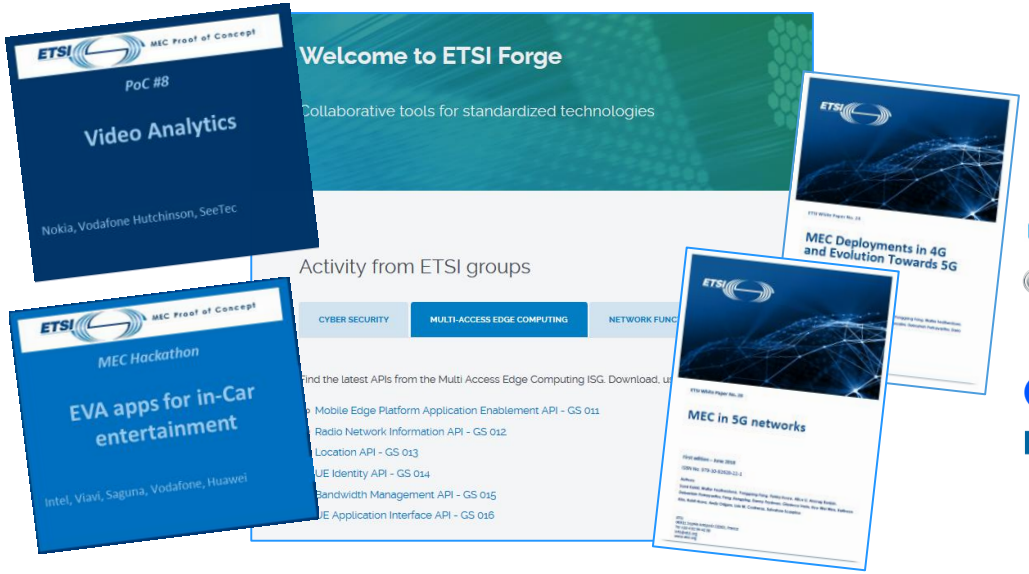
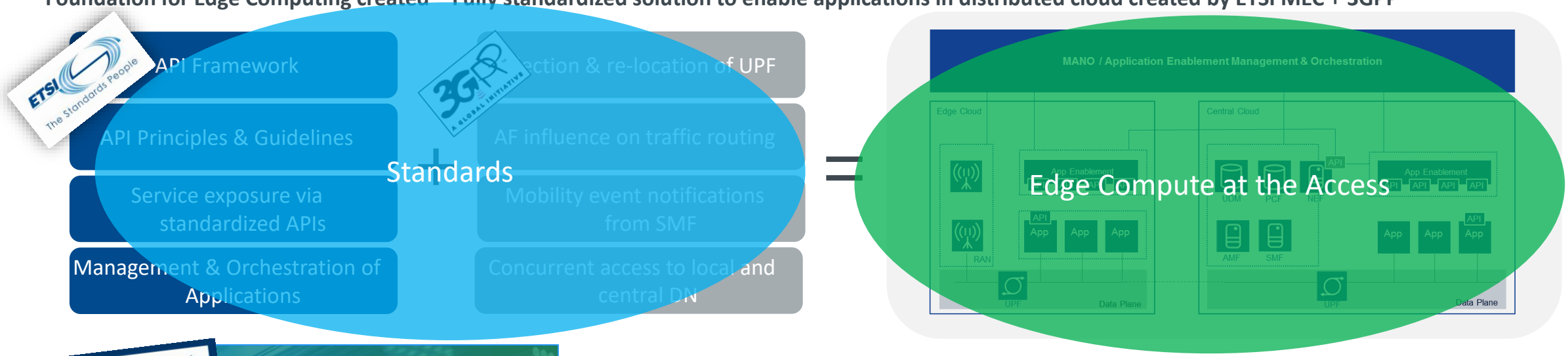




89 members - Operators – Technology Vendors – IT players – Application developers

ETSI MEC – What we do

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



89 members - Operators – Technology Vendors – IT players – Application developers

Now in our 2nd 3-year Phase of work

- Key overall specification
  - Technical Requirements (MEC 002)
  - Framework and Reference Architecture (MEC 003)
  - MEC Proof of Concept (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)
  - Lawful Intercept (MEC 026 - published)
- Addressing key Industry Segments
  - V2X (MEC 022 - published, MEC 030)
  - IoT (MEC 033), Industrial Automation, VR/AR
- Key use-cases and new requirement
  - Network Slicing (MEC 024)
  - Container Support (MEC 027)
- Normative work for integration with NFV
  - Incorporate in v2 of existing specs as needed
- From “Mobile” to “Multi-Access”
  - Wi-Fi (MEC 028)
  - Fixed Access (MEC 029)
- MEC integration in 5G networks (MEC 031)
- Developer community engagement
  - API publication through ETSI Forge (more overleaf)
  - Hackathons
- Testing and Compliance (MEC 025 - published, MEC 032)

Our Standards

ETSI MEC – Foundation for Edge Computing

Application Enablement and Framework

Service definition framework and baseline platform services authorized applications.

- Registration, discovery and notification;
- Methodology for authentication and authorization of apps providing/consuming services;
- Communication support for services (query/response and notifications).

API Principles

Principles and guidance for developing and documenting APIs

- Developer-friendly approach to foster development
- ***Ensures that a consistent set of APIs*** are used by developers.
- Defines approach for authentication and authorization of apps providing/consuming services
- Based on TMF and OMA best practices

Specific service-related APIs

Standardized service-exposure APIs for key services that

- Expose network and context information
- Allow definition of localized, contextual services
- Support key use cases (e.g. enterprise, vehicular)
- Allow fine-grained edge traffic management

Management and Orchestration related APIs

Management of MEC hosts either as ***stand-alone*** entities or part of a larger ***NFV-managed*** framework

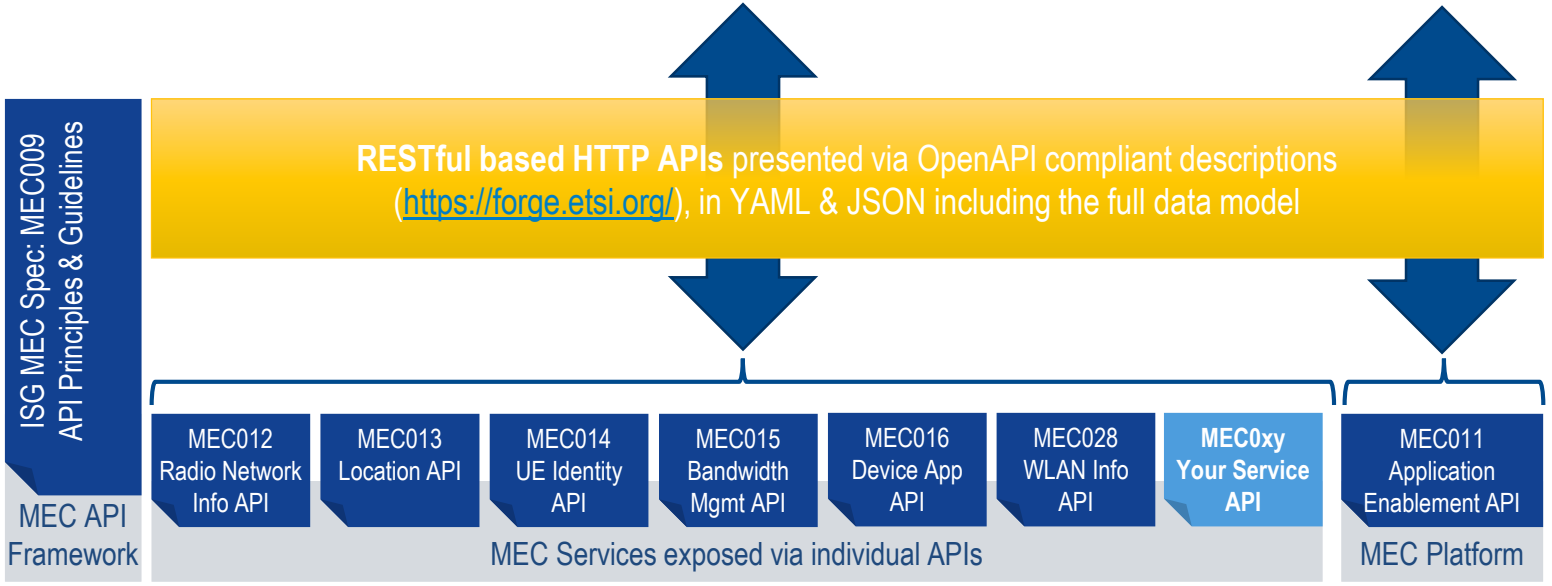
- Facilitate running of 3rd party application
- Enable deployment ***at the correct location at the right time***, based on technical and business parameters
- Integrate into telco operations systems, e.g. OSS

Enables a myriad of new use cases across multiple sectors as well as innovative business opportunities

Enabling Global Application Portability

MEC Application Development Community

Interaction & Information Exposure



- ✓ Simple to use, well documented APIs, published with OpenAPI Framework
- ✓ Create innovative applications quickly and easily, reducing time-to-revenue
- ✓ New APIs (compliant with the MEC API principles) can be added
- ✓ Increase the Total Addressable Market (TAM)

MEC and Management: The Killer Use Case for Automation

MEC deployments present challenging environment

- (large scale: geography) x (small scale: cloud footprint)
- Unmanned/lights out location
- Outside traditional service areas

While supporting “critical infrastructure”

- Telco, public safety, etc.
- “9’s” of availability requirements

Unique requirements and processes

- Minimize need for human presence
- Maximize service time intervals
- Minimize skills required from those on site

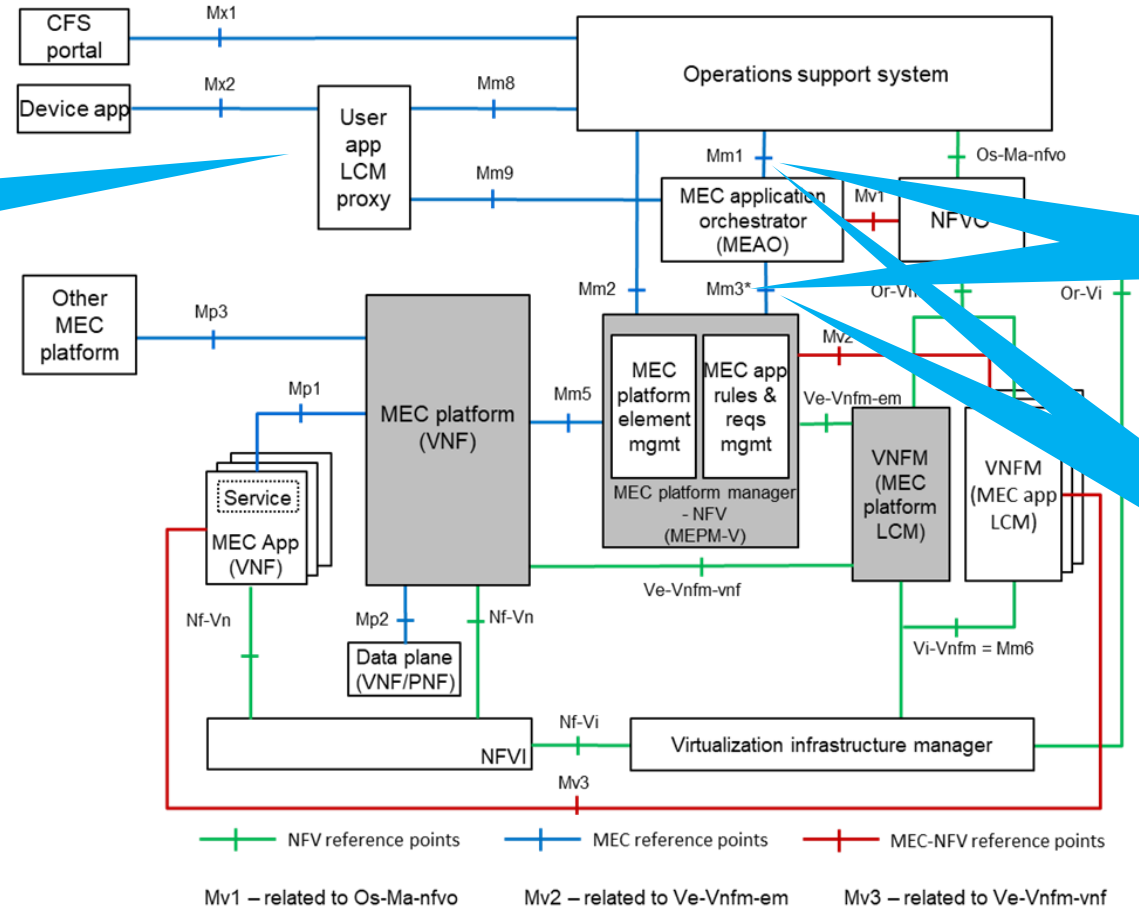
In other words

- Get as close as possible to the web-scale maintenance model
- In a very non-web-scale environment

- The following ETSI White Papers address the MEC deployment aspects:
  - *WP#23: Cloud RAN and MEC: A Perfect Pairing*
  - *WP#24: MEC Deployments in 4G and Evolution Towards 5G*
  - *WP#28: MEC in 5G networks*
  - *WP#30: MEC in an Enterprise Setting: A Solution Outline*

All white papers are available in
https://portal.etsi.org/TBSiteMap/MEC/MECWhitePapers.aspx

A key part of ETSI Network Automation Standards



Device-triggered LCM Enablement (MEC 16)

Management of MEP as a VNF (MEC 10-1)

LCM Mgmt of 3rd party Apps (MEC 10-2)

ZSM: overall approach | NFV, OSM: managing telco clouds | MEC: managing edge telco clouds

MEC White Papers: A view of a whole picture

Standards are necessarily tools, not solutions

- Enable interoperability
- Support a broad range of use cases and system architecture
- Address only a specific part of the whole picture

MEC White Papers: how we help industry see the whole picture

- MEC in an Enterprise Setting
  https://www.etsi.org/images/files/ETSIWhitePapers/etsi_wp30_MEC_Enterprise_FINAL.pdf
- MEC in 5G Networks:
  http://www.etsi.org/images/files/ETSIWhitePapers/etsi_wp28_mec_in_5G_FINAL.pdf
- MEC deployment in 4G and towards 5G:
  http://www.etsi.org/images/files/ETSIWhitePapers/etsi_wp24_MEC_deployment_in_4G_5G_FINAL.pdf
- CRAN and MEC: A Perfect Pairing:
  http://www.etsi.org/images/files/ETSIWhitePapers/etsi_wp23_MEC_and_CRAN_ed1_FINAL.pdf
- Developing SW for MEC (2nd Ed.)
  https://www.etsi.org/images/files/ETSIWhitePapers/etsi_wp20ed2_MEC_SoftwareDevelopment.pdf
- and many more to come!

WG DECODE: Enabling Edge Computing in the Telco Industry

MEC PoCs: Show off YOUR cool Edge

These PoCs are currently active (first 8 are done)

ETSI MEC Proof of Concept

PoC #10

Service-Aware MEC Platform to Enable Bandwidth Management of RAN

Industry Technology Research Institute - Linker Network - FarEasTone

ETSI MEC Proof of Concept

PoC #11

Communication Traffic Management for V2x

KDDI Corporation - Saguna Networks Ltd. - Hewlett Packard Enterprise

ETSI MEC Proof of Concept

PoC #12

MEC Enabled OTT Business

China Unicom, ZTE, Intel, Tencent, Wo video, UnitedStack

ETSI MEC Proof of Concept

The next PoC

IMAGINE YOUR BEST HERE

Thought Leaders in Edge Computing

We encourage new POC submissions to ETSI MEC !

For further details, please see: http://mecwiki.etsi.org or contact CTI_Support@etsi.org

MEC Deployment Trial: MEC in action in Live Networks

Next step from MEC PoC to keep engaging the ecosystem in MEC standards based deployments

- From Proof of Concept to proof of viability in a Live Network environment
- Follows the proven MEC PoC framework with a new set of acceptance criteria
  1. Trial deployed in Live Network
  2. Demonstrated to the industry, e.g. in an industry event or in ISG MEC
  3. Feedback to MEC standardization; improvement proposals, lessons learnt, next steps
- Currently the following three MDTs are active:

We encourage new MDT submissions to ETSI MEC !

MEC Deployment Trial

MDT #1

CDN at the Edge

China Mobile, Nokia

MEC Deployment Trial

MDT #2

MEC in Factory Network

China Mobile, Huawei

MEC Deployment Trial

MDT #3

Edge-Cloud VR cloud game scheme based on 5G network

China Unicom, Huawei, Tencent, Intel

For further details, please see: http://mecwiki.etsi.org or contact CTI_Support@etsi.org

MEC Testing and Conformance

- Based on the testing methodology guidelines & framework specified in MEC 025, the multi-part work item MEC 032 develops conformance test specification for the MEC service APIs
  - Part 1: Test requirements and Implementation Conformance Statement (ICS)
  - Part 2: Test Suite Structure (TSS) and Test Purposes (TPs) using the standardized notation TDL_TO
  - Part 3: Abstract Test Suite (ATS) written in a machine-readable specification languages TTCN-3 & Robot
- The development of the API conformance test specifications validate the standard
- The executable test suites serve the developer communities and industries in enabling the conformance testing of the API implementations

MEC-0025: Testing Framework

Compliancy Test Cases

MEC-0032: MEC API Conformance Test Specifications

"Test once, use anywhere"

MEC Hackathons

ETSI ISG MEC Hackathon Framework:

- **Open Call** for proposers and hosts interested in organizing a MEC Hackathon
- Submit on our Wiki page https://mecwiki.etsi.org

First ETSI MEC Hackathons – September 2018

- ETSI sponsored/organized Hackathon
  - Co-located with Edge Computing Congress
  - http://www.etsi.org/news-events/events/1302-1st-etsi-mec-hackathon
- ETSI supported hackathons:
  - Turin: www.treatabit.net/article/mec-hackathon-turin
  - Beijing: http://www.c114.com.cn/news/126/a1065884.html (press release in Chinese)

Second MEC Hackathon – September 2019

- MEC Hackathon co-located with Edge Computing Congress, London (UK)
  - Endorsed by ETSI
  - Link: https://tmt.knect365.com/edge-computing-congress/etsi-mec-hackathon
- MEC Hackathon in Shenzhen, China
  - Hosted by China Mobile, China Telecom, China Unicom, Huawei
  - Endorsed by ETSI

We encourage new proposals for MEC Hackathons!

For further details, please see: http://mecwiki.etsi.org or contact CTI_Support@etsi.org

OpenAPI description files

OpenAPI Specification (aka Swagger Specification)

- Open source framework for defining & creating RESTful APIs
- OpenAPI Specification (OAS) compliant API description file
  - Inherently includes MEC data structure definitions
  - Machine readable facilitating content validation
  - Allows auto-creation of stubs for both service client & server

Motivation with ISG

- Validation → Integrity and completeness of the Specifications
- Accessibility & Adoption → Outside of the ISG, i.e. 3rd party developers
- Feedback → External critical review & feedback

Where we are now

- ETSI Repository: https://forge.etsi.org. GitHub mirror: https://github.com/etsi-forge
  - MEC 11, 12, 13, 14, 15 & 16 already available
- Tiger Team: timely updates & resolution of bugs, queries, etc.

https://www.openapis.org

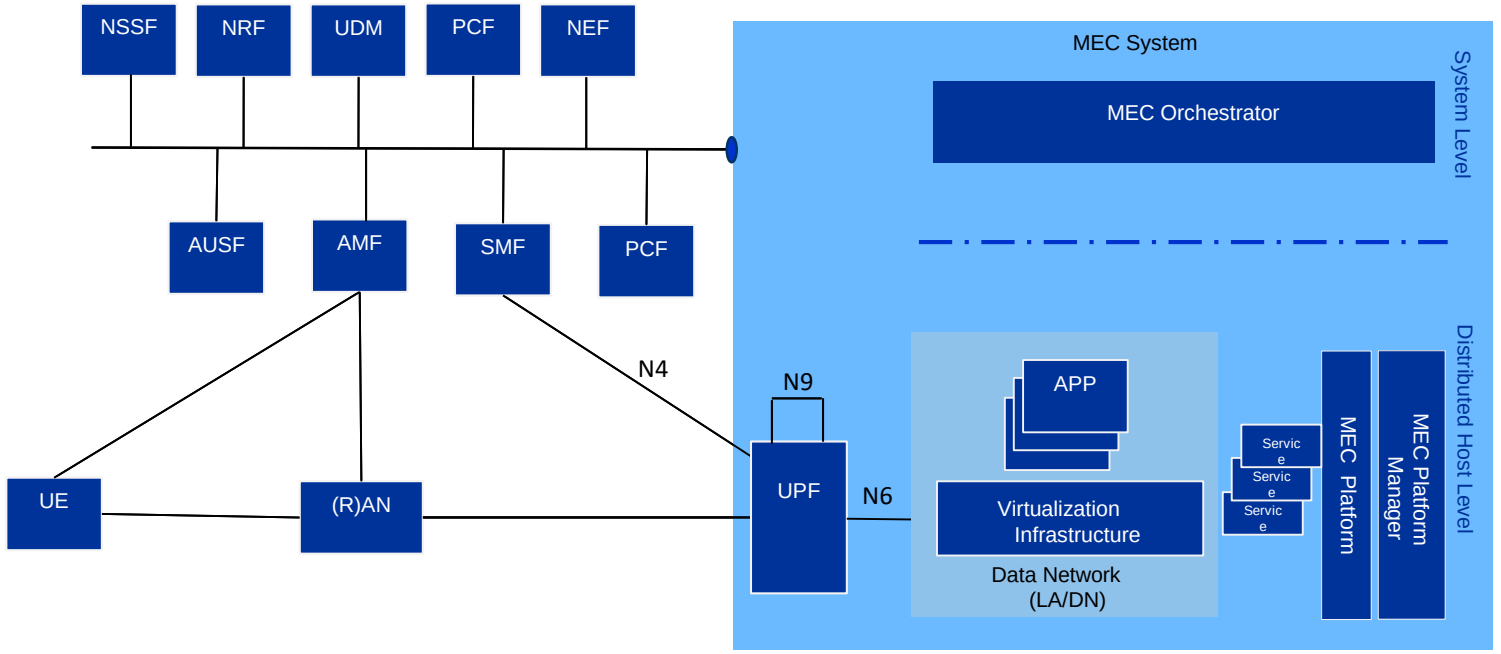
Future Plans

- Release of new API descriptions as corresponding specifications published
- Ongoing upgrade to OAS 3.0 (from current 2.0)
- Currently exploring other approaches towards a more extensive engagement with the developer community

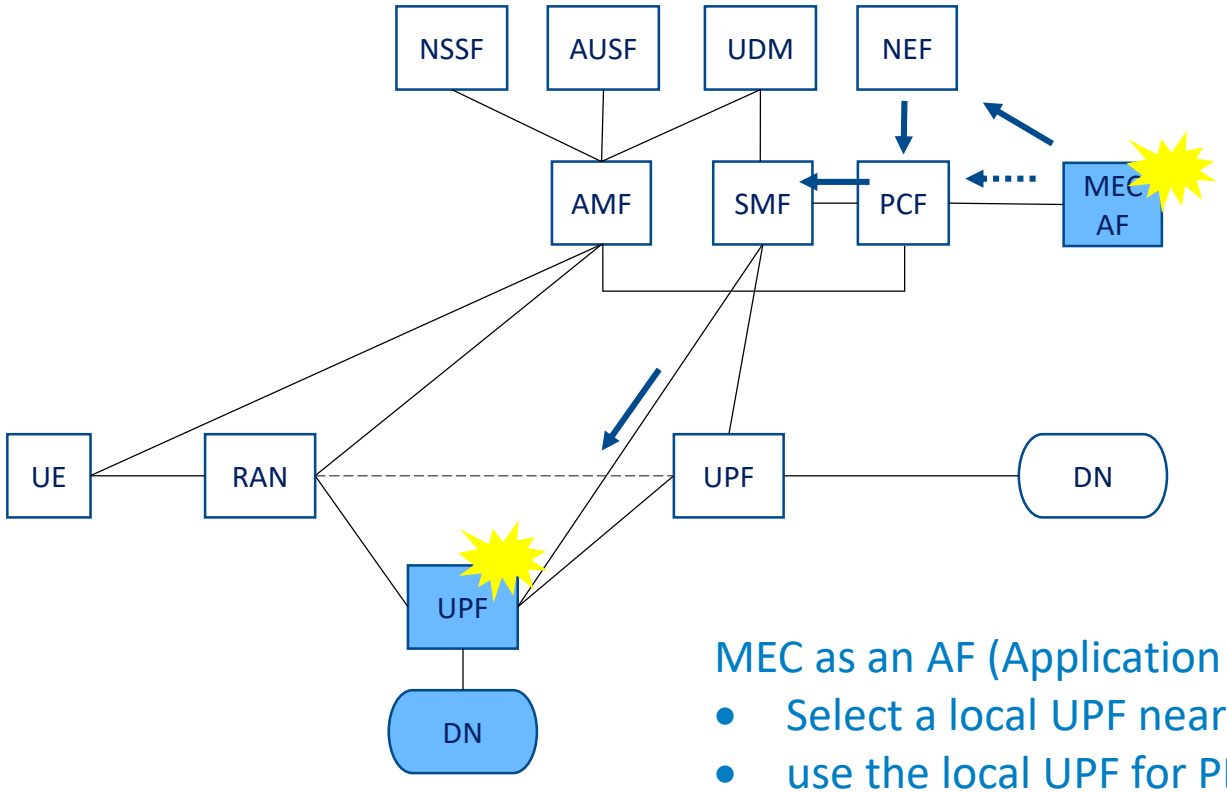
The larger Telco World:
ETSI MEC and 5G

MEC Phase 2 – Study Item MEC in 5G (MEC 031)

- The ETSI white paper MEC in 5G networks sets the scene for this study item
- ISG MEC investigates the opportunities offered to MEC by the 5G system and its edge computing enablers
- The scope includes the following
  1. C-plane interactions with 5GC,
  2. Functional split between MEC and 5GC wrt. API framework,
  3. Organization of MEC as an AF,
  4. Pertinent interactions of MEC with (R)AN



3GPP enablers for MEC – Selection & re-location of UPF

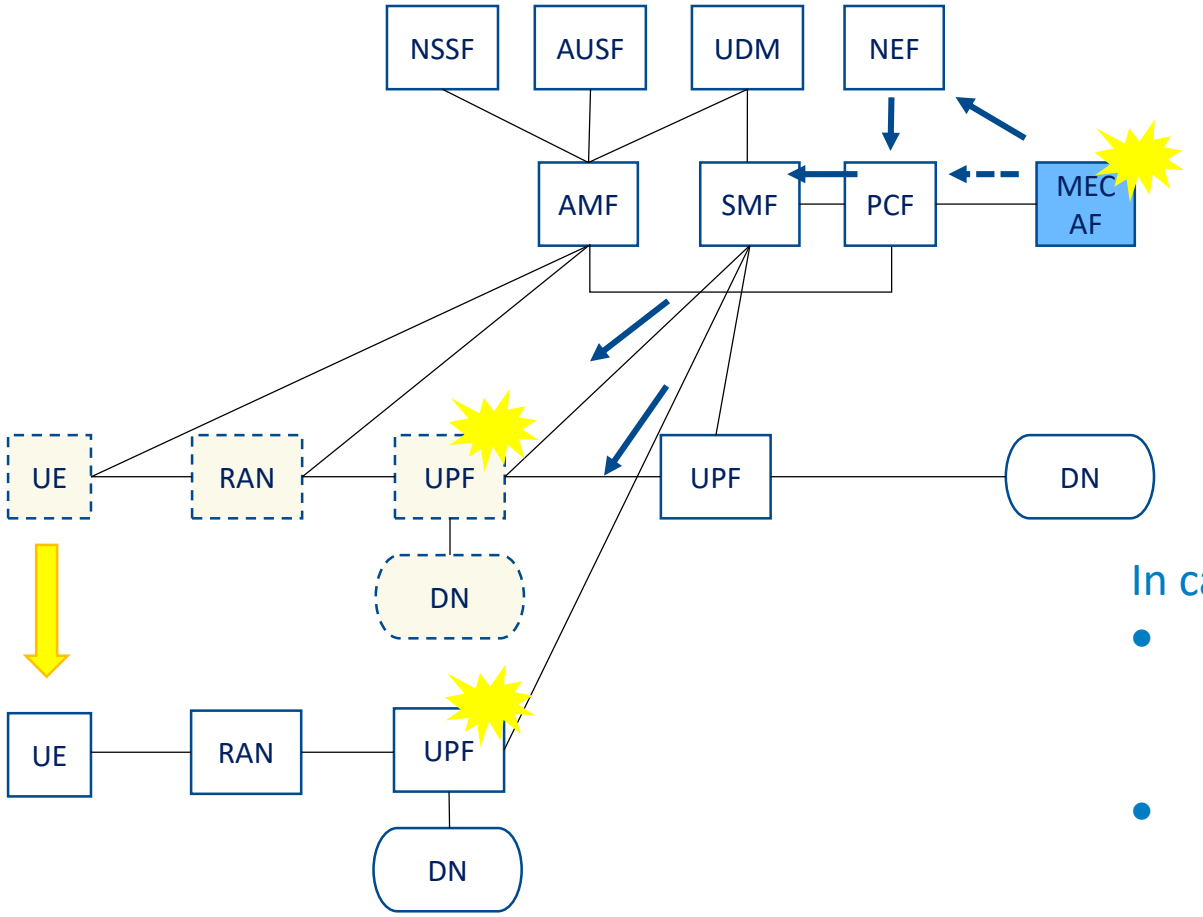


- Selection & re-location of UPF
- AF influence on traffic routing
- Mobility event notifications from SMF
- Concurrent access to local and central DN

MEC as an AF (Application Function) can request the 5GC to

- Select a local UPF near the target (R)AN node
- use the local UPF for PDU sessions of the target UE(s)
- control the traffic forwarding from the local UPF so that the UL traffic matching with the traffic filters received from MEC (AF) is diverted towards MEC hosts while other traffic is sent to the Central Cloud

3GPP enablers for MEC – Selection & re-location of UPF



- Selection & re-location of UPF
- AF influence on traffic routing
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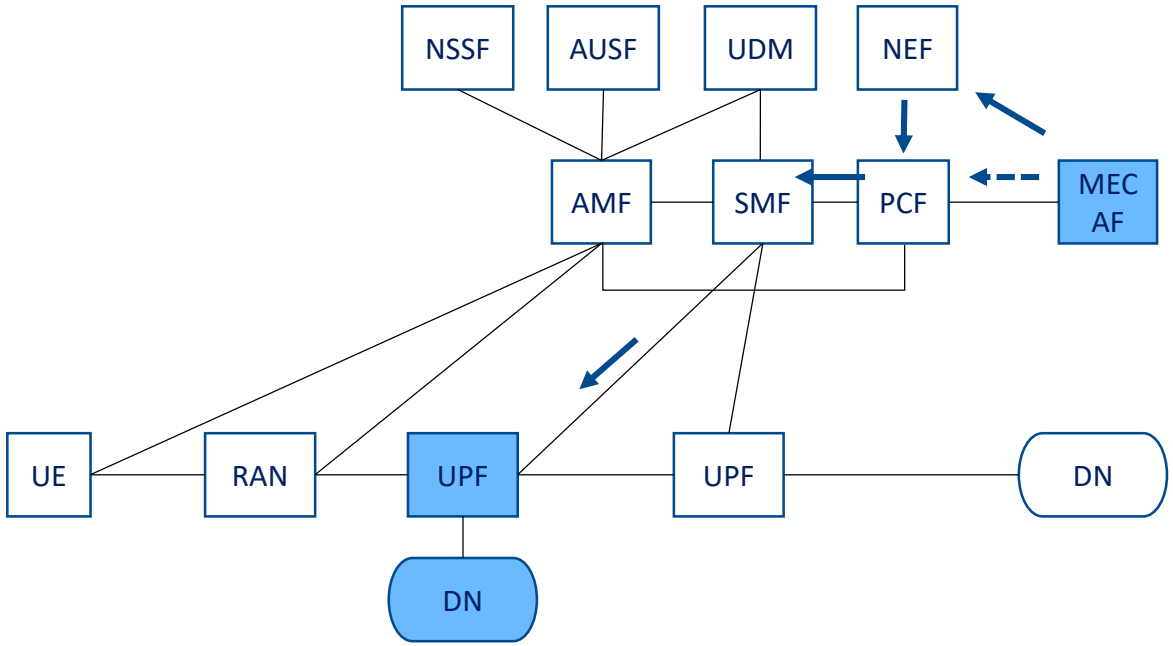
In case of UE mobility, the 5GC can

- re-select a new local UPF more suitable to handle application traffic identified by MEC (AF)
- notify the AF about the new serving UPF

3GPP enablers for MEC – AF influence on traffic routing



Selection & re-location of UPF

AF influence on traffic routing

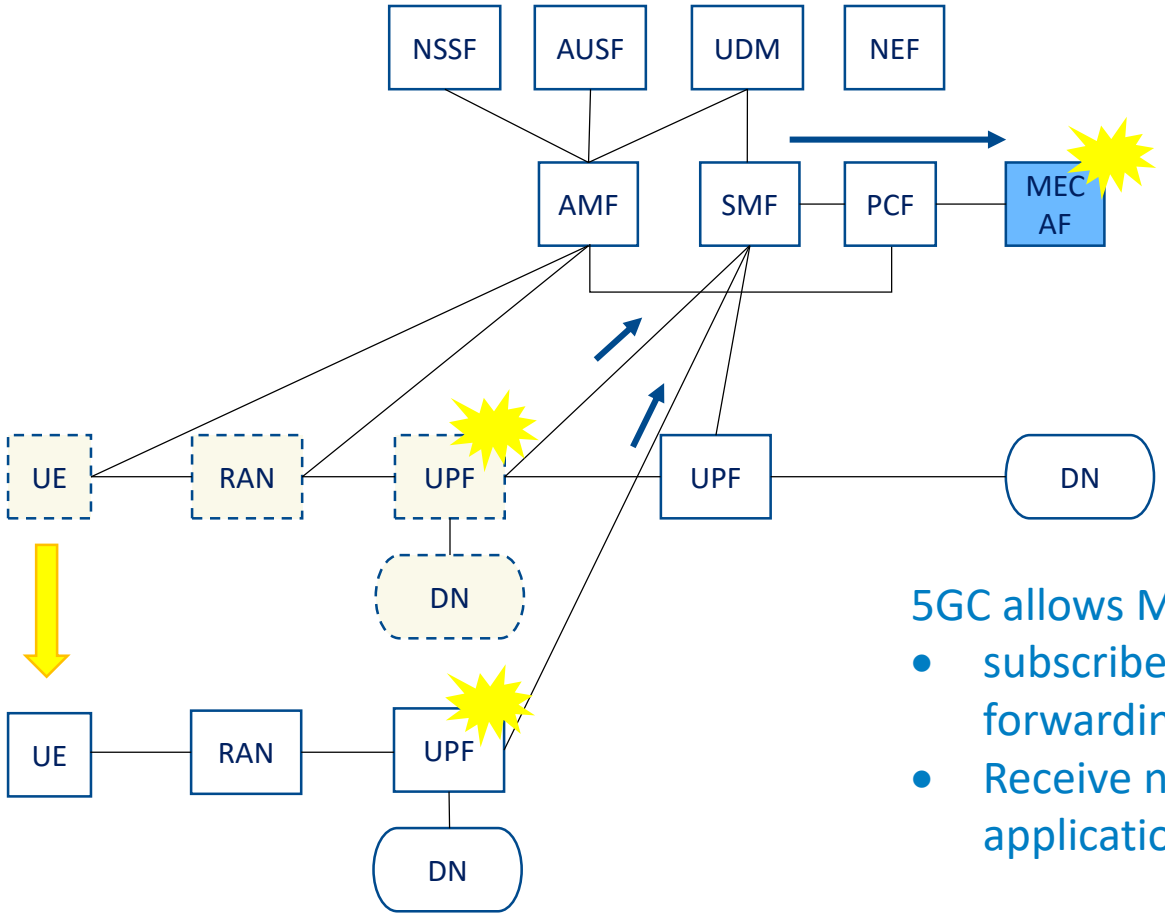
Mobility event notifications from SMF

Concurrent access to local and central DN

MEC as an AF can provide the following to 5GC

- traffic filters identifying MEC applications deployed locally on MEC hosts in Edge Cloud
- the target UEs (one UE identified by its IP/MAC address, a group of UE, any UE)
- information about forwarding the identified traffic further e.g. references to tunnels towards MEC hosts

3GPP enablers for MEC – Mobility event notifications



Selection & re-location of UPF

AF influence on traffic routing

Mobility event notifications from SMF

Concurrent access to local and central DN

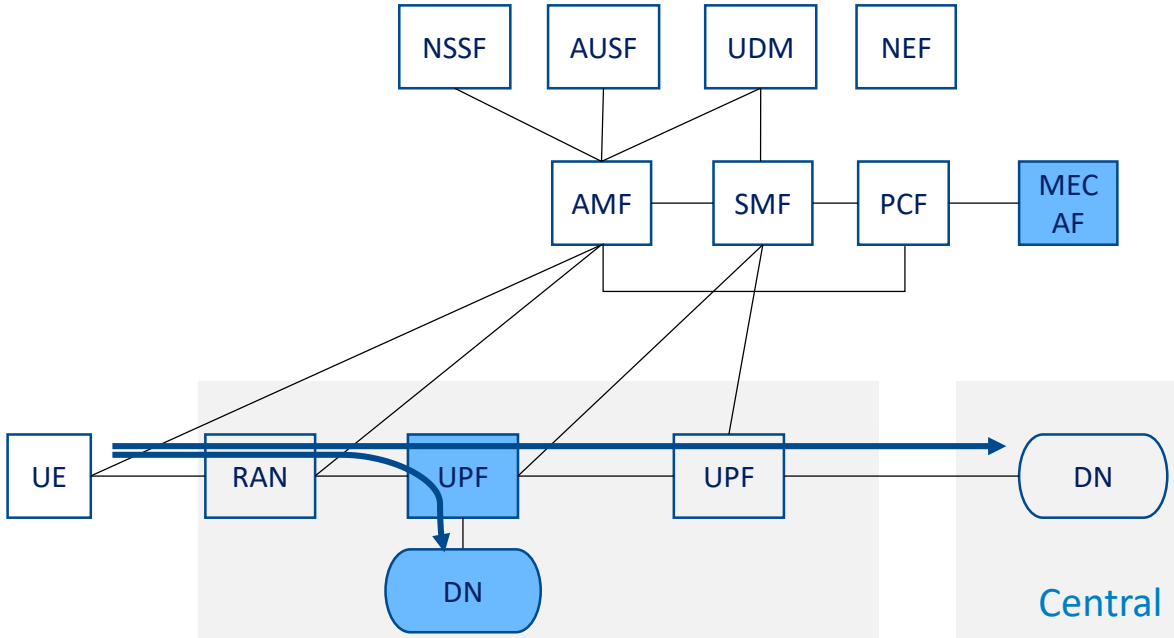
5GC allows MEC as an AF

- subscribe to UE mobility events that may affect traffic forwarding to MEC applications
- Receive notifications of UE mobility events affecting MEC application instances

3GPP enablers for MEC - Concurrent access to local and central DN

Same UP session allows the UE to obtain content both from local server and central server

Service continuity enabled by IP address anchoring at the centralized UPF.
No impact on UE in case of Uplink Classifier (ULCL) option is used.



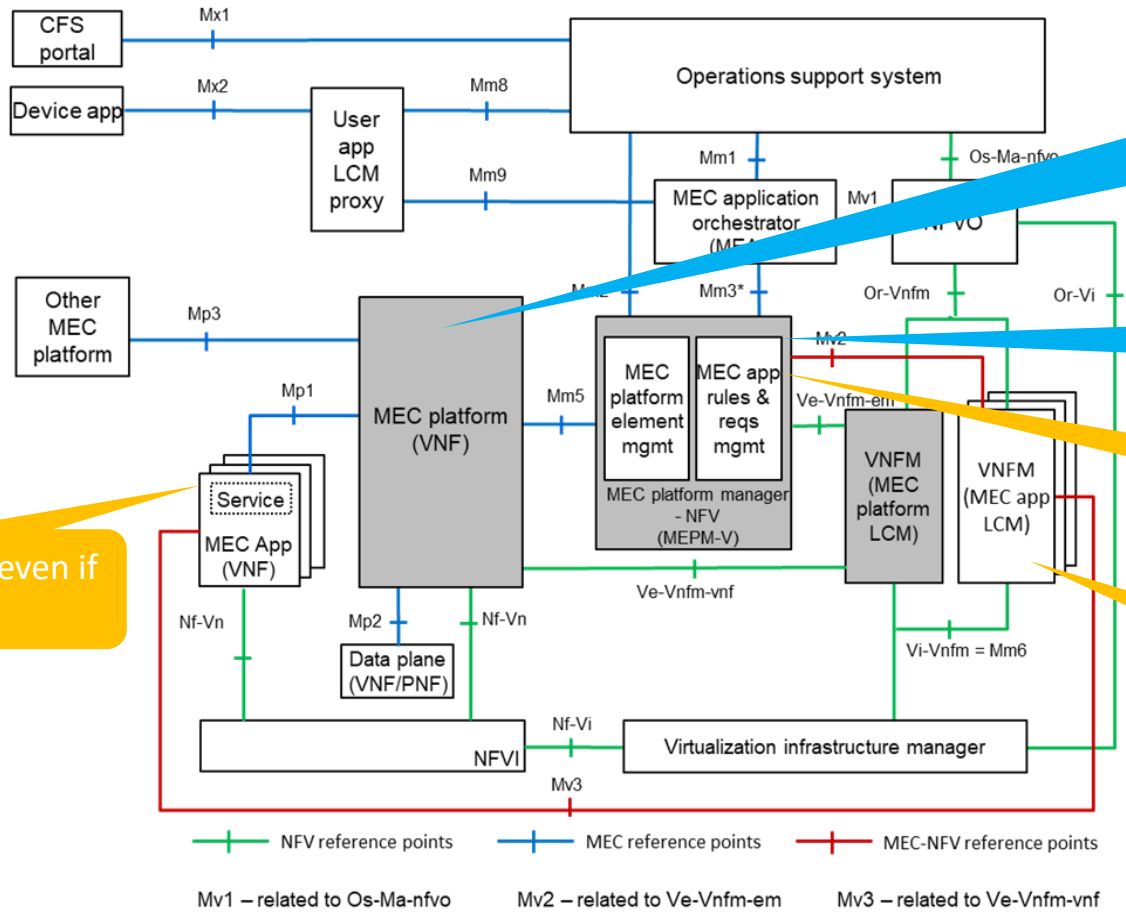
Edge Cloud for Ultra-low latency, high reliability services

Central Cloud
a.k.a. Conventional “internet”

- Selection & re-location of UPF
- AF influence on traffic routing
- Mobility event notifications from SMF
- **Concurrent access to local and central DN**

MEC and NFV
a common approach to management

MEC and NFV: MANO for the Telco Edge



MEP as a VNF:
must be running for any other VNF/app to run

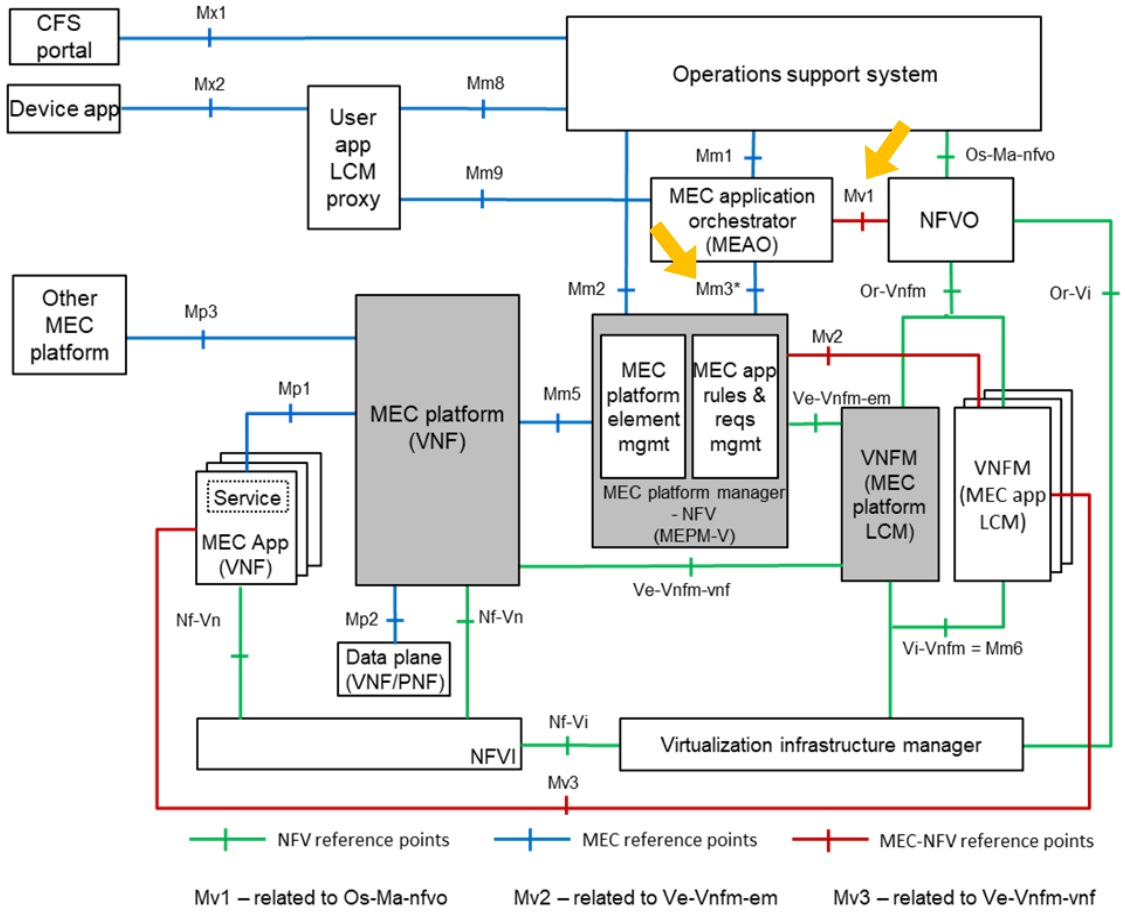
MEPM: EMS for MEP

MEPM is (part of) App's EMS

MEPM can be App's VNFM

App can be a VNF: even if it doesn't know it

MEC management: MEC-specific Operations



Mm1 required APIs:

- Application Package Management
- Application Lifecycle Management

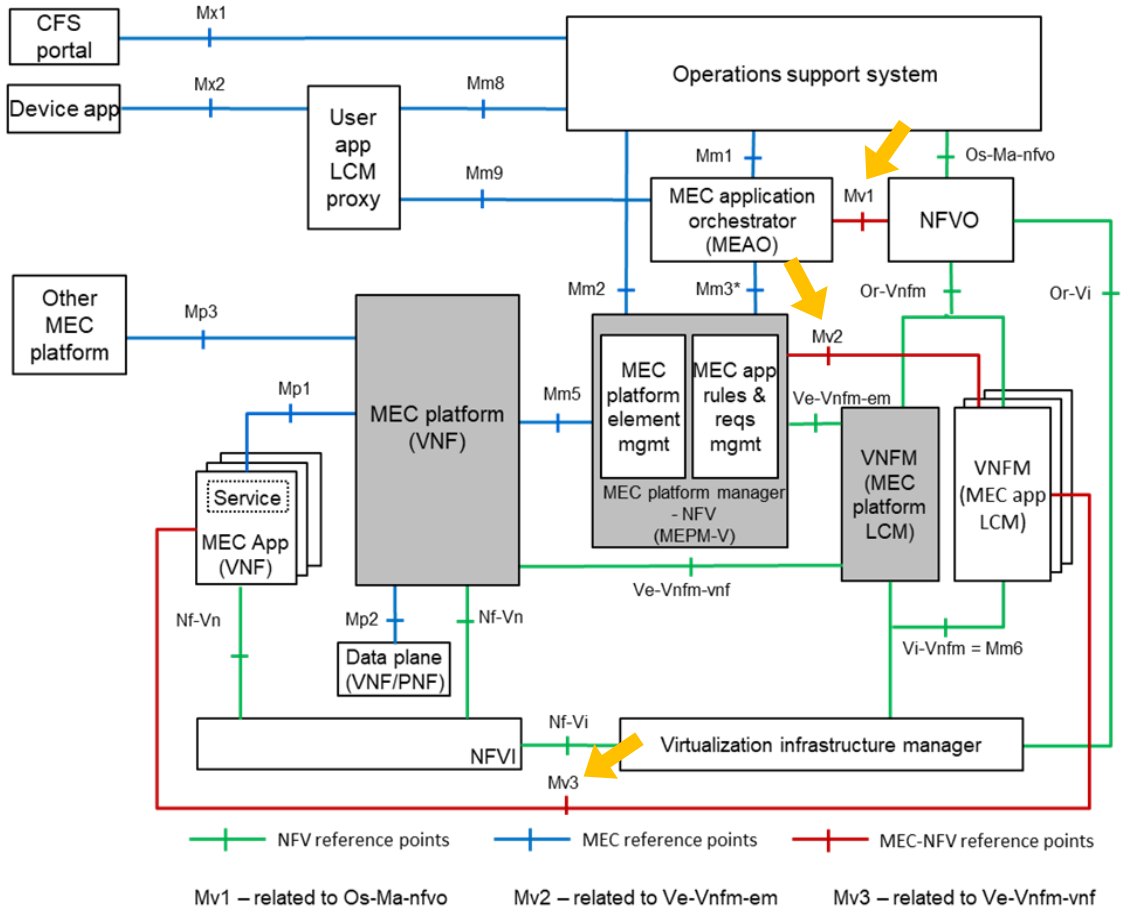
Mm3 required APIs:

- Application Package Management
- Application Lifecycle Management
- Application Lifecycle Change Notification

These NFV semi-agnostic

- Information models designed to be feasible without NFV
- Data models are NFV-consistent and compatible

MEC management: MEC-NFV Interaction



3 “Hybrid” Reference points identified as shown

- Mv3: at this point no specific changes to Ve-Vnfm-vnf are expected (i.e. it can be used as is)
- Mv2: Necessary changes are being addressed by NFV IFA as part of FEAT12 work (MECinNFV)
- Mv1: work identified, coordination plan is on-going

Additionally, MEC descriptor (AppD) must be linked to NFV descriptor (VNFD). This has been addressed as part of Rel 3 work using Non-MANO artifact capability as defined in Annex B of ETSI GS NFV-SOL 004 v. 2.5.1 and higher.

MEC in Action: How to use Service APIs

<Link to slide deck when coming up>

The END

Epilogue

ETSI ISG MEC is the leading voice in standardization & industry alignment around MEC

- Key building block in the evolution of mobile-broadband networks, complementing NFV & SDN
- Key enabler for IoT and mission-critical, vertical solutions
- Widely recognized as one of the key architectural concepts and technologies for 5G
  - Can be used to enable many 5G use cases without a full 5G roll-out (i.e. with 4G networks)
- Enable a myriad of new use cases across multiple sectors as well as innovative business opportunities