



GENERATION OF WIRELESS COMMUNICATION NETWORK

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Abstract — In today's technology-driven world we can see the advancement in electronic devices which in turn helps in the evolution of wireless network. The aim of wireless communication is to provide high quality, reliable communication just like wired communication and each new generation of services represents a big step in that direction. This evolution consists of several generations starting with 1G and followed by further advanced generations i.e. 2G, 3G, 4G, and 5G. Each of the generations has standards that must meet to officially use the G terminology. The main objective of this paper is a detailed and comprehensive study about the evolution of the different mobile generation technologies in wireless communication. The first generation has fulfilled the basic needs of voice, whereas second generation technologies worked with digital signals. Further third generation included high data transmission speed as compared to its predecessor. The fourth generation of mobile technology was known as long term evolution which include advanced services and, in accordance with service demands Fifth generation also has many advancements to provide its users a smoother network facility.

Keywords — CDMA, TDMA, GSM, ITU, LTE, WWW

I. INTRODUCTION

In the past few decades we have witnessed a remarkable growth in the wireless industry. [1] Wireless communication plays an important role in everyday life. Without communication, wireless technology has become an integral part of our daily operations. This provides data transfer without any operator via RF and radio signals. Information is transmitted to all devices within a few meters to hundreds of miles through well-defined channels. The term wireless means to communicate or transmit information remotely without the need for wires, cables, or any other electrical conductors. Wireless communication is one of the most important ways to transfer data or information to other devices. Communication is set up and information is transmitted over the air, without the need for any cables, using radio transmitters such as radio, infrared, satellite, etc., to a wireless communication technology network.

II. FIRST GENERATION

1G refers to the first generation of wireless mobile technology. These are the first analog communications standards introduced in the 1980s and continued until they were replaced. The first generation of wireless communication system was an analog

frequency switching system based on three technologies known as NMT (Nordisk Mobile Telephony), AMPS (Advanced Mobile Phone Service) and CDPD (Digital Packet Data). This analog system was first used in North America as the Analog Mobile Phone System (AMPS), while the system was used in Europe and around the world as the Wide Accessibility Network (TACS). In this case the voice signal is converted to a maximum frequency of about 150 MHz and transmitted between radio towers. The system is allocated a 40-MHz bandwidth between the frequency range of 800 to 900 MHz. Broadcasting takes place from base to mobile channels via the forward channel using frequencies between 869-894 MHz.

Key features of first generation:

- Speed-2.4 kbps
- frequency band of 824-894MHz
- voice calls
- Bandwidth around 10 MHz
- Analogue switching technology used
- Frequency Modulation (FM) is used



Fig 1.. first generation mobile phone

Drawbacks of first generation:

- Poor voice quality
- Poor battery life
- Large phone size
- Limited capacity
- Poor handoff reliability
- Poor security
- Offered very low level of spectrum efficiency



III. SECOND GENERATION

2G is used for second generation technology. This 2G system is based on GSM (Global System for Mobile communication) standard and was launched in Finland in early 1990s. Unlike first generation digital signals were used for transmission as it provide services to deliver text and picture messages along with voice messages.[2] 2G capabilities are achieved by allowing multiple users on a single channel via multiplexing.

up to 144 kbps. As per the demand 2G technologies can be bifurcated into Time Division Multiple Access (TDMA) based and Code Division Multiple Access (CDMA). In CDMA, each user has a unique code whereas in TDMA each user is assigned with a time slot.

Some features of second generation:

- Starting of digitally encrypted communication
- Data speed up to 64kbps
- better quality and capacity
- more efficient use of the radio frequency spectrum
- Data services starting with text messages
- Roaming is possible
- Enhanced security

Drawbacks of second generation :

- Unable to handle complex data such as videos.
- Required strong digital signals
- Speed is very low
- less compatible with the smartphones functions
- lower compatibility with distance changes



Fig 2. Second Generation mobile phone

Partnership Project) Long 3GPP The Term Evolution (LTE) standard is completely fulfilled (International Telecommunications Union) ITU 4G requirements called IMT-Advanced. 4g or 3.9G technology is the first release of LTE.[4] Yours Evolution LTE Advanced 4G technology.

The third generation (3G) technology was invented in the year 2000. Comparing 1G and 2G Technology to 3G in 3G Data . Its Transmission speed 144Kbps-2Mbps. 3G. The technology is for multimedia cell phones, usually it is called smart phone. In 3G, bandwidth and transfer rates were enhanced to accommodate web-based applications and audio and video files. Speed in 3G is much higher than in 2G. there are three types of cellular access technology i.e. CDMA 2000 (Code Division Multiple Access), WCDMA (Wide Band Code Division Multiple access) and TD-SCDMA (Time Division Synchronous Code Division Multiple Access).[4]

Key features of third generation:

- Faster data transfer rate
- Anywhere access to the internet.
- Speed of up to 2 Mbps
- Increased bandwidth and data transfer rates
- Send/receive large email messages
- Large capacities and broadband capabilities



Fig3. Third generation mobile phone

IV. THIRD GENERATION

Third generation based mobile technology wide band wireless network fills International Mobile Telecommunications-2000 (IMT-2000) International data Telecommunication Union. According to IMT-2000 standards, the system is required to provide high quality data values of at least 200 Kbit / s. 3G activities on 2100 Hz frequency and bandwidth 15-20 MHz The communication provides improved clarity as well perfection as a real conversation. The latest 3G release provides mobile broadband access to a few M bit / s on smart phones and mobile phones modems on laptops. The first issue of (Third Generation

Drawbacks of third generation:

- Insufficient bandwidth.
- High expenses
- Power consumption is high.
- Data/voice and roaming
- Require closer base station and are expensive
- Spectrum license cost



V..FOURTH GENERATION

The fourth Generation mobile system was introduced in the late 2000s. It provides same feature as 3G and additional services like Multi-Media Newspapers, to watch T.V programs with more clarity and send Data much faster than previous generations. 4G is considered as LTE (Long Term Evolution) based on GSM/EDGE and UMTS/HSPA technologies.[3] The main goal of 4G technology is to provide high speed, high quality, high capacity, security and low cost services for voice and data services, multimedia and internet over IP. The reason for the transition to all IP is to have a common platform to all the technologies developed so far. It has the capability 100Mbps and 1Gbps. To provide wireless services anytime and anywhere, terminal mobility is a key factor in 4G.Terminal mobility implies automatic roaming between different wireless networks. The 4G technology integrate different existing and future wireless technologies (e.g. OFDM, MC-CDMA, LAS-CDMA and Network-LMDS)[5] to provide freedom of movement and uninterrupted roaming from one technology to another.

Key features of fourth generation:

- Capable of provide 10Mbps-1Gbps speed
- Combination with Wi-Fi
- High security
- Instant service
- Low cost per-bit
- very low latencies
- frequency band used in 4G is from 2000 Mhz to 8000 Mhz
- maximum downlink speed of around 100 Mbps
- uplink speed of around 50 Mbps

Drawbacks of fourth generation:

- Hard to implement
- High battery usage
- Complicated hardware
- High data prize
- Complicated security issue
- Expensive



Fig4.fourth generation mobile phone

VI. FIFTH GENERATION

5G refers to the fifth generation which was introduced from the end of 2010. 5G.Features Viewable with the technology includes improved levels of connectivity and coverage. The main focus of 5G will be World-Wireless World Wide Web (WWW).[6] It is a complete wireless communication with no limitations. 5G refers to the fifth generation which was introduced from the end of 2010. 5G. Features Viewable with The technology includes improved levels of connectivity and coverage. The main focus of 5G will be World-Wireless World Wide Web (WWW). It is a complete wireless communication which does not

Main features of fifth generation:

- It is highly helpful for WWW (Wireless World Wide Web)[7]
- High Speed,High Efficiency
- Provides large transmission of data in Gbps. Watch multi-media newspapers, TV programs with clarity (HD clarity)
- Faster data transmission than the previous generation
- Large phone memory, Dialing speed, Clarity in audio/video
- Support interactive multimedia, voice, streaming video, Internet and more
- More effective and attractive



Fig5.fifth generation mobile phone



Bandwidth	25 MHz
Advantage	Multimedia features (SMS, MMS), internet access and SIM introduced
Applications	Voice calls, short messages

FIG6.COMPARISON AMONG ALL GENERATIONS

VII. CONCLUSIONS

As the world of mobile wireless communication is rapidly developing. In the last few years we have experienced a remarkable growth in wireless industry. Many of the attempts are being made to reduce the number of technologies to a single global standard resulting in 5G, 6G and 7G. From the above research paper, we have studied about the different wireless technologies, generation details and comparison between 1G, 2G, 3G, 4G, 5G. The paper shows how the evolution of wireless technologies occurred and how they came into existence. Advanced Wireless technologies have proved to be of great boon to the telecommunication sector in developing it. With latest research and advances, the purpose of the user has been served more rather than the operator making it more reliable for the user. As a result, the user centric networks are given more priority nowadays giving the provided services which the user may not have experienced before. Now a days 5G aims a real wireless world with no limitations. Trials have already started on 5G which may lead to its commercial availability around 2022. The world is trying to become completely wireless, demanding uninterrupted access to information anytime and anywhere with better quality, high speed, increased bandwidth and reduction in cost

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IX .REFERENCES

- [1] Patel, S., Shah, V. and Kansara, M., 2018. Comparative Study of 2G, 3G and 4G. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, 3(3), pp.1962-1964.
- [2] Shukla, S., Khare, V., Garg, S. and Sharma, P., 2013. Comparative Study of 1G, 2G, 3G and 4G. *J. Eng. Comput. Appl. Sci.*, 2(4), pp.55-63.
- [3] Vora, Lopa J. "Evolution of mobile generation technology: 1G to 5G and review of upcoming wireless technology 5G." *International journal of modern trends in engineering and research* 2, no. 10 (2015): 281-290.
- [4] Mehta, Haard, Darpit Patel, Bhaumik Joshi, and Hardik Modi. "0G to 5G mobile technology: a survey." *J. of Basic and Applied Engineering Research* 1, no. 6 (2014): 56-60.
- [5] Bhandari, Nikhil, Shivinder Devra, and Karamdeep Singh. "Evolution of cellular network: from 1G to 5G." *International Journal of Engineering and Techniques* 3, no. 5 (2017): 98-105.
- [6] Mondal, S., Sinha, A. and Routh, J., 2015. A survey on evolution of wireless generations 0G to 7G. *International Journal of Advance Research in Science and Engineering (IJARSE)*, 1(2), pp.5-10.
- [7] Javed, Mohammad, and Ahmad Talha Siddiqui. "Transformation of Mobile Communication Network from 1G to 4G and 5G." *International Journal of Advanced Research in Computer Science* 8, no. 3 (2017).