“Overview of ETSI initiatives on 5G and beyond with focus on Multi Access Edge Computing”

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Outline

- ETSI overviews on 5G Standardization
- ETSI Building Blocks for 5G Standardization

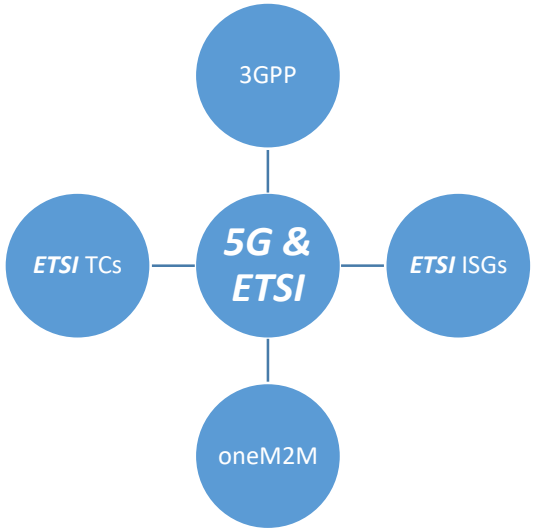
ETSI overviews on 5G Standardization

- Much of the **5G standardization work is done in 3GPP**
  - Radio access technology for submission to IMT2020 including
  - 4G/5G radio integration
  - Spectrum bands covering <6Ghz and >6Ghz
  - Core network technology for submission to IMT2020 including
  - Network Slicing & Fixed-Mobile Integration

- 5G is also expected to **integrate non-3GPP access technologies**, e.g. Wi-Fi, wireline, non-terrestrial networks (e.g. satellite, HAPS)

ETSI Building Blocks for 5G Standardization

- ETSI has several activities that are developing requirements and potential enablers/building blocks for a 5G system
  - Technical Committees (TCs)
  - Industry Specification Groups (ISGs)



Technical Committees (TCs):

- TC BRAN – Broadband Radio Access Networks:
  - **5GHz and 60 GHz RLAN Technologies**
  - **TV White Space Harmonized Standard**
- TC CABLE
  - Standardization of integrated broadband cable telecommunication network technology, the foundation for widely available, high capacity wired data networks,
  - analyzing the potential of cable networks for **backhaul and fronthaul of 5G signals** and additional requirements resulting from this use case, and leveraging 5G architecture and interfaces for **fixed-mobile convergence in the context of cable networks**
- TC CYBER
  - To ensure the **security of the 5G network**, devices and infrastructure from inception, service, improvement and end of life including detailed security work within 5G groups

ETSI Building Blocks for 5G Standardization

Technical Committees (TCs) contd:

- TC CYBER QSC – Quantum Safe Cryptography
  - QSC is fundamentally the **security approach to next-generation computing**, an is extremely appropriate for **certain components of the new 5G architecture** and is Creating and selecting cryptographic techniques that are resistant to attack by next-generation quantum computers.

- TC DECT
  - Developing a new **DECT-2020 air interface**, which is planned to fulfil the IMT-2020 requirements
- TC eHealth
  - All aspects of **5G capability and potential that are relevant to eHEALTH issues** and the role of 5G will considerably expand and significantly improve the environment for IoT and cloud services for all areas of medicine and health.

ETSI Building Blocks for 5G Standardization

Technical Committees (TCs) contd:

- TC INT/AFI – Core Network and Interoperability Testing
  - 5G PoC Multi-Demos Series Program/Project on ETSI GANA (Generic Autonomic Networking Architecture): **Autonomics in 5G Network Slices Creation, Autonomic & Cognitive Management & E2E Orchestration;**
  - **Closed-Loop (Autonomic) Service Assurance of IoT 5G Slices Use Cases;**
  - **Integration & Testing of Autonomics Software for Self-Adaptive Nets**

- TC ITS – Intelligent Transport Systems
  - **Vehicle connectivity** with the capability of using a 5G infrastructure

- TC LI – Lawful Interception
  - Development of a suite of standards allowing ETSI standards to support industry compliance to the requirements of national and international law - **touches many 5G aspects.**

ETSI Building Blocks for 5G Standardization

Technical Committees (TCs) contd:

- TC MSG – Mobile Standards Group
  - Along with its joint task force with ERM (EMC and Radio Spectrum Matters) and is responsible for the development of European Standards to be used for **presumption of conformity for 5G equipment**

- TC MTS - Methods for Testing and Specification
  - Responsible for the identification and definition of advanced specification and testing methods to improve the efficiency and economics of the standard description and associated conformance/interoperability testing processes.
  - Provisioning and evolution of **standardized test languages** allowing harmonized test specification, e.g. **TTCN-3 – Testing and Test Control Notation Version 3 and TDL – Test Description Language, which are essential pieces for testing 5G networks**

ETSI Building Blocks for 5G Standardization

Industry Specification Groups (ISGs):

- ISG ARF – Augmented Reality Framework
  - Developing an interoperability framework for Augmented Reality components, systems and services and **5G will significantly improve network performance for cloud services in particular in terms of bandwidth and latency**
- ISG ENI – Experiential Networked Intelligence
  - The **assessment of Networked Experience using Artificial Intelligence in 5G** communications systems
- ISG IP6 – IPv6 Integration
  - Addressing the transition from IPv4 to IPv6, defining best practices, garnering support and creating awareness of the impact of IPv6 on critical infrastructure and on emerging topics which **encompass a 5G infrastructure, such as IoT (Internet of Things) and SDN/NFV (Software Defined Networking/Network Function Virtualization)**

ETSI Building Blocks for 5G Standardization

Industry Specification Groups (ISGs) Contd:

- ISG mWT – mm Wave Transmission
  - Identification of spectrum regulations and licensing scheme more suitable and sustainable with respect to current ones in order to better match the challenging requirements of **5G mainly in terms of capacity increase**;
  - Facilitating the use of the V-band (57-66 GHz) for Fixed Wireless Access, E-band (71-76 & 81-86 GHz) and in the future higher frequency bands above 100 GHz (i.e. W/D-Band) for **large volume applications in the back-hauling and front-hauling to support 5G deployment**;
- ISG NFV – Network Functions Virtualisation
  - Reviewing and identifying opportunities for an **evolution of networking architectures and protocols to enhance 5G network implementation and performance.**

ETSI Building Blocks for 5G Standardization

Industry Specification Groups (ISGs) Contd:

- ISG NGP - Next Generation Protocols
  - ISG NGP studies the **implementation of the TCP/IP protocol suite and 3GPP protocols in LTE** to identify issues which need to be addressed in support of 5G systems development and standardisation, and technology which would help to resolve those issues
- ISG ZSM - Zero touch network and Service Management
  - Specification of modular, flexible, scalable and extensible service-based management architecture framework and solutions to enable full end-to-end orchestration and automation of 5G network and services
- ISG MEC – Multi-Access Edge Computing
  - In detail, following slides..

Multi-access Edge Computing (MEC)

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

- **Scope of the 5G-related activity:**
  - MEC is a key enabler for a significant number of 5G use cases especially as defined by NGMN and 3GPP SA
  - Moreover, with a scope now expanded to consider multi-access edge computing, MEC is well positioned as a key contributor to fixed-mobile integration
  - Like NFV, MEC also defines architecture and APIs for management of MEC compute infrastructure.
  - Additionally, MEC also defines APIs for several services such as Radio Network Information Service (RNIS) and Location Service

What ETSI MEC has achieved

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

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- …action & 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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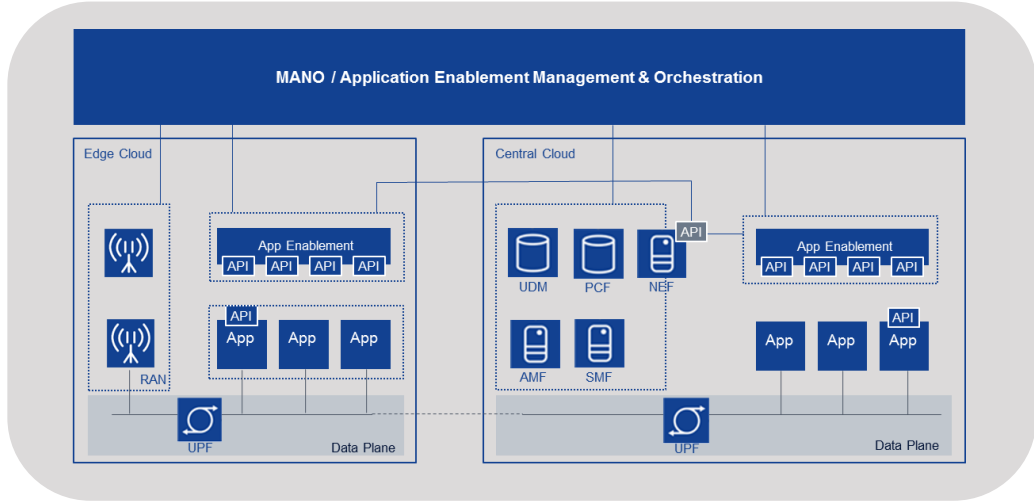

82 members - Operators – Technology Vendors – IT players – Application developers

Hewlett Packard Enterprise, vodafone, NOKIA, HUAWEI, intel, VIAVI, veeaSYSTEMS, ZTE, NEC, INTERDIGITAL, China Telecom, NTT, 中国移动 China Mobile, SONY, MAVENIR, vmware, Saguna, uc3m, docomo, Telefónica, BOSCH Invented for life, orange, PT, ITALTEL, OPENET, AT&T, ROGERS, Türk Telekom, China unicom中国联通, TIM, KEYSIGHT TECHNOLOGIES, SAMSUNG, ATHONET, ETRI, KDDI, Quortus, redhat, iPgallery, CTTC, TNO, JUNIPER NETWORKS, IBM, UNIVERSITY OF SURREY, ECI THE ELASTIC NETWORK, ISMB, POLITECNICO DI TORINO, ITRI Industrial Technology Research Institute, ADVA Optical Networking, netrounds, CERAGON, flex, Accelleran, COBHAM, GSMA, INTRACOM TELECOM, DELL, kpn, SCILD INNOVATIONS, ALTIOSTAR, FUJITSU, EURECOM, vasona networks, cnit, ubiwhere, Tech Mahindra, NETAS, affirmed, CPLANE NETWORKS, NEXTWORKS, DOLBY, ACS, ARTESYN EMBEDDED TECHNOLOGIES, STC, CAICT, telenity, SES, Akamai, ASTRI

[ETSI MEC published related specifications are available here>>]

MEC White Papers

- MEC White Papers
  - **MEC in an Enterprise Setting**
    https://www.etsi.org/images/files/ETSIWhitePapers/etsi_wp30_MEC_Enterprise_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**
    http://www.etsi.org/images/files/ETSIWhitePapers/etsi_wp20_MEC_SoftwareDevelopment_FINAL.pdf
  - **MEC in 5G Networks:**
    http://www.etsi.org/images/files/ETSIWhitePapers/etsi_wp28_mec_in_5G_FINAL.pdf

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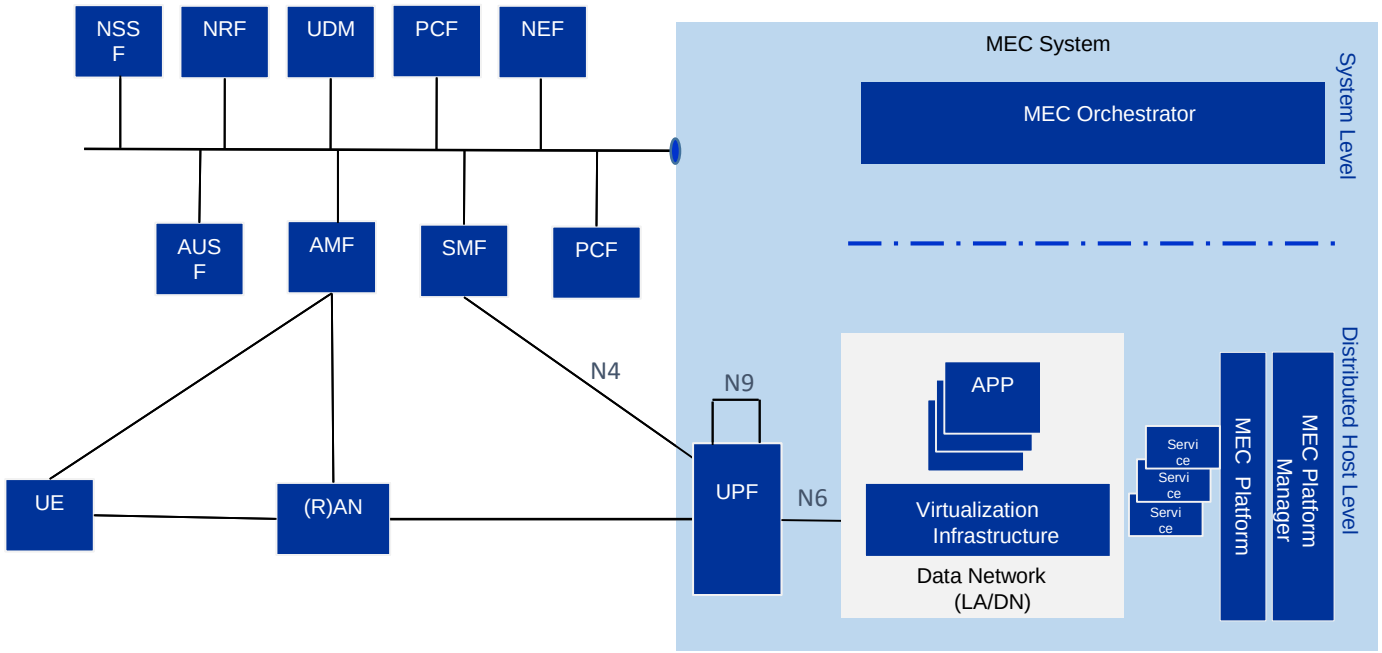
ETSI MEC work (Phase 2)

- **MEC Phase 2 – Study Item MEC in 5G (MEC 031)**
  - **The ETSI MEC white paper on MEC in 5G networks** sets the scene for this new study item - investigate the opportunities offered to MEC by the 5G system and its edge computing enablers

- **The scope includes:**
  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



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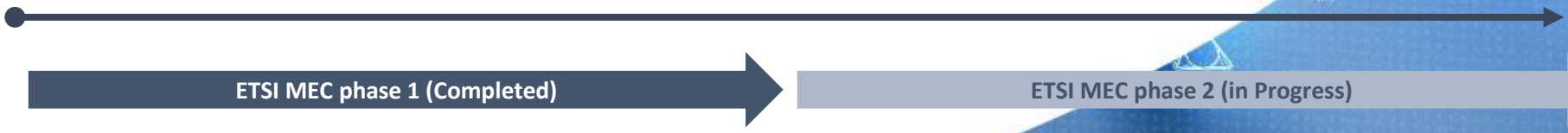
Now in 2nd 3-year Phase of work

- 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 - published)
- 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)



conclusion

- ✓ Whilst there is a wide variety of use cases driving 5G, and a variety of priorities and timescales across various industrial and governmental stakeholders, **standardization is primarily industry-driven, reflecting business opportunities.**
- ✓ ICT Standards need to be global considering the fact of **interoperability, Avoid fragmentation, develop together** or adopt Standards/Specification
  - Several Standards organizations (including ETSI) are developing potential building blocks of an overall 5G system
  - ETSI interacts with many of these, and with TSDSI it has a Cooperation Agreement
  - 5G Standardisation is and will be done at 3GPP
  - Building Blocks/local requirement shall be tabled at 3GPP as it is the place for SDOs to work together and table their requirements

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