International Engineering Journal For Research & Development

Vol.4
Issue 5

E-ISSN NO:-2349-0721

Impact factor : 6.03

# MULTI ACCESS EDGE COMPUTING TECHNOLOGIES FOR HETROGENEOUS INTERNET OF THINGS

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***Abstract-***

**The Internet of Things (IoT) means to interconnect large numbers of heterogeneous devices to present advanced applications that can develop our quality of life. The days when the Internet was the only center of the information society have already gone, and modern network patterns such as IoT, cloud computing, Smartphone networks, social networks, and industrial networks are gaining popularity and creating themselves as indispensable ingredients of the future smart universe. Multi-access edge computing (MEC), known by many by its previous name, mobile edge computing, is a network architecture that gives network operators and service providers cloud computing capabilities as well as an IT service environment at the network frame. Heterogeneous Internet of Things (HetIoT) is an promising research field that has strong prospective to transform both understanding of fundamental computer science principles and future living. HetIoT is being utilized in increasing number of areas, such as smart home, smart city, intelligent transportation, environmental monitoring, security systems, and advanced manufacturing.**

**Keywords— 5G, IoT, MEC**

## I. INTRODUCTION

Internet of Things (IoT) is the network of physical objects embedded with actuators, RFIDs, sensors, software and connectivity to facilitate it to interact with manufacturers, operators and/or other connected devices to reach general goals.

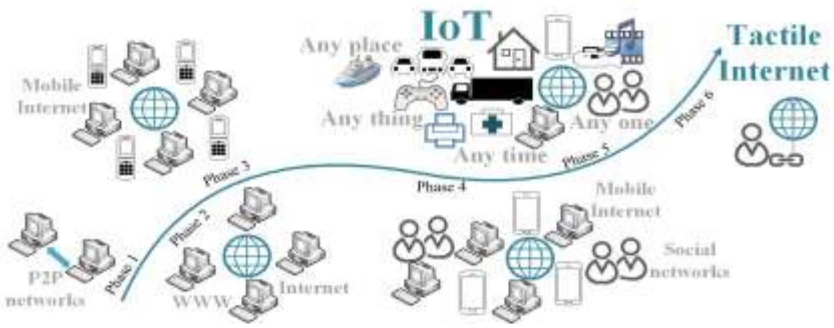


Fig. 1: Evolution of the Internet.

The Internet has evolved from peer-to-peer networking to world-wide-web, and mobile-Internet to the Internet of Things (IoT) shows in fig. 1. The convergence of mobile Internet and wireless systems has not only observed an explosive growth in resource-hungry but also computation-intensive services and applications, which cover a wide range of so-called heterogeneous Internet of Things (H-IoTs) systems including real-time video/audio surveillance, remote e-health systems, intelligent transportation systems, Internet of Vehicles, etc. Mobile edge computing, by placing a variety of cloud resources (e.g., computational and storage resources) closer to smart devices/objects, has been predicted as an enabling as well as highly promising technology to understand and collect the promising advantages of H-IoTs applications. However, the growing commands for ultra-low latency, massive connectivity, and high reliability of the huge number of H-IoTs applications has give up a critical issue in mobile edge computing, i.e., the limited connections (such as connection capacity, bandwidth, or the number of concurrently affordable connections) between mobile edge cloud and smart devices/objects. Multi-access mobile edge computing (MA-MEC), which actively uses a systematic as well as adaptive integration of current radio access technologies including 5G, LTE, and WiFi to improve the access capacity of smart devices to mobile edge platforms, has been considered as a promising technology to tackle this issue. Therefore, with the strength of multi-access for capacity-enhancement, the MA-MEC is expected to bring a variety of benefits, such as:

• Ultra-low latency between smart devices and edge cloud for real-time, interactive, and mission-critical applications, e.g., real-time indoor navigation and augmented virtual-reality.
• Privacy and security in local communications to access mobile edge cloud.
• Big data analytics at the point of capture for IoT applications.

## II. WHY MULTI-ACCESS EDGE COMPUTING?

While primarily showing great promise in mobile technologies, edge computing has since gone on to show how it could also be applied to other access technologies such as Wi-Fi with at least similar, if not greater levels of success.For example, much of the data created by IoT and smart devices have to be collected and responded to in a close to real-time. Data generating processes such as network services, connected manufacturing equipment, automated critical infrastructure, or automated vehicles could all have considerable impacts on network operators and service providers, manufacturing and effective operations and even people's lives if data processing delay their ability to function properly.The logic behind MEC is simple enough. By processing, analyzing and storing the data generated at the very edge of the network, operators and providers can deliver enhanced response times as well as improved services while also laying the groundwork for more advanced concepts such as driverless vehicles and enhanced automation.

## III. INTEGRATION TECHNOLOGIES

The realization of MEC for IoT is increased by several integrating technologies such as SDN, NFV, ICN and Network Slicing. This section provides a high level overview of the role of each technology in MEC-IoT environment and the related works.

### A. Network Function Virtualization

NFV is a network concept which recommends using virtualization technologies to handle core networking functions using software based approach. NFV has been proven as one of the key enablers for not only the development of 5G but also MEC-IoT integration. Specifically, MEC reuses the NFV virtualization infrastructure as well as the NFV infrastructure management to the largest amount possible to both MEC and NFV technologies can be used together in environments such as 5G mobile networks to elevate computing capacity to assemble the increased networking demands. MEC architecture is also based on a virtualized platform quite similar to NFV architecture. Both technologies feature stackable components and each has a virtualization layer.

According to ESTI , it is beneficial to reuse the infrastructure and infrastructure management of NFV to then largest amount possible, by hosting both Virtual Network Functions (VNFs) and MEC applications on the same platform computing experience is enhanced. The use of NFV will equally enhance the scalability of MEC application. NFV can develop the scalability by dynamically scaling up/down the network resources depending on demand.

Several NFV-MEC ingratiation research works have been planned recently. In, NFV-enabled MEC method is proposed to optimize the placement of resources among NFV enabled nodes to support low latency mobile multimedia applications.

### B. Software Defined Networking

SDN is an additional 5G enabling technology which will help to design dynamic, manageable, cost-effective, and adaptable networks. SDN has fuel the improvement of network software by proposing to transfer the control functionality to software based entities, i.e. network controllers. SDN removed the use of vendor exact black-box hardware, thereby promoting the use of commodity servers and switches over proprietary appliances. Notwithstanding, the transfer of network control functionalities to software based centralized entities, requires the data plane devices to communicate frequently with the SDN controllers. Thus, SDN controllers are placed closer to the data plane to reduce the latency in packet processing. MEC offers the opportunity to place control functions closer to data plane devices. Moreover, MEC complements the SDN advancement of the conversion of the mobile-broadband network into a programmable world, ensuring highly resourceful network operation and service delivery. Thus, the popularity of SDN in different domains including 5G, IoT will fuel the adjustment of MEC concept as well. Many recent research works validate the added benefits of the combine use of SDN and MEC in IoT systems.

The role of NFV and SDN in MEC ecosystem is conversed in SDN can be also used to make MEC more flexible as well as cost-effective for 5G applications. The realtime heart attack mobile finding service proposed in, is a novel e-health IoT service that employs SDN-powered

MEC in a Vehicular Ad-hoc Network (VANET) architecture for reliable performance.

**C. Information Centric Networking**

ICN is an Internet architecture that puts information at the center where it needs to be and returns the client-server model by proposing a new publish-subscribe model. The key benefits of ICN consist of fast and efficient data delivery and improved reliability. Thus, ICN is considered one of the promising networking models for IoT ecosystem. MEC and ICN both are complementary concepts which can be deployed independently. However, both could add value to 5G and IoT fields in a complementary fashion. Certain synergies can be exploited when these two technologies are deployed cooperatively. For example, ICN can be used for content allocation over an unreliable radio links and transparent mobility among multiple technologies , while MEC can be used to reduce the latency for delay significant applications such as tangible Internet and AR/VR applications, or to perform distributed data-reduction and security functions for an IoT network. In addition, the use of MEC with ICN can further advance the performance of edge computing. It can solve some of the existing challenges in MEC ecosystem.

ICN can also pick up the edge storage and caching features of MEC enabled networks. ICN permits location independent data replication as well as opportunistic caching at strategic points in the network. These features advantage both real-time and non realtime IoT applications where a set of IoT devices or users share the same content.

Opportunities and challenges of MEC and ICN integration for IoT are presented Here, the authors highlight the synergies that can be exploited when the two technologies are deployed cooperatively for IoT applications.

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**D. Network Slicing**

Network slicing suggests a way of separating the network into different network sections. Thus, it allows multiple logical network sections to be created on top of a common shared physical infrastructure. Future IoT will enable a extensive range of different types of connections and services. These connections as well as services will need performance guarantees and security. Network slicing can satisfy these requirements. Moreover, 5G mobile network will hold both MEC and network slicing technologies.

Network slicing can be used in different IoT domains. One of such application domain is immense IoT. In order to support immense IoT systems, the network should be able to satisfy requirements such as immense cost reduction in communication, network scalability and edge analytics. The integration of MEC with Network slicing can be used to satisfy some of these requirements such as scalability and edge analytics. Another use case is serious communications for delay critical applications such healthcare, autonomous driving and industrial Internet. The key requirements to allow such critical communications are not only reduced latency but also traffic prioritization. While MEC can be used to reduce latency, network slicing can support traffic prioritization. Figure shows the utilization of network slicing in different applications.

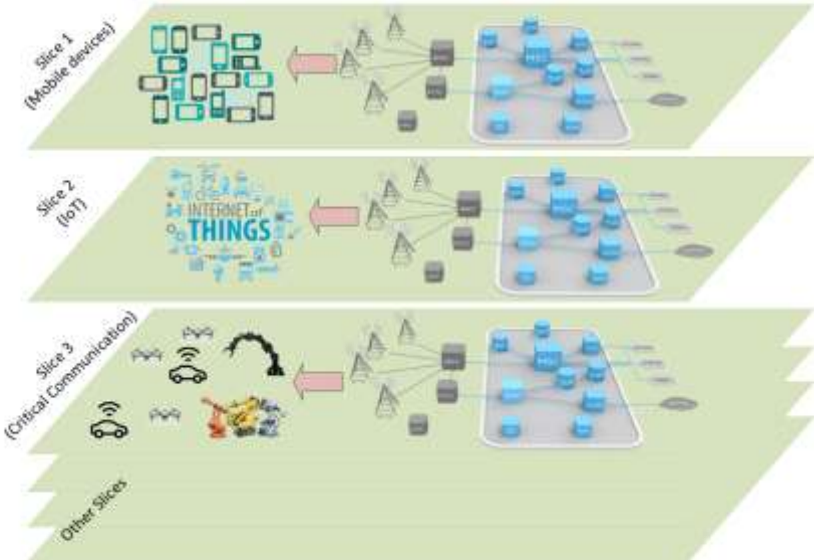


Fig.1 utilization of network slicing

Fig: Use of Network Slicing in different applications more than a few research articles already presented the possibility of using Network slicing with MEC to provide improved services for IoT and other 5G applications.

## IV. CONCLUSION

The improvements of MEC and IoT technologies will be contributing enormously to the realization of the highly anticipated game-changing vision of 5G and future generations of mobile networks. The MEC; which is relatively a recent technology, have identified IoT as one of the important use cases of MEC. MEC server performs as a gateway between the latency critical and massive IoT networks as well as the core network where it can provide edge-cloud computing and networking functionalities. IoT application domains are empowered with MEC technology by enlarging some intelligence to the edge of the network. Although MEC will provide on-site cloud computing services for IoT networks, there are still challenges in terms of device and network heterogeneity, scalability, mobility, and security

## REFERENCES


1. Snehal H. Kuche, Ankur S. Mahalle, Sneha Kalbande, Rupesh Hushangabade, “Multi Access Edge Computing Technologies for Internet of Things”IJECSCSE,2018.
2. Ankur S. Mahalle, Snehal H. Kuche,”Review on Internet of Things Security” International Journal of Innovative and Emerging Research in Engineering Volume 3, Special Issue 1, ICSTSD 2016.
3. Afolabi, T. Taleb, K. Samdanis, A. Ksentini, and H. Flinck, “Network Slicing & Softwarization: A Survey on Principles, Enabling Technologies& Solutions,” IEEE Communications Surveys & Tutorials, 2018.
4. T. Taleb, K. Samdanis, B. Mada, H. Flinck, S. Dutta, and D. Sabella, “On Multi-Access Edge Computing: A Survey of the Emerging 5G Network Edge Architecture & Orchestration,” Communications Surveys & Tutorials, vol. 19, no. 3, pp. 1657–1681, 2017.
5. S. Shahzadi, M. Iqbal, T. Dagiuklas, and Z. U. Qayyum, “Multi-access Edge Computing: Open Issues, Challenges and Future Perspectives,” Journal of Cloud Computing, vol. 6, no. 1, p. 30, 2017.
6. A. Ahmed and E. Ahmed, “A Survey on Mobile Edge Computing,” in 10th IEEE International Conference on Intelligent Systems and Control (ISCO), 2016, pp. 1–8.
7. T. Taleb, S. Dutta, A. Ksentini, M. Iqbal, and H. Flinck, “MobileEdge Computing Potential in Making Cities Smarter,” Communications Magazine, vol. 55, no. 3, pp. 38–43, 2017.