Review and Analysis Studies of Technological Generation Impact with Mobile

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Abstract— Mobile technology revolutionized the way people communicate. Evolution of mobile technologies is about to reach 5G mobile technologies will focus on the development of the user terminals where the terminals will have access to different mobile technologies at the same time and will combine different flows from different technologies. In India with increasing end user demands for wideservice due to the rapid growth and variety of IT (information technology) industry and Mobile device the service with higher data rate cannot accommodate the future mobile technology. The continuous development in semiconductors and computing technologies has accelerated service providers to consider implementing the various mobile technology services to the customers. This paper provides the growth and analysis of mobile technology.

Key words: 1G To 5G, Impact of Mobile Technologies, Successes, Advantages, Differences

I. INTRODUCTION

The first generation (1G) has satisfied the basic mobile voice, while the second generation (2G) has presented capacity and coverage. This is followed by the third generation (3G), which has journey for data at higher speeds to open the gates for “mobile broadband” experience, which was further understood by the fourth generation (4G). The Fourth generation (4G) provides access to wide range of mobile technology services, including advanced mobile services, supported by mobile, which are increasingly packet based, along with a support for low to high mobility applications and wide range of data rates, in accordance with service demands in multiuser environment. Fifth generation should be more intelligent technology that interconnects the entire world.

The last few years have witnessed a phenomenal growth in the wireless industry, both in terms of mobile technology and its subscribers. The ancient stone-age sounding 1G, or analog cellular, then like 80”s rock came 2G, or digital cellular; 3G wireless, 4G, 5G and so on. In last years, remarkable growth in the wireless industry, both in terms of mobile technology and its subscribers as well as mobile devices.

With all the technological improvements, and the instantaneous existence of the 2G, 2.5G, 3G, 4G and 5G networks, the impact of services on network efficiency have become even more serious. Many more scheming scenarios have established with not only 2G networks but also with the advancement of 2G to 2.5G or even to 3G, 4G and 5G networks.

1G refers to analog cellular technologies; it turn into available in the 1980s. 2G denotes initial digital systems, introducing services such as SMS and lower speed data rate. CDMA2000 1xRTT and GSM are the primary 2G technologies, although CDMA2000 1xRTT is sometimes called a 3G technology because it meets the 144 kbps mobile amount needed.

EDGE, however, also meets the same requirement. 2G technologies became available in the 1990s. 3G requests were specified by the ITU as part of the International Mobile Telephone 2000 IMT 2000 project, for which digital networks had to provide 144 kbps of data at mobile speeds, 384 kbps at pedestrian speeds, and 2 Mbps in indoor environments. UMTS-HSPA and CDMA2000 EV DO are the primary 3G technologies, although recently WiMAX was also designated as an official 3G technology. 3G technologies began to be installed last decade.

In telecommunications, 4G is the fourth generation of mobile phone mobile technology standards. It is a follower of the third generation (3G) standards. A 4G system offers mobile ultra-broadband Internet access, for example laptops with USB wireless modems, to smart phones, and to other mobile devices. Feasible applications include mobile web access, IP telephony, gaming services, high-definition mobile TV, video conferencing, 3D television and Cloud Computing.

Two 4G candidate systems are commercially deployed: the Mobile WiMAX standard, and the first release Long Term Evolution (LTE) standard. The key feature of 4G Infrastructures are accessing Information from anywhere, anytime, receiving large volume of information, data, and pictures and so on.

4G networks and technology hold the unique probable to transform businesses and to impact how people interact, work and meet people. 4G World India focuses on key Technologies both India and Global operator businesses, their strategies for 4G network arrangement and provides the entire ecosystem with the annual platform they need to drive invention and gainful business models. The fifth generation wireless mobile internet networks can be fully wireless communication without problem, which makes perfect wireless world – World Wide Wireless Web (WWW). Fifth generation is built on 4G technologies. The 5th wireless mobile internet networks are real wireless world which shall be supported by LAS CDMA (Large Area Synchronized Code Division Multiple Access), OFDM (Orthogonal frequency-division multiplexing), MCCDMA (Multi-Carrier Code Division Multiple Access), UWB (Ultra-wideband), Network-LMDS (Local Multipoint Distribution Service), and IPv6.

Fifth generation technologies offer incredible data abilities and unlimited callbults and endless data broadcast together within latest mobile operating system. Fifth generation should make a significant difference and add more services and aids to the world over 4G. Fifth generation should be more clever technology that interconnects the entire world without limits.

This generation is predictable to be released around 2020. The world of universal, continuous access to
information, entertainment and communication will open new aspect to our lives and change our life style expressively.

II. EVOLUTION

According to mobile users the technology has become more widespread in last few years due to fast transformation in mobile technology. This upheaval is due to very high rise in telecoms customers. This innovation is from 1G- the first generation, 2G- the second generation, 3G- the third generation, and then the 4G the fourth generation,5G-the fifth generation.

A. First Generation (1G):

1G refers to the first generation of wireless telephone technology, mobile communications which was first introduced in 1980s and completed in early 1990s. It’s speed was upto 2.4kbps. It’s based on analog signal. AMPS was first launched in USA in 1G mobile systems. First-generation mobile systems used analog transmission for speech services. The system was allotted a 40-MHz bandwidth within the 800 to 900MHz frequency range by the Federal Communications Commission (FCC) for AMPS. In fact, the smallest reuse issue that would fulfill the 18db signal-to-interference ratio (SIR) using 120-degree directional antennas was found to be 7. Hence, a 7-cell reuse pattern was accepted for AMPS. Transmissions from the base stations to mobileshappen over the forward channel using frequencies between 869-894MHz. The reverse channel is used for transmissions from mobiles to base station, using frequencies between 824-849 MHz AMPS and TACS use the frequency modulation (FM) technique for radio transmission. Traffic is multiplexed onto an FDMA (frequency division multiple access) system.

1) Issues with 1G:

It has low capacity, unreliable handoff, poor voice links, and no security at all since voice calls were played back in radio towers, making these calls susceptible to unwanted eavesdropping by third parties. Analog cellular phones are not very secure. Anyone with an all-band radio receiver linked to a computer can record the 32-bit serial numbers and phone numbers of subscribers when calling canisten in on any conversation. This excuse was abused in many disgraceful ways. There were also stated thefts of airtime. Anyone could collect alarge database by driving around and go into business by reprogramming stolen phones andreselling them. To overcome some of matters in 1G next generation is developed.

B. Second Generation (2G):

2G technology refers to the 2nd generation which is based on GSM. It was launched in Finland in the year 1991. 2G network uses digital signals for voice transmission. It has speed up to 64kbps. It provides different facilities like short messaging service (SMS), picture messages and Multimedia Messaging System (MMS) and used the bandwidth range of 30 - 200 KHz. It provides better quality and capacity.

2G comprised of the following Mobile technologies: General Packet Radio Service (GPRS), Code Division Multiple Access (CDMA), and Global System for Mobile Communication (GSM) and Enhanced Data Rates for GSM Evolution (EDGE). It operates at a range of 2100MHz and has an bandwidth of 15-20MHz used for High-speed internet service, video chatting.

Some key benefits of 2G Network over its predecessors was that, Digital Encryption was supported by 2G systems which had higherpenetration efficiency thereby being more efficient on network spectrum. Moreover, 2G introduced several data services for mobile, the most prominent one being the famous SMS text messages. After 2G was launched, the previous mobile telephones systems were coined as 1G Systems. Although it has been eons since its inception, 2G networks are still used in many parts of the world.

C. Third Generation (3G):

3G technology refer to third generation which was introduced in year 2000. International Mobile Telecommunications-2000 (IMT- 2000), better known as 3G or 3rd Generation, is a generation of standards for mobile phones and mobile telecommunications services satisfying the International Telecommunication Union (ITU). It uses Wide Brand Wireless Network with which transparency, clarity is increased as compared to previous generations. Data transmission speed increased from 144kbps – 2Mbps. Typically called smart phones and features increased its bandwidth and data transfer rates to accommodate web-based applications and audio and video files.

Providing faster communication between base station and mobile devices. Send/receive large email messages and can attached big files. High speed web access and provides more security. Various services are available such as video conferencing, 3d gaming, TV streaming, mobile TV, and phone calls. Large capacities and broadband capabilities. Its performance is like 11 sec – 1.5 minute time to download a 3 min. mp3 songs. Voice calls are interpreted through Circuit Switching. It operates at a range of 2100MHz and has an bandwidth of 15-20MHz used for High-speed internet service.

Video chatting. It uses Wide Brand Wireless Network with which clarity is increased.

3G Technology comprises of Wideband CDMA, WLAN, Bluetooth, and Universal Mobile Telecommunication Systems (UMTS), High Speed Downlink Packet Access (HSDPA). It also provides facilities such as Global Roaming Clarity in voice calls, Fast Communication, Internet, Mobile TV. video conferencing, video calls etc. Additional features also include HSPA (High Speed Packet Access) data transmission capabilities able to deliver speeds up to 14.4 Mbps on the downlink and 5.8 Mbps on the uplink.
The first commercial 3G network was launched by NTT DoCoMo in Japan branded FOMA, based on W-CDMA technology on October 1, 2001. The second network to go commercially live was by SK Telecom in South Korea on the 1xEV-DO (Evolution-Data Optimized) technology in January 2002. Following another South Korean 3G network was by KTF on EV-DO in May 2002. In Europe, the mass market commercial 3G services were introduced starting in March 2003 by 3 (Part of Hutchison Whampoa) in the UK and Italy. This was based on the W-CDMA technology. The first commercial United States 3G network was by Monet Mobile Networks, on CDMA2000 1x EV-DO technology and the second 3G network operator in the USA was Verizon Wireless in October 2003 also on CDMA2000 1x EVDO.

In many countries, 3G networks do not practice the same radio frequencies as 2G, so mobile operators must build entirely new networks and license completely new frequencies; an exception is the United States where carriers function 3G service in the same frequencies as other services. In January 2009, China launched 3G but interestingly three major companies in China got license to operate the 3G network on different standards, China Mobile for TD-SCDMA, China Unicom for WCDMA and China Telecom for CDMA2000.

D. Fourth Generation (4G):

4G technology refer to or short name of fourth generation which was started from late 2000s. In March 2008, the International Telecommunications Union-Radio communications sector (ITU-R) specified a set of requirements for 4G standards, named the International Mobile Telecommunications Advanced (IMT-Advanced) specification, setting peak speed requirements for 4G service at 100 megabits per second (Mbit/s) for high mobility communication (such as from trains and cars) and 1 gigabit per second (Gbit/s) for low mobility communication (such as pedestrians and stationary users). 4G offers a downloading speed of 100Mbps. 4G provides same feature as 3G and additional services like Multi-Media Newspapers, to watch TV programs with more clarity and send Data much faster than previous generations. LTE(Long Term Evolution) is considered as 4G technology. 4G is being developed to accommodate the QoS and raterequirements set by forthcoming applications like wireless broadband access, Multimedia Messaging Service (MMS), video chat, mobile TV, HDTV content, Digital Video Broadcasting (DVB), minimal services like voice and data, and other services that use bandwidth. Some possible standards for the 4G system are 802.20, WiMAX (802.16), HSDPA, TDD, UMTS, UMTS and future versions of UMTS and proprietary networks from ArrayComm Inc., Navini Networks, Flarion Technologies, and 4G efforts in India, China and Japan.

Unlike 3G, which is based on two parallel infrastructures comprising of circuit switched and packet switched network nodes, 4G will be built on packet switching only. This will require low-latency data transmission.

By the time that 4G was deployed, the process of IPv4 address tiredness was expected to be in its final stages. Therefore, in the context of 4G, IPv6 is crucial to support a large number of wireless-enabled devices. By increasing the number of IP addresses available, IPv6 removes the need for network address translation (NAT), a method of sharing a restricted number of addresses among a larger group of devices, although NAT will still be required to communicate with devices that are on existing IPv4 networks.

One of the basic term used to describe 4G is MAGIC. Magic Multimedia, Anytime anywhere, Global Mobility Support, Integrated wireless solution, Customized personal services also known as Mobile Broadband Everywhere.

4G comprised of the following Mobile technologies: Long Term Evolution (LTE) Standard based on the GSM/EDGE and UMTS/HSPA, 3rd Generation Partnership Project (3GPP), Multiple Input Multiple Output (MIMO) smart antenna technology, Orthogonal Frequency Digital Multiplexing (OFDM), 802.16e - Worldwide Interoperability for Microwave Access (WiMAX), 802.20 - Mobile Broadband Wireless Access (MBWA).

E. Fifth Generation (5G):

5G technology refer to short name of fifth generation which was started from late 2010s. Complete wireless communication with almost no limitation. It is highly transportable by Wireless World Wide Web (WWW). The development of LTE does not end with LTE advanced (release 10) rather lasts to grow into further releases. Each new release further improves system performance and adds new skills with new application areas. Some of the additional applications, helping from mobile connectivity, are home automation, smart transportation, securetyetc. The fifth generation communication system is envisionedas the real wireless network, capable of supporting Wireless World Wide Web (WWW) applications in 2010 to 2020 timeframe.

5G is also denoted to as beyond 2020 mobile communications technologies. 5G does not label any particular specification in any official document issued by any telecommunication standardization body. Although well-run standards that define skills beyond those defined in the current 4G standards are under concern, those new
capabilities are still being grouped under the current 4G standards.

The digitization is the transformation of atoms into bits, the digitization of all media content. The 5G Nanocore is a confluence of below mentioned technologies. These technologies have their own effects on exiting wireless network which makes them in to 5G. 1- Nano technology, 2 – Cloud computing, 3 – All IP Platform. The sounds, images, words etc. will get transformed into digital form of information and we will be able to elaborate the probable association between them and thereby enabling them to movement across the available and newly introduced platforms.

There are two opinions of 5G systems: evolutionary and revolutionary. In evolutionary opinion the 5G (or beyond 4G) systems will be skilled of supporting www allowing a highly flexible network such as a Dynamic Adhoc Wireless Network (DAWN). In this opinion advanced technologies including intelligent antenna and flexible modulation are keys to enhance the ad-hoc wireless networks. In revolutionary opinion, 5G systems should be an intelligent technology capable of intersecting the entire world without limits. An example application could be a robot with built-in wireless communication with artificial intelligence.

Researchers at the University of Surrey’s 5G Innovation Centre (5GIC) managed one terabit per second (Tbps) - many thousands of times faster than current data connections. Ofcom has said 5G could be available in Britain by 2020. At 1Tbps, it would be theoretically possible to download a file 100 times the size of a feature film in about three seconds.

The speed is more than 65,000 times faster than average 4G download speeds. It is also far in excess of the previous best achieved in tests: Samsung’s 7.5 gigabits per second (Gbps), which is less than 1% of the Surrey team’s speed. It has said that 5G would be able to use very high-frequency spectrum - above 6 GHz - to run a range of services - from holographic projections to financial trading. The regulator said it expected 5G mobile to be capable of delivering between 10 and 50Gbps, compared with the 4G average download speed of 15 Megabits per second (Mbps).

Nanocore combines with Artificial intelligent (AI) will be capable to control an intelligent Robot expending a mobile phone. Beam Division Multiple Access (BDMA) is the modern allocation technique in which an orthogonal beam is allocated to each mobile station. As reported by the BDMA concept, the antenna beam is divided and allocated to the locations of the mobile stations to deliver multiple access in order to rise the capacity of the system.
Figure 1: 5G Architecture

<table>
<thead>
<tr>
<th>Technology</th>
<th>1G</th>
<th>2G</th>
<th>3G</th>
<th>4G</th>
<th>5G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth</td>
<td>2kbps</td>
<td>14-64 kbps</td>
<td>2Mbps</td>
<td>200 Mbps</td>
<td>&gt; 1Gbps</td>
</tr>
<tr>
<td>Technology</td>
<td>Analog cellular</td>
<td>Digital cellular</td>
<td>CDMA / IP technology</td>
<td>Unified ip &amp; seamless combo of LAN/WAN/WLAN/PAN</td>
<td>4G + WWWWW</td>
</tr>
<tr>
<td>Service</td>
<td>Mobile telephony</td>
<td>Digital voice, short messaging</td>
<td>Integrated high quality audio / video &amp; data</td>
<td>Dynamic information access, variable devices</td>
<td>Dynamic information access, variable devices with AI capabilities</td>
</tr>
<tr>
<td>Multiplexing</td>
<td>FDMA</td>
<td>TDMA/CDMA</td>
<td>CDMA</td>
<td>CDMA</td>
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III. CONCLUSION

The last few years have watched a remarkable growth in the wireless industry. The ever increasing loads of users have triggered investigators and industries to turn up with complete manifestation of the up-coming fifth generation (5G) mobile communication system. 5G technology demonstrated as an Open platform that agrees the best operating system and lowest charge for an exact service using one or more than one wireless technology at the same time.

There are lots of enhancements from 1G to 5G wireless technology. 5G include latest technologies such as SDR, cognitive radio, cloud computing, nanotechnology based on All IP Platforms along with high security, high data rate. 5G is popular to grab the responsiveness of almost all of us in arena of communication. These technology has Personal Data Access to be whole office is in your fingertips. 5G will boost the idea of Super Core that will link all operators universally under same framework or core and same infrastructure regardless of their access methods. So it is all up to users that take control of consuming these wireless generations of mobile technology.

REFERENCES


<table>
<thead>
<tr>
<th>Switching</th>
<th>Circuit</th>
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<th>Packet except for air interface</th>
<th>All packet</th>
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<td>Packet network</td>
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<td>802.11n</td>
<td>802.11ac</td>
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Table 1: Comparison of 1g to 5g with Other Networks