

## A Survey: Wireless Mobile Technology Generations With 5G

Ms. Sachi Pandey  
Asst. Professor(CSE)  
SRM University,  
NCR Campus  
Modinagar, India

Manoj Kumar,  
Pursuing M.Tech (CSE)  
SRM University,  
NCR Campus  
Modinagar, India

Atendra Panwar  
Pursuing M.Tech (CSE)  
SRM University,  
NCR Campus  
Modinagar, India

Ishita Singh  
Pursuing M.Tech (CSE)  
SRM University,  
NCR Campus  
Modinagar, India

### Abstract

*Mobile Wireless Technology has become popular as it has simplified the communication. The ability to connect instantly and anywhere has made the Mobile Wireless Technology successful. It provides high speed services to the users. Wireless Technology helps in transfer the information over a distance without the use of wires. The distance can be short or it can be thousands of kilometre. In this paper the birth of different generations of Mobile Wireless Technology with their advantages and significance has been shown. In past few years, Mobile Wireless Technology has experienced different generations of Technology mainly from 0G to 4G. In present the implementation work of 5G is going on. The research concentrates the advance implementation of these technologies. Presently 5G remains a term which is not officially used for any current technology. With the ever-increasing demand for the newest gadgets, faster mobile broadband and increased efficiency of applications such as GPS, we may see the future generations of 5G technology.*

#### *Index Terms—*

*0G(0.5G), 1G, 2G(2.5G,2.75G), 3G(3.5G,3.75G), 4G, 5G*

### 1. Introduction

Mobile wireless technology came early in 1970s. Mobile Wireless Technology has experienced different generations of Technology mainly from 0G to 4G. Implementation work of 5G is going on. Mobile radio telephone systems (0G) preceded modern cellular mobile telephony technology. The mobile wireless communication was possible only by the introduction of 1G technology. 2G technology replaced the analogy technology by digital communication. Data

communication with voice communication was introduced with 3G technology and currently it is used widely. 4G technology is introduced presently. A 4G system provides mobile ultra broadband internet access. 4G technology is having a great future in market. With the ever-increasing demand for latest gadgets, faster mobile broadband and increased efficiency of applications, future generations like 5G may be seen in coming time.

### 2. Zero Generation Technology (0G – 0.5G)

Mobile radio telephone systems are sometime referred as pre-cellular systems or zero generation. 0G technology includes MTS (Mobile Telephone system), IMTS (Improved Mobile Telephone System), AMTS (Advanced Mobile Telephone Service), PTT (Push To Talk), OLT (Norwegian for Offentling Landmobile Telefoni, Public Land Mobile Telephony) and MTD .

These early mobile telephone systems can be distinguished from earlier closed radiotelephone systems in that they were available as a commercial service that was part of the public switched telephone network, with their own telephone numbers, rather than part of a closed network such as a police radio or taxi dispatch system. The transceiver (transmitter-receiver) was mounted in the vehicle trunk and attached to the "head" (dial, display, and handset) mounted near the driver seat.

IMTS & RCC technology which were used. In public switched network, suppose two caller wants to talk , then the operator of respective caller will secure a common line and let them talk , and till these users don't end their talk the line will remain busy.

## 2.1 0.5 Generation technology(0.5G)

0.5 G was the advance version of 0G (Zero Generation or Mobile Radio Telephone system). This 0.5G technology had introduced ARP (Autoradiopuhelin) as the first commercial public mobile phone network. This ARP network was launched in 1971 at Finland. ARP was operated on 8 Channels with a frequency of 150 MHz (147.9 – 154.875 MHz band) and its transmission power was in a range of 1 to 5 watts. ARP used half duplex system for transmission (voice signals can either be transmitted or received at a time) with manual switched system. This Network contains cells (Land area was divided into small sectors, each sector is known as cell, a cell is covered by a radio network with one transceiver) with the cell size of 30 km. As ARP did not support the handover, calls would get disconnected while moving from one cell to another. ARP provided 100% coverage which attracted many users towards it. ARP was successful and became very popular until the network became congested. The ARP mobile terminals were too large to be fixed in cars and were expensive too. These limitations led to invent of Autotel. Autotel are also known as PALM (Public Automated Land Mobile). Autotel is a radio telephone service which in terms of technology lies between MTS and IMTS. It used digital signals for messages like call step-up, channel assignment, ringing, etc only voice channel was analog. This system used existent high-power VHF channels instead of cellular system. It was developed in Canada and Columbia.

## 3 First Generation Technology (1G)

In terms of overall connection quality, 1G compares unfavorably to its successors. 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.

## 4 Second Generation Technology (2G-2.75G)

2G was first launched in 1991 in Finland. 2G technology is based on global system for mobile communication (GSM). 2G technology replaced the analogy technology by digital communication. 1G technologies were used to transfer analog signals. Services such as text message, picture message and MMS are provided by 2G. All text messages are digitally encrypted. This digital encryption allows for the transfer of data in such a way that only the intended receiver can receive and read it.

There are 3 different types of 2G mobile technologies based on the system they are designed. (FDMA, TDMA, CDMA) All the three different technologies have different working methods. All these 2G mobile technologies have different properties and some special feature.

### FDMA (2G Mobile Technology)

It works like a radio system by separating the frequency into equal spectrum but affecting the quality of voice. FDMA is an analog system still exists in 2G mobile technology with the digital module of 2G in limited area. Instead of frequency division now cellular based technology which divide geographical areas not frequency and improve the service.

#### Properties

- This technology is first used in 1G mobile as an analog system, introduced in 2G with the increase in its frequency with the help of cellular technology.
- Able to carry digital transmission but digital transmission is not quality wise as good as in case of analog system.
- Facilitate with the feature of analogue system by enabling the accessibility of call.

### TDMA (2G Mobile Technology)

2G Mobiles uses TDMA (Time Division Multiple Access) technology in some of its models. It actually divides the band into three time-periods. TDMA contains technologies GSM (Global Service Mobile Communication), which is the most common technology, uses widely across the world.

#### Properties

- It provides roaming in more than 200 countries. This international roaming feature attracts the subscribers to use it for travelling purpose.
- The most used and the most appreciative feature is that of short messaging service (sms).

- Use of sim is a prominent feature of GSM. It needs only a sim to start communication at a particular region.

### CDMA (2G Mobile Technology)

CDMA works using the entire band with the help of code. CDMA is based on a wide spectrum as many calls laid over each other identifying on the basis of unique code.

#### Properties

- CDMA gives a separate code to a separate phone.
- Increase the frequency band space by assigning code in sequence.
- Both senders and receivers are able to use a full band with the help of using their codes.
- Contrast to one analog call, nearly dozen calls can be channelized at the same time.

#### Benefits of 2G technology

The introducing of digital data services, such as SMS and email is one of the many 2g technology advantages. Improved privacy is another added advantage of 2g technology, which was not possible with the earlier technologies. 2G phones are greatly more private than 1G phone, as the calls on the digital cells are almost impossible to eavesdrop on by use of radio scanners.

The use of digital data service with 2g technology has helped mobile network operators to provide the SMS or short message services to any mobile network at any time over the cellular phones. The digital encryption provides privacy and safety to the data and voice calls, which is among the many other benefits of 2g technologies. SMS is also a cheap and easy way to communicate with anyone.

#### 4.1 2.5G – GPRS (General packet radio service)

It is also known as second-and-a-half generation cell phone technology. 2.5G wireless technology is a bridge between 2G & 3G wireless technology.

A 2.5G system may make use of 2G system infrastructure, but it implements a packet-switched network domain in addition to a circuit-switched domain. This does not necessarily give 2.5G an advantage over 2G in terms of network speed,

because bundling of timeslots is also used for circuit-switched data services.

The services and infrastructure of a 2.5G network may be used on a per-transaction basis rather than a per-minute-of-use basis. This is because of packet switched network. This makes its infrastructure more efficient and improves the service delivery.

2.5G networks may support services such as WAP, MMS, SMS mobile games, and search and directory

#### 4.2 2.75G- EDGE (Enhanced Data Rates For GSM Evolution)

EDGE is an inch above GPRS (2.5) and it isn't even UMTS or 3G, it is classified as 2.75G. It is a term occasionally used to refer to EDGE data connectivity, implying that it is faster than GPRS (sometimes called 2.5G), but slower than typical 3G networks. The truth of the matter, however, is that EDGE is an official ITU ratified 3G technology. Typical EDGE implementations generally do not obtain 3G data rates, though, leading people to call it 2.75G.

#### 5 Third Generation Technology (3G)

3G is the third generation of mobile phone standards and technology based on the International Telecommunication Union. It enables network operators to offer a wide range of advanced services while achieving greater network capacity through improved spectral efficiency. Services can be wide area wireless voice telephony, video calls, and broadband wireless data.

3G has the following enhancements over 2.5G

- Enhanced audio and video streaming;
- Several Times higher data speed;
- Video-conferencing support;
- Web and WAP browsing at higher speeds;
- IPTV (TV through the Internet) support.
- There are many 3G technologies as W-CDMA, CDMA2000, UMTS, DECT, WiMAX

#### 5.1 3.5G – HSDPA (High-Speed Downlink Packet Access)

High-Speed Downlink Packet Access (HSDPA) is a mobile telephony protocol, also

called 3.5G, which provides a smooth path for UMTS-based 3G networks allowing for higher data transfer speeds. HSDPA implementations includes Adaptive Modulation and Coding (AMC), Multiple-Input Multiple-Output (MIMO), Hybrid Automatic Request (HARQ), fast cell search, and advanced receiver design.

### 5.2 3.75G – HSUPA (High-Speed Uplink Packet Access)

High Speed Uplink Packet Access (HSUPA) is a UMTS /WCDMA uplink evolution technology. The HSUPA mobile telecommunications technology is directly related to HSDPA and the two are complimentary to one another.

HSUPA will enhance advanced person-to-person data applications with higher and symmetric data rates, like mobile e-mail and real-time person to person gaming.

### 6 Fourth Generation Technology (4G)

4G is the fourth generation of cell phone mobile communications standards. It is a successor of the third generation (3G) standards. A 4G system provides mobile ultra-broadband Internet access, for example to laptops with USB wireless modems, to smart phones, and to other mobile devices. Conceivable applications include amended mobile web access, IP telephony, gaming services, high-definition mobile TV, video conferencing and 3D television.

Two 4G candidate systems are commercially deployed: The Mobile WiMAX standard, and the first-release Long term evolution (LTE) standard .

### 6.1 Worldwide Interoperability for Microwave Access (WiMAX)

WiMAX is an IP based, wireless broadband access technology that provides performance similar to 802.11/Wi-Fi networks with the coverage and QOS (quality of service) of cellular networks. WiMAX is also an acronym meaning "Worldwide Interoperability for Microwave Access (WiMAX).

WiMAX is a wireless digital communications system, also known as IEEE 802.16, that is intended for wireless "metropolitan area networks". WiMAX can provide broadband wireless access (BWA) up to 30 miles (50 km) for fixed stations, and 3 - 10 miles

(5 - 15 km) for mobile stations. In contrast, the WiFi/802.11 wireless local area network standard is limited in most cases to only 100 - 300 feet (30 - 100m).

### 6.2 Long Term Evolution (LTE)

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 using a different radio interface together with core network improvements.

Mobile broadband is becoming a reality, as the internet generation grows accustomed to having broadband access wherever they go and not just at home or in the office. Of the estimated 3.4 billion people who will have broadband by 2014, about 80 percent will be mobile broadband subscribers – and the majority will be served by High Speed Packet Access (HSPA) and Long Term Evolution (LTE) networks. There is a strong supporting prediction of increased mobile broadband usage.

While considering a smooth migration for 5G it is apparent that it should be valid for all sorts of radio access technologies. So that it could make better revenue for current global operators as well as interoperability will become more feasible. To make 5G practical for all sorts of radio access technologies there should be a common platform unique for all the technologies. One of those unique platforms is Flat IP network.

### 7 Fifth Generation Technology (5G)

5G technology going to be a new mobile revolution in mobile market. Through 5G technology now you can use worldwide cellular phones. With the coming out of cell phone alike to PDA now your whole office in your finger tips or in your phone. 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 technology has a bright future because it can handle best technologies and offer priceless handset to their customers. May be in coming days 5G technology takes over the world market. 5G Technologies have an extraordinary capability to support Software and Consultancy. The Router and switch technology used in 5G network providing high connectivity. The 5G technology distributes internet access to nodes within the building and can be deployed with union of wired or wireless network connections. The current trend of 5G technology has a glowing future.

#### Features of 5G Technology

- 5G technology will offer high resolution for crazy cell phone user and bi-directional large bandwidth shaping.

- The advanced billing interfaces of 5G technology will make it more attractive and effective.
- 5G technology will provide subscriber supervision tools for fast action.
- The high quality services of 5G technology based on Policy to avoid error.
- 5G technology will provide large broadcasting of data in Gigabit which supporting almost 65,000 connections.
- 5G technology will offer transporter class gateway with unparalleled consistency.
- The traffic statistics by 5G technology will make it more accurate.
- Through remote management offered by 5G technology a user can get better and fast solution.
- The remote diagnostics will be a great feature of 5G technology.
- The 5G technology will provide up to 25 Mbps connectivity speed.
- The 5G technology will support virtual private network.
- The new 5G technology will take all delivery service out of business prospect
- The uploading and downloading speed of 5G technology will touch the peak.
- The 5G technology network will offer enhanced and available connectivity just about the world.

5G technology is about to begin because 5G technology going to give tough completion to normal computer and laptops whose marketplace value will be effected. There are lots of improvements from 1G, 2G, 3G, and 4G to 5G in the world of telecommunications. The new coming 4G technology is available in the market in affordable rates, high peak future and much reliability than its preceding technologies.

## 8 Conclusion

There are some other projects, which are undertaken by 5G technologies. Here we want to mention that 3G and 4G mobiles are working these days, and 5G technologies are coming and in future we are ready to face 5G technologies and some of its features we have presented in this paper.

## 9 Acknowledgment

Our thanks to our parents, networking team of Hewlett Packard Education Services & WTS, and

all the faculty members of SRM University who have contributed towards development of the paper.

## 10 References

- [1] Young Kyun, Kim; Prasad, Ramjee (2006), “4G Roadmap and Emerging Communication” Technologies. Artech House 2006.
- [2] Tse, David; Viswanath, Pramod (2005). “Fundamentals of Wireless Communication” Cambridge University Press.
- [3] S. Srikanth, P. A. Murugesa Pandian “Orthogonal Frequency Division Multiple Access in WiMAX and LTE – A Comparison”, 2010.
- [4] Leo yi, Kai Miao, Adrian Liu “A Comparative Study of WiMAX and LTE as the Next Generation Mobile Enterprise Network” Feb. 13~16, 2011 ICACT 2011.
- [5] Pearson Education India, Wireless communication Systems
- [6] The Wireless Networking Starter Kit: The Practical Guide to Wi-Fi Networks for Windows and Macintosh.
- [7] 4G:LTE/LTE-Advanced for Mobile Broadband by Erik Dahlman, Stefan Parkyall, Johan Skold.