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A Guide to Wireless Technology and to Drive an Industrial Revolution using 5G

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Abstract

The mobile wireless communication started from 1G which has the ability to use a phone inside the car, or away from home. 2G was introduced for short-messaging layer. 3G the core network which made available to launch the first smart phones. And 4G LTE, with its high data-transfer rates, gave access to mobile video with low buffering and gave rise to many of the connected devices and location services that we rely on. But in this paper we discuss about 5G technologies. 5G is called as Fifth generation of cellular technology. 5G is a unified, and it is capable of air interface. It is designed to deliver higher multi-Gbps peak data speed, to reduce latency and improve flexibility of wireless communication.5G also enhances digital experiences through machine-learning (ML)-enabled automation. Advancements in virtualization, cloud-based technologies, and IT business process automation enable 5G architecture to be agile and flexible and to provide anytime, anywhere user access.

Keywords: IMT, D2D, Cache, EPC, RAN

Introduction

Mobile Wireless communication has increased dramatically during the last decades. 5G network have became the challenging network over the 3G/4G.5G comes with a numerous challenge such as high data rate, low cost, latency, flexibility and inter device connection etc.. The technology for 5G network communication has been listed on this paper, which provides the readers a complete idea about the technologies used in 5G.

To meet the challenges in 5G a various method has been discussed such as:

Macro evolution to Macro local coexisting and coordinating paths in order to meet the high data rate traffic for indoor service, to increases the number of cell in order to improve the Signal to Interference noise ratio. Device to device communication is a multi hop connection, can support high frequencies, low interference, and duplex mode communication system. Caching network can reduce user perceived latency and redundant traffic within the network, Mobile Edge Computing which provide an IT service and cloud computing to mobile subscriber. It aims to reduce latency and increase the efficiency operation to the user. Internet of Things used to inter connected number of devices to different smart technologies.

1. Macro local coexisting and coordinating paths

5G technology use macro-local coexisting and coordinating paths in order to replace one macro – dominated paths such as in 4G technologies. In 3G/4G the system is based on the perspectives and requirement of macro cell. The goal of 3G/4G is to achieve consistent coverage and backward compatibility for both indoor and outdoor application. In 5G it is layered and inconsistent. It will be a heterogonous framework and high data rate service is isolated only in indoor and hotspot. In 5G, the backward compatibility is not mandatory for both indoor and outdoor. 5G will

consist of two coexisting and coordinating paths of a macro based and a local-based IMT path whereas 4G has only one macro dominated path. 5G need high data rate service for indoor and hotspot which is supported by local based IMT. To improve the system capacity and signal to interference noise this local based IMT can be used [1]

2. D2D communication

It is considered as the future technology for mobile communication. In 5G, Device to device (D2D) can be integrated as a supplemental part in to the cellular system. D2D consist of two frequencies such as Co-channel and Dedicated frequency. Separate frequency is used so less interference take place within a cellular system. The important feature in D2D system is a duplex mode communication system. [1]

D2D can be used in mobile cloud computing and sharing of resources such as spectrum, computational power, application etc. for user who are spatially close to each other. [3]

3. Cache

In wireless cache is a path to boost spectral efficiency and reduce the energy consumption. Cache is used to store files at every edge cache. All files are locally delivered by edge devices while others are served by the source i.e. macro base station. Caching have the effect of smoothing traffic spikes and balances the backhaul traffic. Cellular network use Evolved packet core network (EPC) and Radio Access network caching (RAN). Both the EPC and RAN caching can reduce user perceived latency and redundant traffic within the network. There are many routers within EPC and RAN where CCN based caching can be used. In 5G network are expected to have CCN based gateway, router and eNBs. To improve the quality of service (Qos) of all users, it is necessary to consider the caching policy. Caching and sharing mobile user via D2D can reduce the traffic load over the cellular network from eNBs to users. [1, 2]

4. Mobile Edge Computing

Mobile Edge Computing (MEC) is new technology which aims to reduce latency, proximity; high bandwidth and service delivery.5G network will leads to more programmable to software networking and use IT virtualization. [4]

5. Software-Defined Networking (SDN)

It is introduced for Next Generation Internet and data network. It allow to change the network configuration at the software hence reduce the further modification at the hardware. It makes it easy to inherit and deploy new techniques and services. It mostly focuses on adaptability and controlling of network.SDN can support multiple functionalities such as programmability, flexibility, centrally managed, granularity, protocol independence, open standard, dynamic control. [2, 5]

6. MIMO

MIMO (Multiple Input Multiple Output) technology used to improve system performance in coverage and capacity. The performance of MIMO depends on the distance between antenna elements. The relation between antenna element in indoor and hotspot scenario is different from macro scenario. [1]

7. Internet of Things (IoT)

Internet of things (IoT) used in wireless communication. It is dynamic in nature. It is used to connect people anywhere, anytime with anyone. 5G support number of static and IoT device. It has

a wide range of speed, bandwidth and quality of service. IoT devices can be connected to networks which can support ultra reliable and low latency. [6]

Industrial Aspect of 5G

5G is needed in industry for wireless Industrial communication to a new level. It can deploy in both public and private industries for real time communication, reliability, higher bandwidth and high device density. 5G in private industry is good at three things such as high number of device, high data rate and high reliability –low latency. For example: In Machine to machine communication every millisecond count in a private industry is to get the low latency. Private industry needs 5G frequency to optimally support application and to keep their data private.5G can be used in wide range such as manufacturing and process industries, transportation, electric power.5G can support industries in many ways like anything that require wireless connectivity example where workers can get information from the VR glasses, Mobile robots working hand in hand and AGV's in intra logistics.[8]

According to Andreas Müller, a researcher at Bosch describes 5G as a standard of superlatives. For real time application such as remote controlled crane or a manufacturing plant where the operation are absolutely reliable, secure and more flexible production using wirelessly with 5G.[9]

Conclusion:

The flexibility of 5G with its different implementation approaches – private and/or public –makes this standard the most versatile mobile communications solution for the industry. Solutions previously not feasible are now within reach, and applications. 5G technologies provide free coverage in remote areas providing high energy efficiency.5G is the future advance in Virtual Reality (VR) and Augmented Reality (AR) etc. Industrial 5G will be the changing making in manufacture products and maintaining factories.5G will be an end-to- end on various industries-healthcare, Agriculture, Education, disaster management and others.

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