



Overview of 4g Technologies

Hirani Priti K.

Research Scholar, Department of Computer Science and Engineering,
Jayoti Vidhyapeeth Women's University,
Jaipur, India

Abstract: Demand of Wireless data services are constantly growing with increasing usage of Internet services. 4G is a term used to refer to the next wave of high speed mobile technology that will be used to replace the current 3G network. 4G technology provides high speed mobile broadband Internet Access. For example Laptop with 4G modem, Smart phones, Tablets & other hand held devices. It also gives a suitable platform for connecting for high data devices such as gaming consoles like XBOX, Play station, High Definition video streaming like Net flux and Audio Video conferencing. It provides customer high speed data network. 4G technologies is an integrated and global network that provides a comprehensive IP where voice, data and multimedia access can be given at high speeds to users on "Anytime, Anywhere". 4G technologies give the best business solution to the wireless and mobile industries of CDMA WLAN, GPRS, WCDMA, and OFDM. The aim of this paper is to highlight the evolution of 4G technology, its benefits and security issue.

Keywords: Wireless Technologies, OFDM, GPRS, EDGE, SDR, IPV6, VoIP.

I. INTRODUCTION

The Fourth Generation of mobile networks will truly turn the current mobile phone networks in to end IP based networks. Every device in the world will have a unique IP address that allows full IP based communications from a mobile device right to the core of the internet and back out again. 4G is set to deliver 100Mbps to a roaming mobile device globally and up to 1 Gbps to a stationary device. It won't be just the phone networks that need to evolve, increased traffic load on the Internet as a whole will need to expand, with faster backbones and a link requiring major upgrade. 4G Bandwidth will always be the main factor in the development of application and devices. 3G networks are clear, it's just not fast enough, and offering 384kbps doesn't meet the requirement of the most users. The evolution from 3G to 4G will be driven by services that offer better quality of video & sound. Greater bandwidth, more sophistication in the association of a large quantity of information. 4G will encompass all systems from various networks public and private operator-driven broadband networks to personal area and ad hoc networks.

Some possible standards for the 4G system are 802.20, WiMAX, HSDPA, UMTS and other proprietary network from Flarion technologies and Navini Networks. India China and Japan are striving to implement 4G in full scale.

II. EVOLUTION OF WIRELESS DATA SERVICES

At the end of the 1940's the first radio telephone service was designed for users in the car to the public landline based telephone network.

Zero generation technology (0G): 0G refers to pre-cell phone mobile technology. Being the predecessors of the first generation of cellular telephones. The system is called 0g. Technologies used in 0G system included PTT (push to talk), MTS (mobile telephone system), IMTS (improve mobile telephone services), and AMTS (advanced mobile telephone system).

First generation technology (1G): 1G refers to the first generation of wireless telecommunication technology, more popularly known as cell phones. Through 1G, a voice call gets modulated to a higher frequency of about 150 MHz and up as it is transmitted between radio towers using a technique called FDMA.

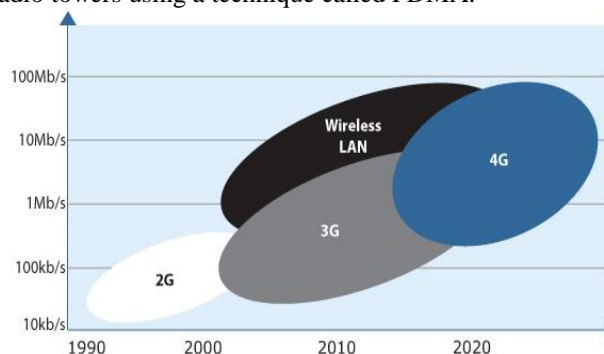


Fig 1. Evolution graph

Second generation technology (2G): 2G first appeared around late 1980's; 2G system digitized the voice signal, as well as the control link. It provides the facility of short message service (SMS) unlike 1G that had its prime focus on verbal communication. Depend the type of multiplexing used 2G technologies can be divided into TDMA and CDMA. A typical 2G GSM network service uses 800/900 or 1800/1900 frequency spectrum. Data rate of GSM is 9.6kbps. The bandwidth of 2G is 30-200 KHz.

2.5G- GPRS (General Packet Radio Service): which are standing for second and a half generations are a cellular wireless technology developed in between 2g and 3g. Data rate of GPRS are ~115kbps. It can be used for services such as wireless application protocol access, multimedia messaging services and for accessing internet.

2.75- EDGE (Enhanced Data Rate for GSM Evolution): EDGE (EGPRS) is an abbreviation for enhanced Data Rate for GSM evolution is a digital mobile phone technology invented by AT &T. The modulation bit rate is 810 kbps. It offers a data rate of 384 kbps, theoretically up to 473.6kbps.

Third Generation Technology (3G): 3G refers to a networking standard in cell phone technology that is capable of providing high –speed data service for mobile device. 3g wireless networks become more widespread you could finally connect to and use the Internet at particular speeds (with 3G enable Smartphone).

Fourth Generation Technology (4G): 4G mobile data protocol. But a growing band of 4G users will tell you, it's all about speed. LTE stands for Long term evolution. 4G Smart-phone on version's 4G LTE networks means you can download files from the Internet up to 10 times faster than 3G. With 4G LTE using the web from your phones becomes as pleasurable as using it from your home computer.

III. 4G TECHNOLOGIES

There are different technologies are used in 4G wireless technology. Smart Antennas for Multiple-input Multiple Output (MIMO), IPV6, VoIP, OFDM, Software Defined Radio (SDR) System.

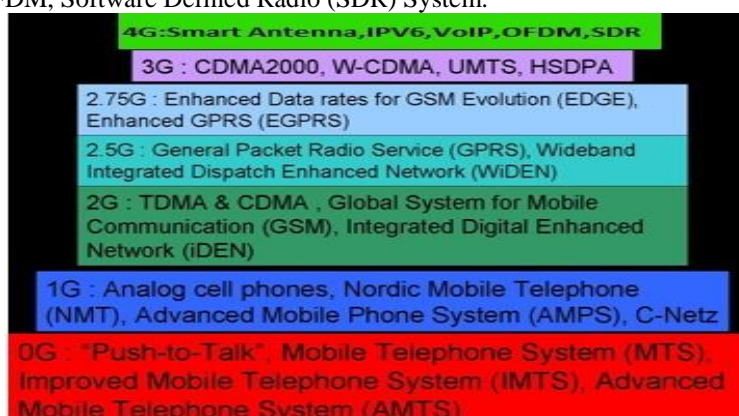


Fig 2. Technologies of Mobile Networks

A) Smart Antennas: Smart Antennas Transmitting and Receiving antennas. It resolves the problem of diminishing spectrum availability and doesn't require increase power or additional frequency.

B) IPV6: IPV6 support is essential in preferring to support many wireless –enabled devices. By increasing the many IP addresses IPV6 removes the need for network address Translation. IPV6 also enables many applications with better multicast.

C) VoIP: VoIP Stands Voice over Internet Protocol. It allows only packets (IP) to be transferred eliminating complexity of two protocols over the same circuit. The All voice data will be wrapped up in a packet. Samples Voice between 8,000 & 64, 000 times per seconds and create streams of bits which is then compressed and put into a packet. Increase battery life attributable to greater data compression.

D) OFDM: OFDM allows for the transfer of more data than a form of multiplexing (Time, frequency, code etc.). It allows for almost the entire frequency band. Currently use in WiMax (802.16) and WI-Fi (802.11a/g). The frequencies are spaced so that the signals do not interfere with each other (no Cross talk). It allows for the sending of multiple signals simultaneously from the same antenna to one device (parallel data transmission).

E) SDR: Software-defined Radio (SDR) technology is one form of open wireless architecture. 4g technology is a collection of wireless standards; the final form of 4G device will constitute various standards. SDR technology which is categorized to the area of the radio convergence.

IV. FEATURES OF 4G

- An all IP, packet switched network.
- An infrastructure to handle pre-existing 3G system along with other wireless technologies, some of which are currently under development.
- Support interactive multimedia
- User friendly
- Terminal heterogeneous
- Network heterogeneous

- Multi-standard wireless system
- Lower cost than previous generations
- A spectral efficient system
- High network capacity i.e. more simultaneous users per cell
- A nominal data rate of 100 Mbps while the client physically moves at high speed relative to the station, 1Gbps while the client and station are in relatively fixed positions as defined by ITU
- Global mobile access (terminal and personal mobility)
- High quality of service

V. APPLICATIONS OF 4G

- Better use of multimedia applications
- Virtual presence: 4G system gives mobile users a virtual presence. Example video conferencing.
- Virtual navigation: remote database contains the graphical representation of streets, buildings and physical characteristics of a large metropolis.
- Tele Geo-processing: Queries dependent on location information of several users in addition to temporal aspects have many application e.g. GIS, GPS.

VI. ADVANTAGES OF 4G

- Pure Data Networks: 4G network is an all-IP based data network. A completely data based network will allow for more bandwidth which means more data can be passed through the network.
- More devices and Application: 4G network devices can take advantages of the higher bandwidth and speed to deliver more robust and data application.
- Speed: Theoretical speed of 4G has been suggested that data rates up to 100 Mbps for high mobility and 1Gbps for low mobility should be the target value.
- Hand off: The improved 4G network standards will allow for smooth hand off from one coverage area to another without interruption to any ongoing data transfer.
- Faster response time: One benefits of 4G technology are faster response time or lower latency.

VII. DISADVANTAGES OF 4G

- Capable of being attacked (jamming frequencies).
- Theft of Service (ToS) and Denial of Service (DoS) attacks are a large possibility.
- Spam over Internet Telephony (SPIT); essentially being spammed through VoIP.

VIII. 4G TECHNOLOGY SECURITY ISSUES

- In 4G technology there are so many security issues: Interference, Scrambling Attacks, signal Jamming, Location Tracking, Key management, Bandwidth, Denial of Service attacks, open Nature.
- **1. Interference:** inserting man made interference onto a medium a communication system can stop functioning due to a high signal to noise ratio. Interference attacks can be easily carried out as the equipment and knowledge to carry out such attacks are widely available. It is easy to detect using radio spectrum monitoring equipments.
- **2. Scrambling Attacks:** Scrambling is a form of interference which is activated for short intervals of time. Scrambling is targeted against a specific frame or part of frames. The attacker may target management of control information of a particular user to disrupt service. The attacker has to be sophisticated and knowledgeable since specific frame and time slots must be identified for the attack to be successful.
- **3. Signal Jamming:** high-speed wireless data networks are vulnerable to a simple jamming technique that could block service across much of a city. Radio frequency can be jammed or blocked, if a transmitter sends a signal at the same frequency. The LTE signal is very complex made up of one subsystem, and in each case if you take out one subsystem, you take out the entire base station. All that is required is a laptop and an inexpensive software defined radio unit and battery power.
- **4. Location Tracking:** tracking in a particular cell or across multiple cells. Location tracking is made possible by tracking a combination of the cell radio network temporary identifier(C-RNTI) with handover signals or with packet sequence numbers. C-RNTI is transmitted in clear text an attacker can determine whether the UE using the C-RNTI is still in the same cell or not. An attacker can link the new C-RNTI from the handover command message and the old C-RNTI.
- **5. Key Management:** key management for WiMAX at the MS has been designed to safeguard. This is possible since the old traffic encryption key and new TEK are included in the key replay message. It can trigger frequent exchange of keying materials. This will cause confusion at the Ms and exhaust resource at the BS.
- **6. Bandwidth Stealing:** buffer status reports are used as input information for packet scheduling, load balancing, and admission control. Due to the nature of the packet scheduling algorithm by sending a false buffer report.
- **7. Denial of service attacks:** Denial of service attacks are a concern for WiMAX networks. DOS attacks can be initiated via simple flooding attacking authenticated management frames. The BS has to sign and replay with it is the public key, processing of public key encryption and signature is CPU intensive.

- **8. Open Nature:** Open Nature of the network architecture and protocols (IP-based). Open protocol standards, 4G wireless networks are now susceptible to computer attack techniques present on the internet. Networks will be increasingly vulnerable to a range of security attacks including for Malware Trojans and viruses.

XI. CONCLUSION

4G technology is still relatively new that provides high speed data rate to mobile devices. It consists of the LTE and WiMAX network. 4G networks are prone to many security threats due to the open nature of the architecture and standards. 4G can be described in one word "MAGIC", which stands for: Mobile Multimedia Anytime anywhere global mobility support Integrated wireless and personalized services. The fourth generation technology promises to full fill the goal of PCC which stands for personal computing and communication. A vision that provides affordable high data rates everywhere over a wireless network. 4g seem to be a very promising generation of wireless communication which will change people's life in the wireless world. This technology will be deployed in the world market soon.

REFERENCE

- [1] Afaq H.Khan, Mohamamed A.Qadder, Juned A.Ansari, sariya Waheed, "4G as next generation wireless network".
- [2] Krunal N.chandewar, Amit N.Sangole, Shailesh S.Shekapure, "3G/4G network evolution".
- [3] Aakash Mehta, Bhaumik Chaudhari, "4G technology".
- [4] Pratishruti Saxena, Dr.Sanjay Kumar, "Challenges & Evolution of Next Generation in Mobile Communication Network".