A Survey On Wireless Networks

Rekha S
Department of ECE, SJBIVT,
Bangalore, India

Abstract: Mobile data traffic is been increasing every year. To address this challenge, many industries have initiated research and development of fifth generation (5G) wireless network. To support this, a large number of small cells are expected at indoors and outdoors, giving rise to heterogeneous networks (HetNets), it is considered as the key way toward 5G. The small cell networks becoming core parts of the 5G cellular networks. The 5G mobile networks are evolved to support the data traffic with reduced energy consumption and improved quality of service (QoS). Technologies, such as heterogeneous networks (HetNets), massive multiple-input multiple output (MIMO), and millimeter wave (mmWave) techniques, have been identified to bring 5G to accomplishment. The emerging 5G networks introduce numerous challenges and opportunities. The softwarization of networks is expected to shape the design, operation and management of 5G networks. However, network softwarization comes with its own set of challenges, including robustness, scalability and resilience. In the past few decades, wireless communications have been evolved from GSM system (2G) to LTE-A networks (4G) with the major interest focusing on the throughput. 5G communication networks, however, extend to a 3-D performance metric cube based on throughput, number of links and delay simultaneously. 5G networks confront a wider range of future applications. 5G communication system design, will further pave the way towards energy efficient, low latency and high reliable communication networks.

I. INTRODUCTION

5G denotes the next major phase of mobile communication beyond the current 4G standards. The 5th wireless mobile multimedia internet networks can be completed wireless communication without limitation, which bring us perfect real world wireless – World Wide Wireless Web (WWW). 5G is based on 4G technologies, which is to be revolution to 5G. The main factors accounting for the significant growth in mobile data traffic are two-fold: the proliferation of devices and emergence of data-hungry applications.

In networking terminology, Wireless is the term used to describe any computer network where there is no physical wired connection between sender and receiver, but rather the network is connected by radio waves and or microwaves to maintain communications. Wireless networking utilizes specific equipment such as NICs and Routers in place of wires (copper or optical fiber).

5G envisions designing a real wireless world, which is free from obstacles of the earlier generations. This requires an integration of networks. 5G aims to design a Multi BW Data path by integrating the current and future networks for new network architecture of 5G real wireless world. The 5G wireless internet networks are real wireless world which shall be supported by CDMA, OFDM, MCCDMA, UWB and IPv6. 5G technology has extraordinary data capabilities and has ability to tie together unrestricted call volumes and infinite data broadcast within latest mobile operating system.

5G Technologies will have an extraordinary capability to support Software and Consultancy. The 5G technology aims to distribute internet access to nodes across the world with almost seamless speed. The advanced billing interfaces of 5G technology makes it more attractive and effective. The high quality services of 5G technology are based on Policy to avoid error.

II. RELATED WORKS

Ning Zhang research interests include dynamic spectrum access, 5G, physical layer security, and vehicular networks. Vehicular Ad Hoc Networks (VANETs) are created by applying the principles of mobile networks it is the spontaneous creation of a wireless network for exchange of data to the domain of vehicles. They are a key component of the intelligent transportation systems (ITS).
Nan Cheng research interest includes Broadband Communication, vehicular communication networks, cognitive radio networks, and resource allocation in smart grid. It the way in which electricity is produced, delivered, and utilized.

Amila Tharaperiya Gamage research interests include resource management for interworking heterogeneous networks, cooperative communication, and cloud computing.

Kuan Zhang research interest includes Broadband Communications, security and privacy for mobile social networks, cloud computing, and e-healthcare.

Jon W. Mark research include areas of adaptive equalization, image and video coding, spread spectrum communications, computer communication networks, ATM switch design and traffic management. His current research interests are in broadband wireless communications, resource and mobility management, and cross domain interworking.

Xuemin (Sherman) Shen research focuses on resource management in interconnected wireless/wired networks, wireless network security, social networks, smart grid, and vehicular ad hoc and sensor networks.

III. STUDY & ANALYSIS

FIRST GENERATION (1G) NETWORK

First-generation (1G) wireless telephone technology, it is the analog telecommunication standard that was introduced in the year 1980s and continued until being replaced by 2G digital telecommunications. The main difference between two succeeding mobile telephone systems, 1G and 2G, is that the radio signals that 1G networks use are analog, while 2G networks are digital. Although both systems use digital signaling to connect the radio towers to the rest of the telephone systems, the voice itself during a call is encoded to digital signals in 2G whereas 1G is only modulated to higher frequency, typically 150 MHz and up.

Mobile radio telephones were used for military communications in the early 20th century. Mobile radio telephone (or 0G) systems preceded modern cellular mobile telephony technology. Since they were the predecessors of the 1G of cellular telephones, these systems are sometimes retro actively referred to as pre cellular systems. Technologies used in pre cellular systems included the Push to Talk (PTT or manual).

Car based telephones were first introduced in the middle of 1940s. This system used a single large transmitter on top of a tall building. A single channel was used for sending and receiving the signal. To talk, the user pushed a button that enabled transmission and disabled reception. By this, it became known as “push-to-talk” systems. Although these systems are old, taxis and police cars use this technology. To allow users to talk and listen at the same time, IMTS (Improved Mobile Telephone System) was introduced in the 1960s. It used two channels one for sending and one channel for receiving thus there was no need for push-to-talk. IMTS used 23 channels from 150 MHz to 450 MHz.

The key idea of 1G cellular network is that the geographical area is divided into cells typically 10-25km, each served by a base station. Cells are small so that frequency reuse can be exploited in nearby (but not adjacent) cells. This allows many more users to be supported in a given area. For example, as compared to IMTS, Advanced Mobile Phone System (AMPS) can support 5 to 10 times more users in the same 100-mile area by dividing the area into 20 smaller cells that reuse the same frequency ranges. In addition, smaller cells also require less powerful and cheaper, smaller devices to transmit and receive information.

Actually, the first generation wireless mobile communication system is analog cellular telephone system which was used for voice service only during the early 1980s. This AMPS was a frequency modulated analog mobile radio system using Frequency Division Multiple Access (FDMA) with 30kHz channels occupying the 824MHz − 894MHz frequency band and a first commercial cellular system deployed until the early 1990’s.

1G cellular network are primarily based on analog communications. When a phone is turned on, it scans for control signals from base stations. It sends this information to the BS with strongest control signal and the BS passes this information to MTS (Mobile Telephone System) as a packet. The subscriber initiates a call by keying in a phone number and pressing the send key. The MTS verifies the number and authorizes the user. MTS issues a message to the user’s cell phone indicating send and receive traffic channels. MTS sends a ringing signal to the called party. Party answers; MTS establishes the circuit and initiates billing information. Either party hangs up; MTS releases the circuit, frees the channels, and completes billing.

DRAWBACKS WITH 1G

1G system had some limitations such as no support for encryption, poor sound quality and inefficient use of the spectrum due to their analog nature. Analog cellular phones are insecure. Anyone with an all-band radio receiver can listen in to the conversation, Poor Voice Quality, Poor Battery Life, Large Phone Size, No Security, Limited Capacity, Frequent call drops and Poor Handoff Reliability.

SECOND GENERATION (2G) NETWORK

Second Generation (2G) cellular networks, introduced in the late 1980s, are based on digital transmission and its data speed was upto 64kpbs. Digital transmissions offer several benefits over analog. 2G is short for second generation wireless telephone technology. 2G cellular telecom networks were commercially launched on the GSM standard in Finland by in the year 1991. Three primary benefits of 2G networks over their predecessors were that phone conversations were digitally encrypted, 2G systems were significantly more efficient on the spectrum allowing for far greater mobile phone penetration levels; and 2G introduced data services for mobile, starting with SMS text messages.2G phones using global system for mobile communications (GSM) were first used in the early 1990 s in Europe. GSM
provides voice and limited data services and uses digital modulation for improved audio quality. Digital AMPS, CDMA were some of the 2G systems. Integrated Digital Enhanced Network (iDEN) is a mobile telecommunications technology which provides the benefits of trunked radio and cellular telephone. It is called the first mobile social network by analysts. After 2G was launched, the previous mobile telephone systems were retrospectively dubbed 1G. While radio signals in 1G networks are analog but in 2G it is digital. Both systems use digital signaling to connect the radio towers to the rest of the telephone system. 2G technologies can be divided into TDMA-based and CDMA-based standards depending on the type of multiplexing used.

Digital voice data can be compressed and multiplexed much more effectively than analog voice encodings through the use of various codec’s, allowing more calls to be packed into the same amount of radio bandwidth. The digital systems were designed to emit less radio power from the handsets. This meant that cells had to be smaller, so more cells had to be placed in the same amount of space. This was made possible by cell towers and related equipment getting less expensive.

The difference between first and second generation cellular networks is:

- **Digital traffic channels** – 2G systems are digital.
- **Encryption** – all 2G systems provide encryption to prevent eavesdropping.
- **Error detection and correction** – digital traffic allows for the detection and correction, giving clear voice reception.
- **Channel access** – It allows channel to be dynamically shared by a number of users.

**ADVANTAGES**

- The lower power emission helped address health concern.
- Going all digital allowed for the introduction of digital data services, such as SMS and email.
- Greatly reduced fraud
- Enhanced privacy: 2G phones are immensely more private than 1G phone, which have no protection against eavesdropping.

**DISADVANTAGES**

Although the 2G technology is widespread, there exist some disadvantages of 2G technologies. They are as follows

- **WEAKER DIGITAL SIGNAL**
  In less populated areas, the weaker digital signal may not be sufficient to reach a cell tower. This tends to be a problem on 2G systems deployed on higher frequencies, but is mostly not a problem on 2G systems deployed on lower frequencies. National regulations differ among countries which dictate where 2G can be deployed.

- **ANGULAR DECAY CURVE**
  Analog has a smooth decay curve whereas the digital signals have a jagged decay curve. This can be both an advantage and a disadvantage. Under good conditions, digital will sound better. Under slightly worse conditions, analog will experience static, while digital has occasional dropouts. As conditions worsen, though, digital will start to completely fail, by dropping calls or being unintelligible, while analog slowly gets worse, generally holding a call longer and allowing at least a few words to get through.

- **REDUCED RANGE OF SOUND**
  Although digital calls are free from static and background noise, the use of lossy compression by the codecs will reduce the range of sound that they transmit. There will be less quality of tones of someone’s voice conversing on a digital cell phone. Another drawback of 2G system is that they are unable to handle complex data such as Videos.

**2.5G NETWORKS (GPRS)**

2.5G (second and a half generation) is used to describe 2G systems that have implemented a packet switched domain in addition to the circuit-switched domain. It does not provide faster service. Major step in the evolution of GSM to 3G occurred with the debut of General Packet Radio Service (GPRS). CDMA2000 networks evolved through the debut of 2.5G. Its approach ventured on the use of packet data. The packet switched approach routed individual packets of data from the transmitter to receiver, so this allows same circuit to be used for different users. So this enables system to be used more efficiently and according to the data transfer charges are metered. Features of 2.5G network include Phone Calls, E-mail Messages, Web Browsing, Camera Phones, it takes about 6-9 mins to download a 3 mins Mp3 song. Examples of 2.5G network are GPRS and EDGE. GPRS (General Packet Radio Service) is packet switching technologies that facilitate data transfer through cellular networks. It is used for MMS, mobile internet and other data communication. The speed limit is 115 kbps, but in most networks it is around 35 kbps. GPRS supports certain protocols such as Internet Protocol (IP) which is built-in mobile browsers uses IPv4. Point-to-Point Protocol (PPP) it is used for IP tunneling to phone. This allows an IP address to be assigned dynamically to the mobile equipment.

**2.75G NETWORKS (EDGE)**

GPRS networks evolved to Enhanced Data for Global Evolution (EDGE) networks with the debut of 8PSK encoding, while the symbol rate remained the same at 270.833 samples per second, each symbol carried three bits instead of one bit. EDGE stands for Enhanced Data rates for GSM Evolution, Enhanced GPRS (EGPRS), or IMT Single Carrier (IMT-SC) is a backward compatible digital mobile phone technology that allows improved data transmission, as an extension. EDGE is standardized as part of the GSM family and it provides threefold increase in capacity of GSM/GPRS networks. Its speed is about 115–384 kbps. The increase in data speeds to 384Kbps placed EDGE as an early pre-taste of 3G, although it was labeled 2.75G by industry analyst.

EDGE Evolution has:

- Improved spectral efficiency with reduced latencies down to 100ms
- Increased throughput speeds to 1.3Mbps in the downlink and 653Kbps in the uplink
2.75G is a term that is rarely used to refer EDGE data connectivity, implying that it is faster than GPRS, but slower when compared to 3G networks. EDGE is a data system used on top of GSM that provides faster data speeds when compared to GPRS.

THIRD GENERATION (3G) NETWORK

3G or third generation is based on a certain sets of standards that are used for mobile phones and mobile services that satisfy with International Mobile Telecommunications-2000 (IMT-2000) specifications given by the International Telecommunication Union. 3G standards evolved to meet the growing demand in network capacity, rates required for high speed data transfer and multimedia applications. 3G finds application in mobile Internet access, e-commerce, videoconferencing wireless voice telephony, fixed wireless Internet access, mobile TV and video calls. It allows concurrent use of data and speech services. The data are sent through the technology called Packet switching. Voice calls are interpreted through circuit switching. 3G networks use a connectionless (packet-switched) communications mechanism. Data are split into packets to which an address uniquely identifying the destination is appended. This mode of transmission, in which communication is broken into packets, allows the same data path to be shared among many users in the network. By breaking data into smaller packets that travel in parallel on different channels, the data rate can be increased significantly. Data Transmission speed increased from 144kbps-2Mbps. Mobile broadband access of several MBits to computer, smart phones is provided by latest 3.5G, 3.75G versions. 3G networks offer greater security compared to 2G because 3G permit validation measures when communicating with other devices. It is much more flexible because it can support 5 major technologies that operate under FDMA, TDMA and CDMA. CDMA holds for IMT-DS (direct speed), IMT-MC (multi carrier). TDMA accounts for IMT-TC (time code), IMT-SC (single carrier). The example of 3G is UMTS (Universal Mobile Telecommunications System), it is used to describe a 3G system that originated in Europe and is being used elsewhere. In fact, several analysts claim that UMTS-3G. The overall idea is that UMTS users will be able to use 3G technology all over the world under different banners. This roaming ability to use devices on different networks will be made possible by satellite and land based networks. UMTS provides a consistent service environment even when roaming via “Virtual Home Environment” (VHE). A person roaming from his network to other UMTS operators experiences a consistent set of services, independent of the location or access mode.

FEATURES OF 3G

- Providing Faster Communication.
- Send/Receive Large Email Messages.
- High Speed Web / More Security
- Speed: 200 Kb/sec-2Mb/sec.
- Video Conferencing / 3D Gaming.
- TV Streaming/ Mobile TV/ Phone Calls.
- Large Capacities and Broadband Capabilities.
- 11 sec – 1.5 min. time to download a 3 min Mp3 song.

ADVANTAGES

- New radio spectrum to relieve overcrowding in existing systems.
- More bandwidth, security & reliability.
- Inter-portability between services providers.
- High data rates.
- Rich multimedia services.
- Always online devices.

DISADVANTAGES

- Expensive input fees for the 3G licenses service.
- Lack of buy-in by 2G mobile users for the new 3G.
- It is not available in certain regions.

FOURTH GENERATION (4G) NETWORK

4G is a successor to the 3G and 2G families of standards. In the year 2009 ITU-R organization specified the IMT-Advanced(International Mobile Telecommunications Advanced) requirements for 4G standards, setting high speed requirements for 4G at the rate of 100 Mbit/sec for high mobility communication and 1 Gbit/sec for low mobility communication. Technologies of 4G and beyond are called Open Wireless Architecture (OWA); it supports multiple wireless air interfaces in an open architecture platform. A 4G system is expected to provide a secure and comprehensive all-IP based mobile broadband solution to laptop computer wireless modems, smart phones. It facilitates IP telephony, ultra-broadband Internet access, and gaming services.

4G technologies are sometimes referred by the acronym “MAGIC,” which stands for Mobile multimedia, Anytime/any-where, Global mobility support, integrated wireless and Customized personal service. 4G has less buffering better audio quality improved gaming experience streaming services with reduced lag.

3G and 4G components made for one continent is not always compatible with another due to carrying frequency bands. Another issue in 4G systems is to make higher bit rates available in larger portion of the cell. In current research, it is addressed by macro diversity techniques, also known as group cooperative relay, and also by Beam-Division Multiple Access (BDMA). WiMAX (Worldwide Interoperability for Microwave Access) is one of the broadband wireless technologies. It is a wireless communications standard designed to provide 30 to 40 megabit-per-second data rates, with the 2011 update providing up to 1 Gbit/s for fixed stations. WiMax is a standardized wireless version of Ethernet intended primarily as an alternative to wire technologies to provide broadband access to customer. WiMAX can provide at-home or mobile Internet access across the countries. WiMAX refers to the implementations of the IEEE 802.16 family of wireless networks standards ratified by the WiMAX Forum.
WiMAX is an organization formed by leading component, communications, and equipment companies to promote and certify interoperability and compatibility of broadband wireless access equipment. WiMAX would operate similar to WiFi, but at higher speeds over greater distances and for a greater number of users. It has the ability to provide service even in areas that are difficult for wired infrastructure to reach and the ability to overcome the physical limitations of traditional wired infrastructure. It can satisfy a variety of access needs. Potential applications include extending broadband capabilities to bring them closer to subscribers, filling gaps in service, in cable, DSL and T1 services, WiFi, and cellular backhaul, providing last 100 meter access from fiber to the curb and giving service providers another cost-effective option for supporting broadband services. It can support very high bandwidth where large spectrum deployments are desired using existing infrastructure keeping costs down while delivering the bandwidth needed to support a full range of high-value multimedia services. WiMAX is intended to serve as the next step in the evolution of 3G mobile phones, via a potential combination of WiMAX and CDMA standards called 4G.

LTE (Long Term Evolution) marketed as 4G LTE, is a standard for wireless communication of high-speed data for mobile phones and data terminals. It is based on the GSM/EDGE and UMTS/HSPA network technologies, increasing the capacity and speed. LTE does not fulfill the requirements of 4G. However due to marketing pressures and the significant advancements that WiMAX, HSPA+ and LTE bring to the original 3G technologies, ITU later decided that LTE together with the aforementioned technologies can be called 4G technologies. IMT-Advanced compliant versions of LTE and WiMAX are under development and called "LTE Advanced" and "WirelessMAN-Advanced" respectively. ITU has decided that LTE Advanced and WirelessMAN-Advanced should be accorded the official designation of IMT-Advanced. ITU has defined them as "True 4G".

The CDMA spread spectrum radio technology used in 3G systems and also in IS-95 is abandoned and replaced by OFDMA and other frequency domain equalization schemes. This is combined with MIMO (Multiple In Multiple Out) example, channel dependent scheduling, multiple antennas and dynamic channel allocation. The 4G system is an IP-based network system. 4G technology should integrate different current existing and future wireless network technologies to ensure freedom of movement and roaming from one technology to another. These will provide multimedia applications to users by accessing different technologies continuously. 4G networks can integrate several radio access networks with fixed internet networks as the backbone. This kind of integration combines multiple radio access interfaces into a single network to provide seamless roaming or handoff and the best connected services.

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<th>Features of 3G and 4G</th>
<th>3G</th>
<th>4G</th>
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<tbody>
<tr>
<td>Speed</td>
<td>Up to 2Mbps</td>
<td>Full mobility: up to 100Mbps</td>
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<tr>
<td>Services</td>
<td>Difficulty of global roaming</td>
<td>Roaming smoothly</td>
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<td>Core Network</td>
<td>Wide area concept Circuit and packet switching</td>
<td>Broadband, Entirely IP-based packet switching</td>
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<td>Technologies</td>
<td>WCDMA, CDMA2000, TD-SCDMA</td>
<td>All access convergence including: OFDM, MC-CDMA, LAS-CDMA, Network-LMPS</td>
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Table 1: Comparison of 3G and 4G

APPLICATIONS OF 4G
• Ultra high speed internet.
• HD video calling.
• Wi-MAX.

FEATURES OF 4G
• Support interactive multimedia.
• User friendliness.
• High speed, high capacity and low cost per bit.
• Higher bandwidth.
• Terminal Heterogeneity.
• Network Heterogeneity.

ADVANTAGES
• Quickly download files over a wireless network.
• More security.
• Extremely high voice quality.
• Easily access Internet, IM, Social Networks, streaming media, video calling, etc.
• Higher bandwidth.
• WiMAX, LTE, and HSPA+ are all versions of 4G, WiMAX is used by Sprint, LTE is used by Verizon and AT&T, HSPA+ is used by AT&T and TMobile.
• 4G is 10 times faster than 3G.

DISADVANTAGES
• New frequencies means new components in cell towers.
• Higher data prices for consumers.
• Consumer is forced to buy a new device to support the 4G.
• Requires expensive infrastructure for operation. This is embodied in the eNodeB’s (Access Points) and mainly the EPC’s (Gateways or Routers).

FIFTH GENERATION (5G) NETWORK

5G technologies were started from late 2010s. It is a complete wireless communication with almost no limitations. It is highly supportable to WWW (Wireless World Wide Web). The next evolution in wireless networking technology might download movies in the blink of an eye. 5G networks

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will be about 66 times faster than 4G. That speed opens up intriguing new capabilities. Self-driving cars can make time-critical decisions. Cities can monitor traffic congestion, pollution levels and parking demand and then feed that information to smart car in real time. 5G is the coming fifth-generation wireless broadband technology based on the IEEE 802.11ac standard. 5G will provide better speeds and coverage than the current 4G. 5G operates with a 5 GHz signal and is set to offer speeds of up to 1 Gb/s for tens of connections or tens of Mb/s for tens of thousands of connections. 5G also increases network expandability up to hundreds of thousands of connections. The signal technology of 5G has also been improved for greater coverage as well as spectral and signaling efficiency. These improvements stand to further enable changes like pervasive computing and the Internet of Things (IoT).

5G (5th generation mobile networks or 5th generation wireless systems) denotes the proposed next major phase of mobile telecommunications standards beyond the current 4G/IMT-Advanced standards. 5G planning includes Internet connection speeds faster than current 4G, and other improvements. The Next Generation Mobile Networks Alliance feels that 5G should be rolled out by 2020 to meet business and consumer demands. In addition to providing simply faster speeds, they predict that 5G networks also will need to meet new use cases, such as the Internet of Things as well as broadcast-like services.

REQUIREMENTS FOR 5G NETWORKS:

- Data rates of tens of megabits per second for tens of thousands of users
- 1 gigabit per second simultaneously to many workers on the same office floor
- Several hundreds of thousands of simultaneous connections for massive wireless sensor network
- Spectral efficiency significantly enhanced compared to 4G
- Enhanced Signal efficiency
- Latency reduced significantly compared to LTE.

5th generation technology is designed to provide incredible and remarkable data capabilities, unhindered call volumes, and immeasurable data broadcast within the latest mobile operating system. Hence, it is more intelligent technology, which will interconnect the entire world without limits. Likewise, our world would have universal and uninterrupted access to information, communication, and entertainment. To deliver 5G, carriers will need to boost network capacity between phones and the big antennas, called base stations. They are installed every few miles. They can start by tapping into unoccupied spectrum radio-wave territory relatively uncluttered with signals today. Radio waves vibrate with a frequency measured in megahertz or even faster gigahertz. Today’s phones communicate at less than 3GHz; 5G will require higher frequency bands. But radio waves at higher frequencies are harder to transmit over longer distances. To compensate these carriers will rely on advanced antenna technologies. These include massive MIMO antennas, which send many radio signals in parallel, and beam forming, which focuses radio energy in a specific direction.

To develop 5G, the efforts have been made from three aspects: spectrum expansion, spectrum efficiency enhancement, and network densification. Network densification is considered as the paramount and dominant approach to address the data challenge. It can be achieved by deploying a large number of small cells, such as microcell, picocell, femtocell, relay nodes, and Wi-Fi access points, which are low-powered radio access nodes and have smaller coverage areas compared with macrocells. Due to the dense deployment of small cells in a very large scale, the increased level of complexity, coupled with reduced control over applications and data, the network operators are facing great challenges: i) difficult to manage and control; ii) costly to deploy small cells densely; and iii) intercell interference. Those factors affect and limit the development of 5G.

ADVANTAGES

- There are several advantages of 5G technology
  - High resolution and bi-directional large bandwidth shaping.
  - Technology to gather all networks on one platform.
  - More effective and efficient.
  - Technology to facilitate subscriber supervision tools for the quick action.
  - Most likely, will provide a huge broadcasting data (in Gigabit), which will support more than 60,000 connections.
  - Easily manageable with the previous generations.
  - Technological sound to support heterogeneous services (including private network).
  - Possible to provide uniform, uninterrupted, and consistent connectivity across the world.

DISADVANTAGES

- Though, 5G technology is very useful, because of some security reason and lack of technological advancement in most of the geographic regions, it has following shortcomings
  - Technology is still under process and research on its viability is going on.
  - The speed, this technology is claiming seems difficult to achieve (in future, it might be) because of the incompetent technological support in most parts of the world.
  - Many of the old devices would not be competent to 5G; hence, all of them need to be replaced with new one — expensive deal.
  - Developing infrastructure needs high cost.
  - Security and privacy issue yet to be solved.
The development of the 2G (GSM) and 3G (IMT-2000 and UMTS) standards took about 10 years from the official start of the R&D projects, and development of 4G systems started in 2001 or 2002. However, still no transnational 5G development projects have officially been launched, and industry representatives have expressed scepticism towards 5G. New mobile generations are typically assigned new frequency bands and wider spectral bandwidth per frequency channel (1G up to 30 kHz, 2G up to 200 kHz, 3G up to 5 MHz, and 4G up to 40 MHz), but sceptics argue that there is little room for new frequency bands or larger channel bandwidths. From users' point of view, previous mobile generations have implied substantial increase in peak bit rate (i.e. physical layer net bitrates for short-distance communication). However, no source suggests 5G peak download and upload rates of more than the 1 Gbps to be offered by ITU-R’s definition of 4G systems. If 5G appears, and reflects these prognoses, the major difference from a user point of view between 4G and 5G techniques must be something else than increased maximum throughput. For example lower battery consumption, lower outage probability (better coverage), high bit rates in larger portions of the coverage area, cheaper or no traffic fees due to low infrastructure deployment costs, or higher aggregate capacity for many simultaneous users.

IV. CONCLUSION

The 1G, 2G, 3G mobile communication technology and predicted the future generations of 4th, 5th generation. The first generation (1G) wireless mobile communication system is analog system which was used for public voice service with the speed up to 2.4 kbps. It was introduced around the year 1980. The second generation (2G) is based on digital technology and network infrastructure. As compared to the first generation, the second generation can support text messaging. It was introduced around the year 1990. The third generation wireless system (3G) was to provide wireless data service with data rates of 144 kbps to 384 kbps in wide coverage areas, and 2 Mbps in local coverage areas, which can connect with internet. It was introduced around the year 2000.

In order to provide wireless mobile internet to users as the same quality as the fixed internet networks, 4G shall integrate current existing cellular networks and Wireless LAN with fixed internet networks. Thus, the feature of 4G is one word - integration. It can be introduced around the year 2010.

This kind of integration may cause the handoff issue once the mobile users moving from one technology to another, which limit the movement of mobile users. The Mix bandwidth data path is designed to solve this problem and make the 5G in real wireless world. It can be introduced around the year 2020.

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