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NEW: NEW EVOLUTION IN WIRELESS TECHNOLOGIES

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Abstract

In the past few years numerous technologies has emerged in the field of wireless networks. This paper will discuss advance cutting edge technology such as 5 G wireless networks. The 5G wireless architecture, beam forming and small cells will be explained under the light of several factors before a reasonable conclusion is drawn. The major focus of this paper is provide knowledge of 5G network to the beginners of cellular networks to gain some technical understanding of advanced wireless network. The information is collected from various prominent international and national journals.

1. Introduction

The wireless networks are evolved in the past few decades and tremendous changes are seen in past few years. Initially the objective of mobile networks was to transfer the voice message only, later other demands such transfer of text message and multimedia content to other wireless devices gave a motivation to develop new hardware and technology to support

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better services. Therefore various generations such as 1G, 2G, 3G, 4G and 5G are developed.

1.1. History of Wireless Cellular Technologies

1G: The first generation of mobile network was purely dependent upon analog technology and the subscriber can only use it for the purpose of voice communication. It was firstly introduced in Japan in 1979 and after that in many countries such as USA in 1980. Base Stations known as mobile towers were built in various parts of the country to cover most of the geographical area of nations, so that subscriber can transmit voice signal up to few thousand kilometers. On the contrary, the 1G network was not reliable and had numerous security issues. For illustration, call drop was the major issue and interference of other radio signals caused disturbance in the voice calls and this make vulnerable. The data rate was 2.4 kbps.

2G: The Second generation was introduced in late 1990. This new technology uses digital signal, which improved security as well as the capacity of the base station. Users of second generation can send SMS and MMS messages. The data rate was up to 64kbps.

3G: The usage of third generation of mobile networks is still in use but the most of the users are upgraded to 4G networks. 3G enables the subscribers to experience better services as compared to 2G. This technology was equipped to transfer the data at higher rate up to 2 Mbps. Therefore, subscribers could make video call, share files, use the internet, watch Live TV and play online games with the help of servers on their mobiles.

4G or LTE: The 4G or Long Term Evolution was revolutionary technology in the field of mobile networks and it is 5 times faster than the 3G network. The data rate is up to 100Mbps. This was first time after decades of using phone phones that mobile become such a powerful tool because subscribers never experienced such high speed internet connectivity.

5G: The 5G network is not released in most of the countries where subscribers are using 4G networks. It is only released in South Korea and Japan. Researchers believe that 5G network will be available in 2020. This technology is designed to support data rate of up to 10 Gbps. Many veterans claim that the network will bring a tremendous change in the field of mobile

network connectivity. The better speed and capacity of the mobile network will allow the connectivity of various different network enabled devices such as vehicular networks, smart cities and IoT in the office and home. The 5G mobile network is different from previous generations due to following reasons:

- High peak bit rate.
- Higher bandwidth in per unit area.
- Increased capacity to allow more number of device connectivity.
- Battery consumption is lower.
- Improved connectivity irrespective of the geographic location.
- Larger number of supporting devices.
- Higher reliability of the communications.

2. Motivation

In today era, there is a strong need of adaptive infrastructure to support various on-demand Internet services for numerous consumers' applications and devices. Such adaptive infrastructure should be smart and scalable to tackle various challenges, which includes high bandwidth requirement, lower latency, better connectivity and most importantly providing these features at very less power consumption. In line with the above facts, the following points rationalize why 5G the next evolution Internet is required to support various applications.

- Develop a common observational reference frame to share and provide all services among connected devices at minimal latency.
- To provide efficient solution for dense small cell deployment of traditional technology.

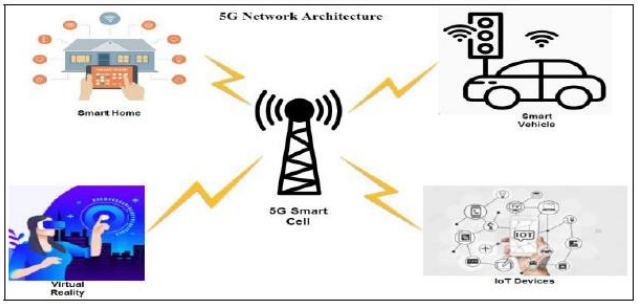

Figure 1. Architecture of Smart City in 5G Scenario.

3. Contribution

The following major contributions of the paper are presented.

- A study on NEW: New Evolution in Wireless technology is presented in this paper.
- Architecture of the next generation technology is also presented.

4. Organization

The rest of this paper is organized as follow. Section 2 presents the related work. Section 3 illustrates the system model. In section 4, SDN based location optimization solution for UAVs networks and the performance evaluation of the proposed scheme is presented in Section 5. Finally, Section 6 provides the conclusion.

2. Related Work

The comparison of related work is presented in this section. This comparison is performed of the various QoS parameters as follows.

Table I. Comparison of existing proposals.

Focus	LO	Sec	FT	EE	CE
5G disruptive technology [1]	Y	N	N	N	N
UAV energy efficient QoS [2]	Y	Y	N	Y	Y
Consumer Applications [3]	Y	Y	Y	N	Y

Antenna Coverage [4]	N	N	Y	Y	N
Data offloading in 5G using SDN [5]	Y	N	N	Y	N
Ultra dense 5G [6]	Y	N	Y	N	Y
Tactile Internet [7]	N	N	N	N	Y
Architecture for 5G [8]	N	N	N	N	Y
Deployment [9]	Y	N	N	N	Y
Opportunistic offloading [10]	Y	N	Y	Y	Y
Hybrid techniques [11]	N	N	N	N	Y
Team association [12]	N	N	N	N	Y

LO: Localization, Sec: Security, FT: Fault-tolerant, EE: Energy Efficient, CE: Capacity enhancement

5. Architecture

The architecture of 5G consist of mainly two parts

A. 5G Radio Access Networks B. 5G Core

A. 5G Radio Access Network (RAN):

MIMO: Massive MIMO is a multi input and multiple output antenna technique used by 5G network to provide the data transmission at high speed as compared to other convention antenna techniques. Multiple transmitters are used to transmit the data and multiple receivers are used to receive the data and finally data is combined to achieve higher throughput which results in higher signal to noise ratio. This technique is extensively used in 5G enabled networks. The antenna which contains 16 transmitters and 16 receivers is considered as Massive MIMO antenna [2].

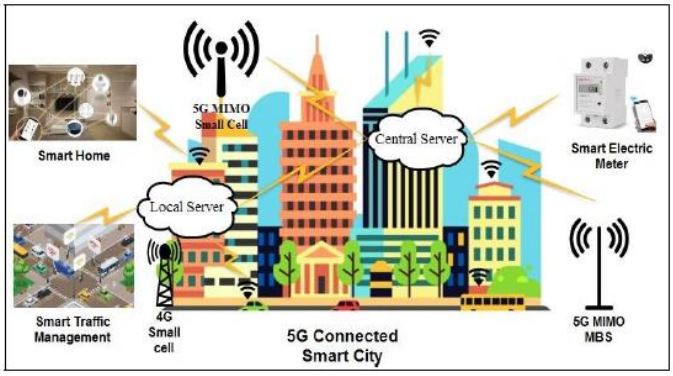

Figure 2. Cloud based Smart City Architecture for 5G.

Frequency Spectrum: Frequency spectrum is the heart of any wireless communication. The 5G network uses high frequency bands which are known as NR spectrum. Spectrum is divided into various frequency ranges. Frequency range 1 is below 6 GHz and frequency range 2 is above 24 GHz-40GHz. NR uses new channel coding option. LDPC (Low density parity Codes) are used for data channels and polar codes are used for control channels [3] [4].

Dual Connectivity The dual connectivity of 5G enabled network provides fast load balancing, improved mobility and higher per user throughput [5].

B. 5G Core

5G is design is designed to support every type of service, it means one network to provide many services to subscribers or the users. Earlier LTE (Long Term Evolution) was designed to provide only two services namely voice service and Mobile Broadband Service but 5G objective is to provide every kind of service to the users. Moreover, to cater all the services network should be flexible but it becomes complex [6].

Network Slicing: Network slicing is the distinct feature of 5G network because it enables the 5G to run many virtual networks on the top of physical infrastructure. Each virtual network contains data traffic according to the specific service such as one virtual network having transmission of medical information or emergency related data. Therefore, services are divided into various virtual networks and hence 5G gives better reliability, flexibility and robustness.

Service Based architecture: 3GPP is standardizing the service based architecture of 5G network. Different types of services are added into network and every service is independent and it does not affect the performance of network it fails to operate. Different companies are collaborating to provide services to the users. Group of services are called as slice in 5G networks. Different companies are providing their services and taking services from other operators to provide better services to the end users. Therefore, it is more flexible than other kind of networks.

NFV (Network Function virtualization): The 3rd Generation Partnership Project covers telecommunication technologies including radio access, core transport networks and service capabilities. 3GPP has been providing the complete system specifications for 5G network architecture. Services are provided through common frame- work to network functions that are permitted to make use of these services. Modularity, reusability and self-containment of network functions are additional design considerations for a 5G network architecture described by the 3GPP specifications. The main components of the 5G architecture are described below [1]

4. Conclusion

5G will play a predominant role in coming years because every smart device will be connected with internet whether it is farming equipment or office gadget and this increased demand of high speed data will be fulfilled by 5G enabled networks. Users can experience the benefit high bandwidth and transmit their data with more security and reliability. The use of high frequencies causes many health issues such as cancer but researchers are continuously working on this issue to minimize risks and other associated problems. In the future, we will explore the interference in the communication channel and security aspects of the technology.

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