Multi Access Edge Computing Technologies for Internet of Things

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Abstract- **Internet of Things (IoT) has newly advanced from an experimental technology to what will become the backbone of future customer value for both product as well as service sector businesses. This highlights the fundamental role of IoT on the journey towards the fifth generation (5G) of wireless communication systems. IoT data are presently processed in the cloud, mostly through computing resources located in distant data centers. IoT technologies improved with intelligent and big data analytics are expected to quickly change the background of application domains ranging from health care to smart cities and industrial automations. The surfacing of Multi Access Edge Computing (MEC) technology aspires at extending cloud computing potentialities to the edge of the radio access network, therefore providing real-time, high-bandwidth, low-latency access to radio network resources. IoT is recognized as a key use case of MEC, given MEC's ability not only to provide cloud platform but also gateway services at the network edge. MEC will motivate the development of myriads of applications and services with demand for ultra low latency and high Quality of Service (QoS) due to its intense geographical distribution and ample support for mobility. MEC is thus an important enabler of IoT applications and services which involve real-time operations. In this analysis, present a holistic overview on the utilization of MEC technology for the realization of IoT applications and their synergies.**

Keywords: Multi-Access Edge Computing (MEC), Internet of Things (IoT), 5G, edge computing, virtualization, network architecture, latency, reliability.

I. INTRODUCTION

The IoT is differentiated by resource-constrained devices such as sensors, smartphones, wearable devices and machines connected to the Internet. Over the last four decades, the Internet has developed from peer-to-peer networking to worldwide- web, and mobile-Internet to the Internet of Things (IoT) (Fig. 1). IoT appeared as a huge paradigm shift by connecting a flexible and enormous collection of elegant objects to the Internet. With IoT, people and things are able to connect at any time to any place with anything and anyone, ideally using any path or network and any available services [1]. From the user and application points of view, fifth generation (5G) wireless networks will be extremely proficient mobile networks with high bandwidth (e.g., 10 Gbps), very low latency (e.g., 1 ms), and low operational cost which will direct to highly advanced quality of service and quality of experience. One more significant development of the Internet will be the Tactile Internet; which is a highly the IoT lays out a organization for the digitalization of the physical world that can be explained in terms of machine-friendly data. Once sampled or produced, these data can be automatically practiced and interpreted to provide original services in different areas ranging from mobile healthcare, to smart power generation and intelligent transportation systems.

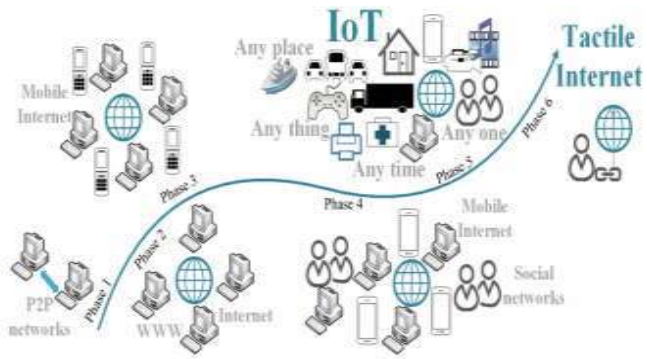

Fig.1 Evolution of the Internet

The next fifth generation (5G) network, which is implemented using Virtualized Multi-access Edge Computing (vMEC), Network Function Virtualization (NFV) and Software Defined Networking (SDN) technologies, is a flexible network that supports different Internet of Things (IoT) devices. Although NFV presents flexibility by permitting network functions to be dynamically arranged and inter-connected. vMEC provides intelligence at the edge of the mobile network reduces latency and increases the presented capacity. With the various development of networking applications, the proposed vMEC use of Container-based Virtualization Technology (CVT) as gateway with IoT devices and also proposed IoT device flow control mechanism in scheduling and analysis methods will effectively increase the application Quality of Service (QoS). Multi-Access Edge Computing (MEC), formerly known as Mobile Edge Computing. Mobile Edge Computing was introduced by the European Telecommunications Standards Institute (ETSI) Industry Specification Group (ISG) as a

signifies of extending intelligence to the edge of the network along with higher processing and storage capabilities. The ETSI industry group renamed it to Multi-Access Edge Computing (MEC), since the benefits of MEC technology accomplished beyond mobile and into Wi-Fi as well as fixed access technologies. Multi-Access Edge Computing (MEC) shifts the computing of traffic and services from a centralized cloud to the edge of the network along with closer to the customer. As a replacement for sending all data to a cloud for processing, the network edge analyzes, processes, and also stores the data shown in Fig.2. Assembling as well as processing data closer to the customer reduces latency and brings real-time presentation to high-bandwidth applications.

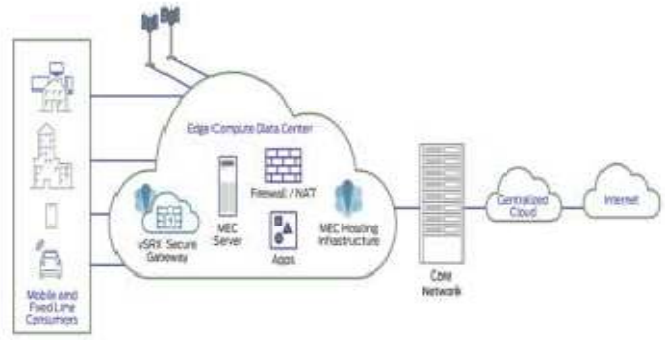

Fig.2 Architecture of Multi-Access Edge Computing (MEC)

Multi-access Edge Computing (MEC) suggests application developers and content providers cloud-computing capabilities and an IT service environment at the edge of the network. This situation is characterized by ultra-low latency and high bandwidth as well as real-time access to radio network information that can be influenced by applications. MEC provides a new ecosystem along with value chain. Operators can open their Radio Access Network (RAN) edge to authorized third-parties, permitting them to flexibly and rapidly deploy innovative applications and services towards mobile subscribers, enterprises and vertical segments.

II. ROLE OF MEC FOR IOT

Multi-Access Edge Computing (MEC), formerly known as Mobile Edge Computing, is one such remarkable modification which brings intelligence to the edge of the network along with higher processing and storage capabilities. According to the latest trends of MEC with other edge computing concepts, 5G networks will play a main role of connecting IoT devices.

With such possible advantages, the role of MEC in IoT realization becomes apparent, more so the role of both MEC and IoT (MEC-IoT) technologies towards the evolution to 5G. The achievement of MEC-IoT still requires tackling many key challenges at the edge nodes, e.g., resource management, network connectivity and scalability, energy efficiency, middleware, security, privacy, trust, service management, societal impact, etc.

Internet of things (IoT) is the vast world of things that are completely linked to internet business. In this fast rapidity world, IoT has developed approach of thinking towards business. MEC plays a key role as an enabler for the things related to IoT for the reason that it is known to be a more valuable or known concept and technology in architecture. That's the reason, it is an important part for the network of future generation. ETSI is a technological trend in MEC that explains MEC in more general. Mostly, ETSI is an IT service supplier that is proceed with cloud computing abilities in the mobile network along RAN (Radio Access Network). On the other hand, the centralized nature of predictable cloud servers may face several challenges such as the single point of failure, lack of location awareness, reachability, and latencies associated with typical Wide Area Networks (WANs). However, many IoT applications require to be provided with decentralized systems which require mobility management, geo-distribution, location awareness, scalability, and ultra-low latency. IoT enlarge MEC services to all types of smart objects ranging from sensors and actuators to smart vehicles. As shown in Figure 2, MEC servers can execute as gateway nodes which can collective and process the small data packets produced by IoT services before they reach the core network.

Fig.3 IoT gateway service

III. IOT AND MEC APPLICATION SCENARIOS

This part focuses on how IoT can control MEC technology in various application scenarios. IoT itself is a classic application of MEC where the key important proposal of MEC is exemplified in a selection of application scenarios (Fig.4). These values become apparent in the utility factor measured by the end user experience while using such IoT related services.

A. Smart home and Smart city

Some smart home applications that are built on the origin of IoT concept are already existing in most consumer markets. These range from the simple thermostat sensors to other more sophisticated automation systems like smart metering, smart heating and lighting, cleaning services, and home entertainment systems. IoT technology has advanced from home to community, and even city scale applications.

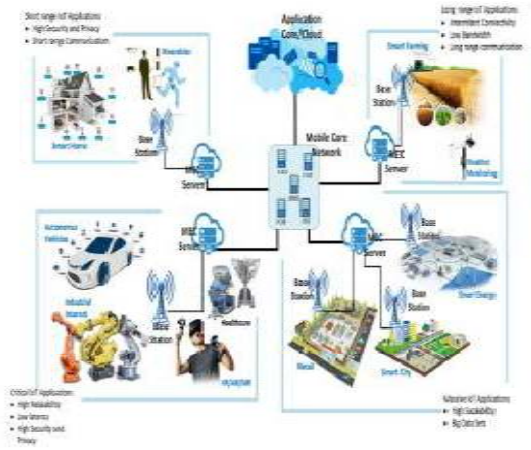

Fig. 4: IoT and MEC application scenarios.

B. Healthcare

Mobile health and telemedicine are identified as significant use cases of 5G. Wearable low power IoT medical sensors for monitoring health related data and tracking records are now accepted in public healthcare facilities.

C. Autonomous Vehicles/IoT Automotive

5G is a key enabler of V2X (Vehicle to Everything) concept which coats Vehicle to Vehicle (V2V), vehicle to infras7 structure, vehicle to device, vehicle to pedestrian, vehicle to home and vehicle to grid.

D. Retail

The second largest MEC use case is supposed to be in the retail businesses. Currently, IoT has dominated retail market applications in many systems including digital signage, supply chain management, intelligent payment solutions, smart vending machines, shelves, doors, resource management, streaming, and safety.

IV. Conclusion

The advancements 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. IoT application domains are allowed with MEC technology by extending some intelligence to the edge of the network. in addressing the MEC integration with IoT, they are mostly focusing on the requirements and usability of MEC in IoT applications.

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