Mobile Edge Computing

Boosting user experience by innovating at the mobile network edge

Nurit Sprecher (ETSI ISG MEC Chair) and Mansoor Hanif (EE)

ETSI Webinar, November 1, 2015
Mobile Edge Computing

Presented by Nurit Sprecher (ETSI ISG MEC Chair)
Trends and market drivers

- Growth in mobile traffic driven by smart devices, HD video/audio, enterprise business process extension, vertical industries, IoT, wireless sensors, etc.
- Demand of end users for personalised services, better performance and user experience
- Demand of businesses for enhanced and secured interaction with consumers
- Enablement of connectivity between sensors, machines and other devices
- Convergence of IT and Telco networks
Mobile Edge Computing
An environment for Innovation and value creation

This environment is characterized by:
- Proximity
- Ultra-low latency
- High bandwidth
- Real-time access to radio network information
- Location awareness

Can be leveraged by applications to create value

Offers application and content providers cloud-computing capabilities and an IT service environment at the edge of the mobile network.
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
Mobile Edge Computing
Business Benefits

A new value chain and an energized ecosystem, based on Innovation and business value

Flexibility and agility

New Market Segments

Mobile operators, application developers, content providers, OTT players, network equipment vendors, IT and middleware providers can benefit from greater cooperation

Operators can open their Radio Access Network (RAN) edge to authorized third-parties, allowing them to flexibly and rapidly deploy innovative applications and services

New innovative applications and services towards mobile subscribers, enterprises and vertical segments

Translates local context, agility, rapid response time and speed into value
Mobile Edge Computing
Service Scenario Categories

- Consumer-oriented Services
- Internet of Thing (IoT) Services
- Operator Services
- Third-party Services
- Network-performance Services

© ETSI 2012. All rights reserved
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.
The MEC application analyses the output from a device’s camera and the precise location; objects viewed on 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
IoT Service Scenarios
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
Third-party Service Scenarios
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.
Mobile Edge Computing (MEC) Technology
A key technology for enabling the transformation to 5G

<table>
<thead>
<tr>
<th>Broadband access everywhere</th>
<th>Broadband access in dense areas</th>
<th>Higher user mobility</th>
<th>Massive Internet of Things</th>
</tr>
</thead>
<tbody>
<tr>
<td>50+ MBPS EVERYWHERE</td>
<td>PERVERSIVE VIDEO</td>
<td>HIGH SPEED TRAIN</td>
<td>SENSOR NETWORKS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Extreme real-time communications</th>
<th>Lifeline communications</th>
<th>Ultra-reliable communications</th>
<th>Broadcast-like services</th>
</tr>
</thead>
<tbody>
<tr>
<td>TACTILE INTERNET</td>
<td>NATURAL DISASTER</td>
<td>E-HEALTH SERVICES</td>
<td>BROADCAST SERVICES</td>
</tr>
</tbody>
</table>

Mobile Edge Computing
Help satisfying the demanding requirements for the 5G era in terms of expected throughput, latency, scalability and automation.

5G Use Cases Families and Related Examples

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

- **TCO and QoE**
  - Ensures highly efficient network operation and service delivery, and **ultimate** personal experience.

- **Business segments**
  - Enables a myriad of **new** use cases across multiple sectors
  - Enables a **new** value-chain, **fresh** business opportunities
ETSI ISG MEC
Formed on September 2014; first meeting on December, 2014

Founding members

- Creates an open and standardized IT service environment
- Exposes real-time radio network and context information
- Hosts third-party applications that can serve the vast majority of the population
- Enables a new value-chain, fresh business segments
- Stimulates innovation

Compliance with regulatory and legal requirements
The ISG MEC 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.

The MEC architectural blueprint and the scope of the work of the first release are described in the MEC Introductory Technical White Paper.
ETSI ISG MEC Members/Participants

A multi-stakeholder industry initiative:

A NEW VALUE CHAIN:  MOBILE OPERATORS  BASE STATION VENDORS  TECHNOLOGY PROVIDERS  APPLICATION AND CONTENT PROVIDERS
The ISG MEC is responsible for producing the technical specifications.

An industry-enabling Working Group (IEG WG) is tasked with advancing Mobile-edge Computing in the industry and accelerating the adoption of the concept and the specifications.

The dissemination of the ISG MEC deliverables will foster the development of favorable market conditions which can create sustainable business for all players in the value chain, and facilitate global market growth.
Note: The Technical requirements draft GS is available via the MEC Open Area. Feedback and comments are welcomed.
ETSI ISG MEC has called for PoCs to demonstrate the viability of MEC implementations.

MEC PoCs are multi-party projects including at least one service provider, one infrastructure provider and one application/content provider.

MEC PoCs address at least one of the PoC Topics listed on the ETSI MEC WIKI page: [http://mecwiki.etsi.org/](http://mecwiki.etsi.org/)

The results and lessons learnt by the MEC PoCs are fed back to the ISG MEC specification activities.
Mobile Edge Computing can complement SDN and NFV and advance the transformation of the mobile-broadband network into a programmable world, ensuring

1) highly efficient network operation and service delivery,
2) ultimate personal experience, and
3) new business opportunities.

Mobile Edge Computing will evolve into one of the key technologies for enabling the transformation to 5G architecture, helping to satisfy the demanding requirements for the 5G era in terms of expected throughput, latency, scalability and automation.

The different players in the value chain are welcome to join the ISG effort, contribute to the development of the specifications and demonstrate MEC Proofs of Concepts (PoCs).
A View from the Edge

Mansoor Hanif
Director of Radio Access Networks, EE
Not if but when: Industry collaboration to grow the MEC ecosystem

- An Introduction to EE
- Innovating from the Edge
- EE activity on MEC
- From OTT to TTM
- The challenge of interoperability
- Ensuring an effective interface for technical & commercial teams to drive adoption of MEC
A brief history of EE
From Bristol and Borehamwood to the whole of Britain

- An Introduction to EE
- Innovating from the Edge
- EE activity on MEC
- From OTT to TTM
- The challenge of interoperability
- Ensuring an effective interface for technical & commercial teams to drive adoption of MEC
Innovating from the Edges

Urban Edge: 100% Indoor & New Revenue streams

Mobile Edge Computing + Open-Source Networks +IOT

Rural Edge: 100% Cost-efficient Coverage

Satellite Backhaul, In-Band Backhaul, Meshed small-cells, Low-cost Macros,

Carpet a locality 4G or 5G

Open access indoor (MultiHost solutions)

Indoor Hot spot

800 MHz VoLTE Network edge
EE: Signalling the future

Pushing the UK from 54th to 4th for 4G subs

Pioneer of 300Mbps CA (>1000 sites live)

>92% 4G population coverage

>£1.5 billion investment in next 3 years

Joint founders of 5G innovation center in Surrey

95% 4G coverage by the end of the year

Voice Dropped call
Continuous Improvement

More connected products

Voice for everyone
Rural coverage solutions (MESH, 800MHz, Volte)
Air Masts

Wi-Fi Calling

Customer-centric Operations

Double-speed 4G and 4G+ (300Mbps in London) and other cities
Demo of 410 Mbps 3CC in Wembley
1st 4CC sites ready for trial
EE First Steps on MEC

- Early 2014: Initial discussions with Nokia (Liquid Apps) and Intel
- End 2014: Launch of Intel/Nokia MEC Innovation and test centre in Bath UK
- Early 2015: EE joins and becomes active member of ETSI MEC ISG (Matt Stagg)
- Early 2015: Agreement with key partners on open collaboration and sharing of use cases
- Q2 2015: Agreement on Multiple use cases going into trial phase on EE network this year
- Strong support from the FA to showcase MEC use cases in Wembley (BTY to Rob Ray)
- Q3 2015: B2B workshop and definition of B2B Top 5 Use cases
- Q4 2015: trial use cases go live
- Q4 2015 – Q1 2016 B2B trial cases go live
Real time feedback of radio conditions
Content providers implement optimisation & congestion control mechanisms
Improves quality and reduces unnecessary traffic on network
Non intrusive and works for encrypted traffic
Trial (Q4) including rail routes
Global 1st with Akamai, 1st outside US (AT&T) with Google

**Edge Video Orchestration**

- Camera signals broken out at cell site (MEC)
- Video production done at event
- Post production played out from cell site (MEC)
- Low latency for live events
- Traffic does not impact backhaul
- Trial at Wembley Stadium
MEC – Wembley Trials

Tour App
Augmented reality

1. Tour Customer launches app
2. App welcomes Tour Customer to Wembley and shows customer location on digital map
3. App highlights were AR opportunities on the tour and are located using a dynamic map
4. App vibrates device when Tour Customer is located at an AR point or when a Tour Customer points device at an AR marked location or picture
5. Tour Customer clicks to play content
6. Content rapidly streams to device

Incident Alert

1. App is running on device
2. Wembley Steward either presses camera button (Android/Windows) or swipes screen (Apple) to initiate Incident Alert
3. App vibrates 3 times to indicate alert communicated

Incident Capture

1. Incident alert received by MEC Service Monitor
2. MEC Service Monitor requests Video Engine to capture feed
3. MEC Service Monitor requests Video Engine to make feed available to Event Control Operator

Incident Review

1. Incident has been resolved or managed
2. Event Control Operator marks the incident as closed
3. MEC Service Monitor instructs Video Engine to stop recording
4. Incident meta data and video is stored for later review

Multiple video streams

1. Video feed from each camera delivered to Video Engine service via dedicated IP network or separate VLAN
2. Video Engine packages video and presents as a subscription service and web page to securely logged in Club Wembley Guest
3. Club Wembley Guest logs into video portal and selects one of multiple video streams
4. CIWVA - Video App provides authenticated request to Video Engine for selected video feed
OTT: Big/Smart OTT players understand a Network TTM Strategy: Entice them “Through the Middle” where the value is

Standards: To engage OTTs we must innovate at their rhythm: pragmatic approach driven by pioneering operators required early – calculated risk!

Architecture: MEC as a subset of Core/NFV with specifics – common high-level approach across Core/AGG/RAN as well as Fixed/Mobile.

Flexibility: Modularity of MEC should allow faster innovation cycle (more failures!) than on the Core. Network functions and/or apps can be flexibly moved around Core/AGG/RAN

Internal obstacles: focus on early trials of use cases which provide clear value - Early engagement with Customers is key (ref FA and B2B key accounts)

External obstacles: orchestration and security aspects need tackling

Threats - partners need to adapt - new players are emerging
ETSII ISG MEC
Call for active participation
Call for active participation

The ETSI ISG allows ISG Members (ETSI Members) and ISG Participants (ETSI non-members) to participate and contribute to this innovative foundation of MEC.

The ISG MEC Members/Participants Agreements can be found at the ISG MEC portal (http://portal.etsi.org/mec).

The different players in the value chain are invited to actively participate and contribute to the development of the Mobile Edge Computing specifications.

The Industry players are also invited to take part in the PoC activities.
Contact Details:

Nurit Sprecher, ETSI ISG MEC Chair

Nurit.sprecher@nokia.com

Mansoor Hanif, Director of Radio Access Networks, EE

mansoor.hanif@ee.co.uk

ETSI MEC Support:

Emmanuelle.Chaulot-Talmon@etsi.org

Thank you!
BACKUP SLIDES
The multi-technology (LTE/3G) cell aggregation site can be located **indoor** or **outdoor**, for example:

- within an enterprise (e.g. hospital, large corporate HQ);
- for a special public scenario (e.g. stadium, shopping mall) to control a number of local, multi-technology (3G/LTE) access points, providing radio coverage to the premises.
### Relationship to NFV

Complementary concepts which can exist independently

| Focused on porting network functions to virtual environments |
| Enables the 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 myriad of new use cases across multiple sectors |

**MEC**

- MEC MEC will reuse the NFV virtualisation infrastructure and the NFV infrastructure management to the largest extent possible.
- The scope of MEC is focused and its business objective differs from that of NFV.