TECHNOLOGY HORIZONS JOURNAL

Vol. 2 (4), 15 March 2018, pp. 59-61

Third Generation and Fourth Generation Networks (Review Paper)

Doaa Hashim Osman, Khalid Hamed Belal[b], Ibrahim Elemam Abdallah[a,b,]*

University of Neelain Faculty of Engineering, Sudan, Khartoum

Corresponding author E-mail: *doaahashim09@gmail.com*

Received: 25 December 17

Accepted: 01 February 18

ABSTRACT

Third generation and fourth generation are standards for mobile communication. Standards specify how the airwaves must be used for transmitting information voice and data. Third Generation 3G networks were a significant improvement over Second-Generation 2G networks, offering higher speeds for data transfer. The improvement that 4G offers over 3G is often less pronounced. The objective of this paper is to compare 3G and 4G mobile technology using descriptive analysis and previous study.

Keywords: WiMAX; Long-Term Evolution; WLAN; CDMA.

I. INTRODUCTION

Third Generation is called this name because it is the third generation of communication standards. It is also the general technology of mobile networks and passes the latest 2.5G. The technology is founded on the ITU or International Telecommunication Union group of standards which belongs to the IMT-2000 [1].

The definition of 4G has changed over the years. The technologies currently commercially available have been demanded by Long-Term Evolution (LTE) and WiMAX that they are advanced enough from 3G and thus claimed the right to connect 4G technology. However, in October 2010, the global standards group International Telecommunication Union declared that after long study, it had determined which technologies truly qualified for its IMT-Advanced label i.e. 4G (fourth-generation). The maximum velocity was at least 100 Mbps to qualify for the 4G label. Only two systems made the list: LTE-Advanced, an emerging version of LTE technology, and Wireless MAN-Advanced, the next version of WiMAX, also called WiMAX [2].

II. PREVIOUS STUDIES

In [3] the arrival of 4G is sure to revolutionize the field of telecommunication domain bringing the wireless experience to a completely new level. The 3G technology has been completely absolute and the modern trends of technology are going on because the quality of service and data reliability and data download and uploading need digital assistance.

In [4] from the comparing of two network models and the observed result it is concluded that 4G is more efficient than 3G. The 4G network has high performance, which has shown by the measured and analyzed parameters, 4G has higher throughput, and less delay also queuing delay time in 3G is longer than 4G queuing delay time which caused more jitter in voice and RTP applications.

In[5] Someday 4G networks may replace all existing 2.5G and 3G networks, perhaps even before a full deployment of3G. Multiple 3G standards and springing up that would make it hard for 3G devices to be truly universal.

III. SPECIFICATION OF 3G AND 4G

3G Technology is designed for multimedia communication. It provides services like higher data transfer rates. One of its key insights is to provide seamless global roaming, Allowing users to navigate across borders with the same number and phone. According to ITU, it is expected that IMT-2000 will provide higher transmission rates: a minimum speed of 2Mbit/s for stationary or walking users, and 348kbit/s in a moving vehicle[5].

The 3G transmission rate is between 128 and 144 kbps (kilobits per second) for faster moving devices and 384 kbps slower than (such as pedestrians). For fixed wireless LANs, the speed goes beyond 2 Mbps. 3G is a set of technologies and standards that include W-CDMA, WLAN and cellular radio, among others. 3G follows a pattern of 2G's that started in the early 1990's by the ITU. The style is, In fact, a wireless initiative called IMT-2000 (International Mobile Communications 2000).

In addition, the 3G comes after 2G and 2.5G, us in that General Package Radio Service (GPRS), Enhanced Data rates for GSM Evolution (EDGE), Universal Mobile Telecommunications System (UMTS) [6]. One of the most important features of the use of 4G technology is the speed of data transfer, providing the user with high speed of data transfer with the possibility of doubling in high- speed Internet connection, which is one of the most important features of interest to the user as well as higher sound quality, but it must be said that speed varies From one company to another according to the network infrastructure of that company. Among the features of the fourth generation technology.

Correspondingly, the possibility of obtaining a higher degree of security and data protection, video transmission services, as well as international roaming better than it is currently.

In other words, enable users to watch HD videos quickly without having to wait for the download, facilitate video conversations at high speed, and download a movie in less than 5 minutes to access it without an Internet connection [7].

ARCHITECTURE OF 3G AND 4G

Figure (1) shows the key components of the 3G architectures:

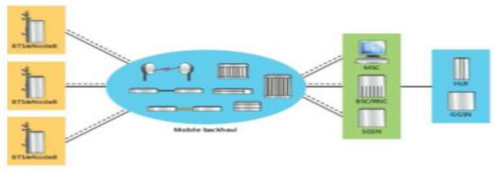

Figure (1) Functional of 3G network architecture

A functional representation of 3G network architecture is in Figure (1). In this network, the Base Terminal Station (BTS)/NodeBs aggregate the radio access network (RAN) traffic and transport it over a mobile backhaul network to the Radio Network Controllers (RNCs)/Base Station Controller (BSCs).

Typically this transport is over T1/E1 copper fa-ciliates. If the fibers are available at or near the location of the cell, the movement of the cell through the SDH/SONET rings or, more recently, a carrier Ethernet transferred when the eNodeBs are equipped with IP/Ethernet interfaces.

The carrier traffic is sent from a number of RNCs/BSCs to the Mobile Telephone Switching Office (MTSO) and then transmitted via direct tunnel to the Gateway GPRS Serving Nodes (GGSNs) in the hub data center. This transfer is usually over the SDH/SONET ring or the Ethernet network of the carrier. This accumulated structure is aggregation and transport gives way to the point-to-point network topology to reduce both the amount of required assembly equipment and land transport expense [8]. In the pre 3G version 8 network, the RNCs and SGSNs were designed to support signalling and packet handling and bandwidth requirements.

The focus of the Design of these network elements is to provide the necessary processing to support the high subscriber numbers and Packet Data Protocol PDP contexts as the bandwidth requirements to provide 3G data services (text and e-mail) were not significant. Since the data services that usually run on these systems are not real-time service or latency was a problem. Therefore, the development of these elements is normally in locations that meet primarily the requirement of the PDP and the response time requirements of the network.

Correspondingly, the current generation of the 3G packet is typically a central design of the network with the GGSNs networks deployed in the main data centers, all data services are placed from the SGSNs are strategically deployed in regional service offices. Since the total bandwidth of these services did not increase significantly until the last few years, intermediate transport costs could be controlled and could be supported by using TDM or lower rate OC-n/STM-n interfaces[6]. Figure (2) provide the key components of the 4G architectures:

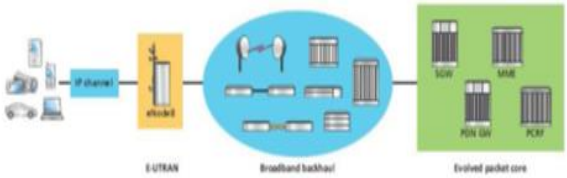

Figure (2) A high-level of an LTE/4G network

Provides a high-level functional representation of an LTE/4G network. This network is composed of three major sub-networks: the Evolved Universal Terrestrial Radio Access Networks (EU-TRAN),which provides the air interface and local mobility management of the user equipment (UE), the evolved packet core (EPC), and the broadband connection network that provides aggregation of cell movement and transmission to EPC.

The 3GPP LTE standards defined the EPC as a set of logical data and control plane functions that can be implemented either as integrated or as separate network elements. The four EPC functions are the Serving Gateway (SGW), the Packet Data Network

Gateway (PGW) that supports the data or bearer traffic; and the Mobility Management Entity (MME) and the Policy Charging and Rules Function (PCRF) which support the dynamic mobility management and policy control traffic. The transmission network either is owned by the wireless agent or leased by a third party service provider. Any number of transport technologies can be used in the links including packet carrier, packet visualization, Carrier Ethernet, IP/MPLS, GPON and XDSL [9].

V. APPLICATION OF 3G AND 4G

The 3G application are used for many application such as : The 3G mobile can be used as a modem for a computer that can access the internet and can download games and songs at high speed. 3G technology provides high quality voice calls and video calls. View live TV broadcasting in mobile. Get Weather updates and news headlines in mobiles.

3G bit rate increase which helps service providers to provide high speed internet facility and many applications to their customers. 3G devices can provide data transmission speed up to 2mbits/s when used in stationary mode. Provides multimedia services such as sharing of digital photos and movies.

This technology provides real-time multi-player gaming and location-based services. 3G lets the user to be online all the time and to have mobile office services, like virtual banking and online sales. Teleconferencing at work is one of the best applications[10].While 4G application: 4G will provide for a vast no. of presently nonexistent application for mobile devices . The 4G device will differ from the present-day mobile device in that there will be navigation menus. 4G provides a seamless network for users who travel required uninterrupted voice/data communication[10].

COMPARISON BETWEEN 3G AND 4G

The specification of 3G and 4 G are depicted in Table (1)

Table (1): Specification Comparison of 3G and 4G

Specifications	3G	4G
Frequency Band	1.8 – 2.5 GHz	2 – 8 GHz
Bandwidth	5-20 MHz	5-20 MHz
Data rate	Up to 2Mbps	20 Mbps or more
Access	Wideband CDMA	Multi-carrier – CDMA or OFDM(TDMA)
FEC	Turbo-codes	Concatenated codes
Peak Download Rate	100Mbit/s	1Gbit/s
Data Throughput	Up to 3.1mbps	3to5mbps but potential estimated
		at a range of 10 to300 Mbps.
Frequency Band	1.8 – 2.5GHz	2 – 8GHz
Services And Applications	CDMA 2000, UMTS, EDGE etc	Wimax2 and LTE-Advance
Network Architecture	Wide Area Cell-Based	Integration of wireless LAN and Wide area
Peak Upload Rate	50 Mbit/s	50 Mbit/s
Switching	Circuit/Packet switching	Packet switching

VII. CONCLUSION

The major difference between 3G and 4G is velocity 4G get broadband to your phone. If you want to future-proof your mobile communications and entertainment, you need 4G, with speeds of up to ten times faster than 3G. With 4G, it has the latest and fastest phone network in the country, allowing you to watch live TV, stream movie multiple games on your phone.

REFERENCE

[1] A. Eriksson. (2017, 30 may 2017). *3G History and Background*.

[2] (2017, 2nd may 2017). *3G-vs-4G*. Available: <http://www.diffen.com/difference/3G-vs- >ference/3G-vs-4G

[3] A. M. M.Phil, I. J. o. R. i. I. T. 5G Mobile Network Data Offloading Method a Survey ', and p. 3(2001-5569), "Comparative Studies of 3G, 4G 5G Mobile Network Data Offloading Method a Survey " *International Journal of Research in Information Technology* vol. 3, 2015.

[4] K. Kumaravel, "Comparative Study of 3G and 4G in Mobile Technology," *IJCSI International Journal of Computer Science Issues*, vol. 8, 2011.

[5] (2017, 2nd March 2017). *3G Technology* Available:https://www.engineers http://www.engineersgarage.com/ articles/what-is-3g- >arage.com/articles/what-is-3g- technology-specifications

[6] A. Kavas, "Comparative Analysis of WLAN, WIMAXand UMTS Technologies," ed, 2014.

[7] A. A. Osman, "Enhancing Data Encryption using Elliptic Curve Cryptography (ECC) Algorithm in 4G Networks" *International Journal of Advanced Research in Computer Science and Software Engineering* vol. 7, 2017.

[8] S. a. R. Arun Kumar, "Comparision of 3G Wireless Networks and 4G Wireless Networks" *International Journal of Electronics and Communication Engineering* vol. 6 2013.

[9] n.d., "Architectural Shift from 4G to 5G Wireless Mobile Networks " *International Journal of computer sciencs and mobile computing* vol. 3.

[10] S. Y. C.Theebendra, M.K.Pavithra "Network Evolution in 3G / 4G: Applications and Security Issues," *International Journal of Computer Science Engineering and Technology(IJCSET)*, vol. 4, 2014.

