Study on 5G Mobile Communication

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\textbf{Abstract:} Impetus for millimeter wave is the upshot of topical advancement in innumerable new technologies in the mobile communication arena. With abrupt upsurge in the mobile data demand, the fifth generation (5G) mobile network would impressively escalate communication capability by expending the bulky expanse of spectrum in the millimeter wave (mm Wave) bands. The mm Wave communication system distinct from prevailing other communication systems, in terms of high propagation loss, directivity, and sensitivity to blockage. This distinctive of mm Wave communication announces numerous encounters to completely exploit the potential of mm Wave communication. This work presents the incentive for new mm-wave cellular systems, approach, in terms of extents of gain, path loss, for the design of future mm-wave cellular systems operating at 28 and 38 GHz frequencies. These frequencies can be used when engaging steerable directional antennas at base stations and mobile devices.

\textbf{Keywords:} 28GHz, 38GHz, millimeter-wave, 5G, mobile communication.

1. Introduction

The speedy advancement in mobile data demand and the Smartphone’s users are generating unmatched encounters for wireless service providers to overcome a problem of global bandwidth scarcity. 3G and 4G wireless communication systems are still incapable of solving the incessant complications of bad interconnectivity, poor coverage, poor quality of service and flexibility. Progress of the new technology to solve the endless complications accompanying with presently existing wireless communication systems is necessary. To overcome these problems, the millimeter wave mobile network is presented which exploits the vast amount of spectrum in the millimeter wave (mm-Wave) bands to significantly upsurge communication capacity.

5G is a wireless communication structure where mobile data proportions magnify to the multiGigabit per second assortment, and is conceivable by the use of mm-wave spectrum and steerable antennas that could concurrently upkeep mobile communications. With enormous bandwidth in the millimeter wave (mm-Wave) band from 30 GHz to 300 GHz, millimeter wave (mm-Wave) communications have been presented to be a vital part of the 5G mobile network to deliver multi-gigabit-per-second kind communication services such as high and ultra-high definition video. Most of the present-day research is fixated on the 28 GHz band and the 38 GHz band.

Mm-wave frequency could be used to escalate the present inundated 700 MHz to 2.6 GHz radio spectrum band for wireless communication. It sanctions for larger bandwidth provision which surges data transfer speed.

Mm-wave frequency, because of the much reduced wavelength, the base station to device connection as well as the connection between base station will be able to handle much superior capability than nowadays 4G network in enormously populous regions.

2. Literature Review

Beforehand working to 5th generation or we can say the 5G, we must endure early ones which impressively stipulates the data transfer speeds and the type of services of each class of technologies. We must understand that what is the necessity to contrivance new technology like 5G (mm Wave communication).

In paper “Some thoughts on the transformation of information and communication technologies”, confab is made on 1G, 2G and 3G [2].

A. First Generation

In the 1980s, 1G cellular networks were invented. They were analog systems and working in the frequency band of 150MHz. 1G encompassed of Mobile technologies such as Mobile Telephone Systems (MTS), Enhanced Mobile Telephone Service (IMTS), Advance Mobile Telephone Systems (AMTS) and Push to Talk (PTT) [1].

There are some concerns with 1G that 1G Analog cellular phones are not much secure.

B. Second Generation

2G cellular telecom networks were sprung in 1991. 2G were digital systems and they used digital signals for voice communication. 2G had a speed of up to 64 kbps. It delivered the facility of SMS (Short Message Service) and used
30 - 200 KHz bandwidth[1].

2G encompassed of Mobile technologies such as Global System for Mobile Communication (GSM), General Packet Radio Service (GPRS), Enhanced Data Rates for GSM Evolution (EDGE) and Code Division Multiple Access (CDMA)[2].

Some gains of 2G Network over 1G was that, 2G systems sustained Digital Encryption which outcomes in higher penetration efficacy consequently being more resourceful on network spectrum. Furthermore, 2G presented data services for mobile, the vital one being the SMS text messages.

C. Third Generation

3G or 3rd Generation is also branded as International Mobile 3G Technology comprises following Mobile technologies WLAN, Bluetooth, DMA, Universal Mobile Systems (UMTS), High Speed Downlink Packet Access (HSDPA).

There are some issues with 3G that, it is still much costly as compared to 2G technologies. With 3G, power intake widely increases which results in reduced device battery life because of its high bandwidth communication. In paper “4G vision and technology development in Korea”, the author discoursed about 4th generation [3]. 4G is entitled as International 100 megabits per second (Mbps) for high agility communications and 1 gigabit per second (Gbps) for low mobility communications [5].

D. Fourth Generation

Along with voice and other 3G facilities, the 4G system also offers ultra-broadband network admittance to mobile devices. The USB wireless modem was one of the early devices to access 4G network, which was later subsequently cellular phones with WiMax and LTE technology [2].

4G provisions Mobile technologies such as Long Term Evolution (LTE), Customary based on the GSM/EDGE and UMTS/HSPA, Multiple In Multiple Output (MIMO) smart antenna technology, 3rd Generation Partnership Telecommunications— 2000 (IMT—2000). With Project (3GPP), 802.16e - Worldwide 3G clarity is improved. It uses Packet Switching for sending data and Circuit Switching for Voice calls [1]. Accompanied by voice communication it comprises entrance to television/video, data services and new services like Global Roaming. It has a bandwidth of 15-20MHz and maneuvers at a range of 2100MHz used for video chatting and High-speed internet service.

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Interoperability for Microwave Access (WiMAX), Orthogonal Frequency Digital Multiplexing (OFDM) [3]. There are some complications with 4G that, 3G and 4G components made for one continent is not always compatible with another continent due to carrying frequency bands. Another problem in 4G systems is to benefit higher bit rates larger portion of the cell, specifically to users in an unprotected position amidst numerous base stations.

E. Fifth Generation

At some point around 2020, the wireless network will be fronting cramming as well as need to device new technology yonder 4G to appropriately oblige the enduring demand of customers. For this, 5G is the new generation of radio systems for ultra-robust and extreme broadband, low latency connectivity, to empower the programmable world. In paper “Millimeter Wave Mobile Communications for 5G Cellular: It Will Work” author conferred about 5G and its necessity [4]. 5G is also stated to as millimeter wave (mm-wave) mobile communication system, as we are expending the mm- wave spectrum frequencies such as 28 GHz and 38 GHz [7].

In 5G there are several rewards as compared to its predecessors, such as Battery Consumption will be a reduced amount, it will upkeep interactive multimedia, voice, video, Internet, and other broadband amenities [6].

5G system will be adept of providing mobile data rate of over 1Gbps along with a large capacity to transmit 65,000 connections at a time. Over and above that it will deliver enhanced security, improved Software Development Radio (SDR) and advanced system level spectral adeptness [5].

5G technology offers high speed for cell phone users. 5G technology turn out to be more striking and effective due to its cutting-edge billing interfaces. For fast action 5G technology is also providing subscriber supervision tools [8].
3. Conclusion

As declared above, this paper presents the complete idea about the existing mobile communication generations and future generation or 5th generation. 1G had presented the need for a basic mobile voice, the 2G had satisfied coverage and capacity, subsequently 3G, which had a look for data at higher speeds for actually a mobile broadband experience, which was auxiliarily achieved by the 4G. 5G promises to present greater data transfer speeds (reaching up to Multi-Gigabits per sec) and some other high quality facilities. 5G is the only answer to the speedy upsurge in the volume demand of consumers and it will also deliver better coverage, low latency and improved spectral efficiency.

4. References


