Technical Forum

How Mobile Edge Computing Is Helping Operators Face the Challenges of Today's Evolving Mobile Networks



SETO-1000

intel IoT Solutions Alliance Premier

ADLINK TECHNOLOGY INC. www.adlinktech.com

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Introduction

Mobile data usage is on the rise—subscribers all over the world churn through gigabytes of streaming video, music and social network-related data every month. Mobile network owners are scrambling to stay ahead of data demand by densifying their radio access networks with small cells. Wired network owners increasingly offer higher speeds to homes and businesses because mobile devices—smartphones, tablets and laptops—are all behind this surge in demand. To compensate for the non-stop increase of mobile data traffic, mobile operators are doing several things:

- Re-farming spectrum as fast as they can from 2G to 3G and then to 4G.
- Implementing carrier aggregation, made possible in the 3GPP standards.
- Employing network densification, or more network equipment in more places—and that means more environmental, size and power considerations across the network.

Year-in, year-out, mobile operators need to be able to deliver higher throughput and lower latency in more places at far lower cost per GB. The ongoing shift to LTE helps improve cost efficiencies, but that is always balanced against the need to continually invest in the network.

With 5G, the mobile network will need to be able to deliver bigger payloads to mobile devices cost effectively. At the same time, there is also a need for reduced latency to further improve the customer experience along with all of the 5G-centric use cases mentioned earlier. Densification is one way to help provide these gains, but mobile operators can also move content closer to the edge of the cellular network. Today, content or application servers are not collocated with any equipment in the mobile operator's network. But, meeting the requirements for higher throughput with lower latency and improved cost efficiencies becomes possible if carriers move toward an emerging concept called Mobile Edge Computing (MEC).

Benefits of Mobile Edge Computing

Mobile Edge Computing (MEC) is a new option for network owners. According to the European Telecommunications Standards Institute (ETSI), the current standard bearer for MEC deployments, MEC offers application developers and content providers cloud-computing capabilities and an IT service environment at the edge of the mobile network. This environment is characterized by ultra-low latency and high bandwidth, as well as real-time access to radio network information that can be leveraged by applications.

MEC's key value proposition is that it allows an operator to provide new services by opening up their Radio Access Network (RAN) edge. It does this by placing smart nodes at the edge of a mobile network, for example, right where small cells would likely be placed. These nodes would run virtualized software on general-purpose server hardware all housed within a secure form factor. These edge nodes can emulate parts of the core network, serve as reliable caching units and/or run virtualized applications from any number of an operator's developer partners.

For the mobile operator, MEC benefits could include:

- Monetizing that highlights network reach and power as it relates to content providers and their need for a digital distribution channel. The MNOs could increase their revenue by charging based on resource use (storage, NW bandwidth, CPU, etc.) of each content provider, if such resource usage could be obtained via specific APIs in a MEC server.

- Better customer service—lower latency, higher throughput and services that are more diverse, localized and personalized. Application-aware cell performance optimization for each device in real time can improve network efficiency and customer experience. Physically closer servers and tight RAN integration can help reduce video stalling and increase browsing throughput.

- Caching video content at the edge of the network to reduce transport costs and improve customer experience.

- Supporting IoT/M2M applications and services, which tend to transmit small amounts of data but may also include higher-bandwidth applications such as video surveillance.

- Shrinking the volume of signaling offloaded to the core network, which could reduce OPEX for the MNOs, as compared to hosting all enhanced services in the mobile core. A distributed caching technology can save backhaul and transport costs and improve QoE. Content caching has the potential to reduce backhaul capacity requirements by up to 35 percent. Local Domain Name System (DNS) caching can slash web page download time by 20 percent.

- Opening the edge to more application designers for over-the-top (OTT) services and/or DVR services offered by a cable operator. In the case of an OTT provider, with MEC servers, their service would likely feel faster since requests for new programs and/or "fast forward or rewind" functions would not have as far to travel. A cable operator might be able to move the DVR from the set-top box to the edge of its network, which would potentially allow the operator to offer more storage to its customers.

Requirements for Successful MEC Deployments

MEC's core value proposition is that it allows an operator to provide new services by opening up their RAN edge. In turn, this means new revenue streams that are fundamentally different from the "speeds and feeds" services that are the current market focus. MEC can make the idea of offering more data for less dollars per month about as relevant as "free long distance calling" is now.

MEC offers cloud-computing capabilities and an IT service environment at the edge of the mobile network. And it offers an ultra-low latency, high bandwidth and real-time access to radio network information. However, all of these capabilities have to be built into the hardware of the base station itself (or into a "box" that is collocated with, and connected to, the base station).

The following figure illustrates the base components of a MEC server. All of the green-highlighted components are essentially software components running on hardware.

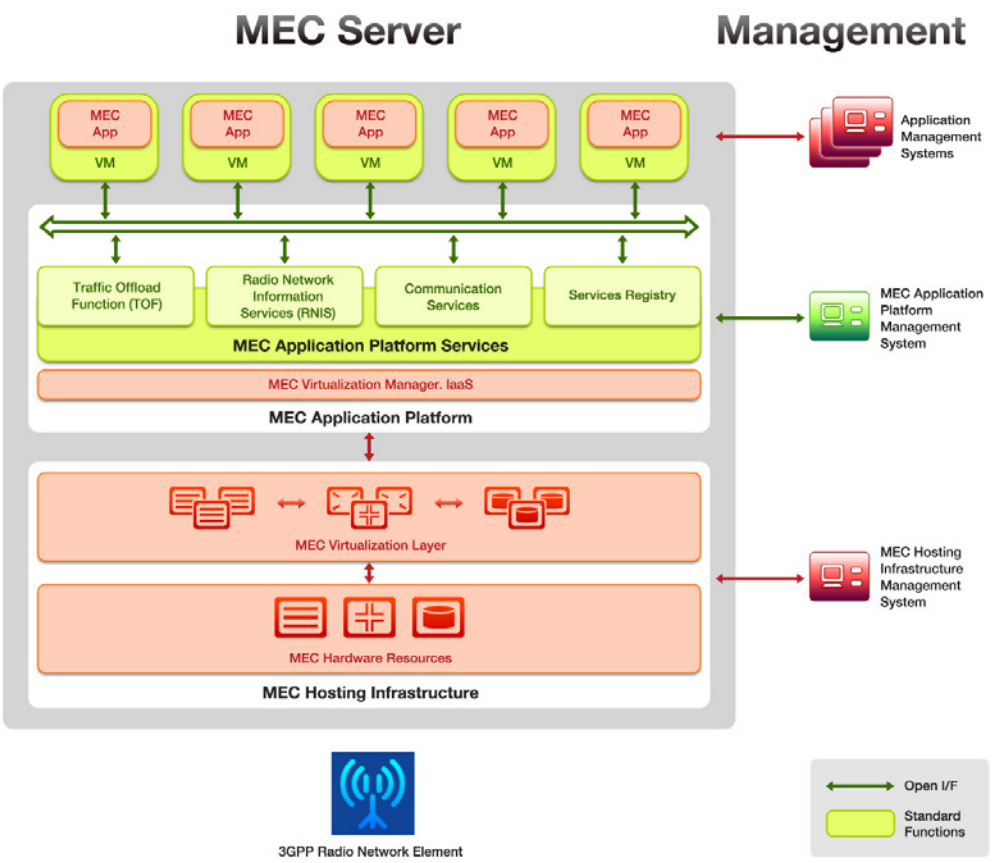


Figure 1: MEC Server Building Blocks Source: Mobile-Edge Computing – Introductory Technical White Paper, Sept. 2014

Fundamentally, the MEC hardware must be cost effective, particularly if it will be deployed at multiple points in the carrier's edge. One way to push costs lower is to use off-the-shelf hardware and leverage network functions virtualization (NFV) and virtualization. For example, the MEC Virtualization Manager layer in Figure 1 provides Infrastructure as a Service (IaaS) facilities, and therefore supports a flexible and efficient multi-tenancy, run-time and hosting environment for the MEC Application Platform services.

Figure 2 shows one view, based on an Intel MEC presentation, of the value chain of the Mobile Edge Computing Cloud—everything from the ETSI Industry Specification Group (SIG) to the silicon provider (Intel) to the OEMs, who either manufacture the equipment themselves or white-label it through a third-party such as ADLINK Technology. The service providers who would deploy the equipment in their networks and then license access to the MEC equipment to either OTT content vendors and/or Independent Software Providers (ISVs) are also shown.

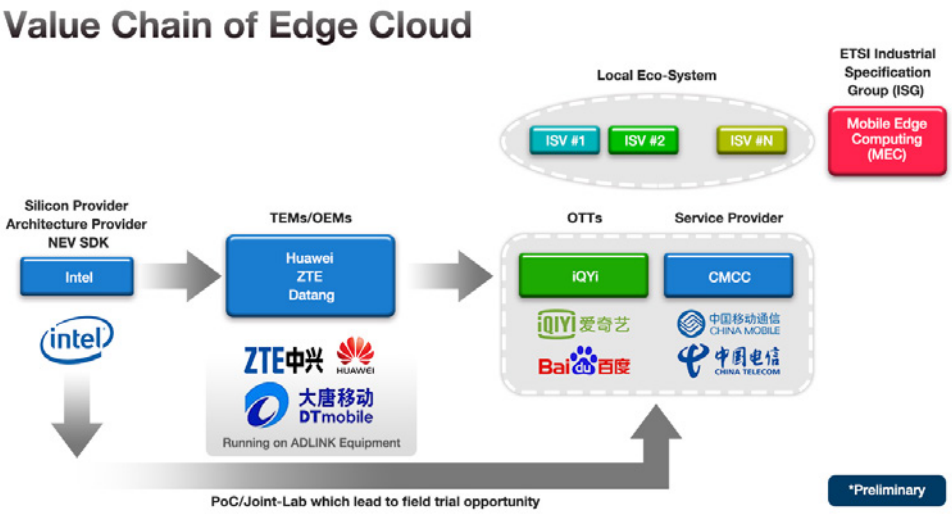


Figure 2: The MEC Cloud Value Chain Source: Intel / ADLINK, 2014; slightly modified by iGR, 2015

Viewed in the above context, it is easy to see how critically important minimizing the cost of the MEC hardware is to a successful MEC deployment. There are multiple moving parts—OEMS, OTTs, ISVs, operators, etc.—that all touch the value chain at one point or another.

And even beyond the above example, cost is also important with respect to environment, safety and/or regulatory requirements—particularly if the MEC hardware will be deployed within a small cell (low-powered radio access nodes that operate in licensed and unlicensed spectrum with a range of 10 meters to 1 or 2 kilometers) enclosure, collocated as an attachment on a small cell site or even just deployed in a macrocell (cell in a mobile phone network that provides radio coverage) enclosure at the base of a tower. Operating costs, failure rates, replacement/upgrade requirements, backhaul, power use and the like all factor into the initial deployment costs, as well as the total cost of ownership. The cost of rolling a truck to all of those different locations would also vary. Physically touching 100 small cells would be more costly than visiting a single macrocell site.

An Open Standard for Mobile Edge Computing

MEC is led by a previously mentioned SIG within ETSI, which has been set up by Huawei, IBM, Intel, Nokia Networks, NTT DOCOMO and Vodafone. Since late 2014 when the MEC SIG was announced, more than 28 companies, including ADLINK, have joined the effort to create an open standard for Mobile Edge Computing. The MEC SIG is already generating considerable interest in the market and participation in the effort continues to grow.

ETSI plays an active, integral role in the development and implementation of many extant telecommunication standards, including GSM, UMTS and LTE, independently and with partners in other regions. Not only have these specifications been successfully adopted worldwide, they also form the basis of today's evolving cellular communications infrastructure. In addition, ETSI is currently working on the development of standards relating to cloud and Internet technologies as well as end-to-end network architecture.

The MEC Industry Specification Group (ISG) aims to unite the telco and IT-cloud worlds, providing IT and cloud- computing capabilities within the RAN. The ISG MEC will specify the elements that are required to enable applications to be hosted in a multi-vendor Mobile Edge Computing environment.

ETSI also has an active ISG working on NFV, which is tasked with leveraging the IT virtualization technology to consolidate multiple types of network equipment into standards-based, high-volume servers, switches and storage which could be located in data centers, network nodes and at the end user's premises. Using NFV, entire classes of network functions can be virtualized into building blocks that may be connected or chained together to create communication services.

The scope of work on MEC will be highly focused and complement the work on NFV. MEC will enable applications and services to be hosted on top of the mobile network elements, e.g. above the network layer. These applications and services can benefit from being in close proximity to the customer and from receiving local radio-network contextual information.

The ISG MEC will produce interoperable and deployable Group Specifications. The ISG MEC will deliver results in different releases, whereby the scope of the first release will be tightly controlled to ensure delivery within 18-24 months (with the start date being in late last year).



Figure 3: ADLINK's Extreme Outdoor Server SETO-1000

Used as an edge node, the MEC devices, such as ADLINK's Extreme Outdoor Server (SETO-1000), can emulate parts of the core network, serve as a reliable caching units and/or run virtualized applications from any number of an operator's developer partners to help monetize network services and improve the end customer experience. ADLINK's SETO-1000 is the first high-performance MEC platform specifically designed for extreme environments and outdoor telecom/networking applications. Based on the Intel® Dual Xeon® E5-2400 v2 family processors, the Extreme Outdoor Server enables Telecom Equipment Manufacturers (TEMs) and Application Providers to deliver data center performance at the edge of the network.

More information, go to
http://www.adlinktech.com/mobile_edge_computing

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Headquarters

ADLINK Technology, Inc.

9F., No.166, Jian 1st Rd., Zhonghe Dist.,
New Taipei City 235, Taiwan
新北市中和區建一路166號9樓
Tel: +886-2-8226-5877
Fax: +886-2-8226-5729
Email: service@adlinktech.com

Worldwide Offices

Ampro ADLINK Technology, Inc.

5215 Hellyer Avenue, #110, San Jose, CA 95138, USA
Tel: +1-408-360-0200
Toll Free: +1-800-966-5200 (USA only)
Fax: +1-408-360-0222
Email: info@adlinktech.com

ADLINK Technology Singapore Pte. Ltd.

84 Genting Lane #07-02A, Cityneon Design Centre,
Singapore 349584
Tel: +65-6844-2261
Fax: +65-6844-2263
Email: singapore@adlinktech.com

ADLINK Technology Singapore Pte. Ltd. (Indian Liaison Office)

#50-56, First Floor, Spearhead Towers
Margosa Main Road (between 16th/17th Cross),
Malleswaram, Bangalore - 560 055, India
Tel: +91-80-65605817, +91-80-42246107
Fax: +91-80-23464606
Email: india@adlinktech.com

ADLINK Technology Japan Corporation

〒101-0045 東京都千代田区神田鍛冶町3-7-4
神田374ビル4F
Tel: +81-3-4455-3722
Fax: +81-3-5209-6013
Email: japan@adlinktech.com

ADLINK Technology, Inc. (Korean Liaison Office)

137-881 서울시 서초구 서초대로 326, 802 (서초동, 모인터빌딩)
Tel: +82-2-2057-0565
Fax: +82-2-2057-0563
Email: korea@adlinktech.com

ADLINK Technology (China) Co., Ltd.

上海市浦东新区张江高科技园区芳春路300号 (201203)
Tel: +86-21-5132-8988
Fax: +86-21-5192-3588
Email: market@adlinktech.com

ADLINK Technology Beijing

北京市海淀区上地东路1号盈创动力大厦E座801室(100085)
Tel: +86-10-5885-8666
Fax: +86-10-5885-8626
Email: market@adlinktech.com

ADLINK Technology Shenzhen

深圳市南山区科技园南区高新南七道数字技术园
A1栋2楼C区 (518057)
Tel: +86-755-2643-4858
Fax: +86-755-2664-6353
Email: market@adlinktech.com

LiPPERT ADLINK Technology GmbH

Hans-Thoma-Strasse 11, D-68163, Mannheim, Germany
Tel: +49 621 43214-0
Fax: +49 621 43214-30
Email: emea@adlinktech.com

ADLINK Technology, Inc. (French Liaison Office)

6 allée de Londres, Immeuble Ceylan 91940 Les Ulis, France
Tel: +33 (0) 1 60 12 35 66
Fax: +33 (0) 1 60 12 35 66
Email: france@adlinktech.com

ADLINK Technology, Inc. (Israeli Liaison Office)

27 Maskit St., Corex Building PO Box 12777 Herzliya 4673300, Israeli
Tel: +972-54-632-5251
Fax: +972-77-208-0230
Email: israel@adlinktech.com

ADLINK TECHNOLOGY INC.

www.adlinktech.com

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