Implementing and Evaluating QoS while Handover between Stations in 4G/3G Network using OPNET

Jyoti[1] and Ashok[2]

[1]M. Tech. Scholar, Department of Computer Science and Engineering,
BITS College of Engineering, Bhiwani, Haryana (India)

[2]Assistant Professor, Computer Science and Engineering Department,
BITS College of Engineering, Bhiwani, Haryana (India))

Abstract

Mobile technology is one of the grooming and versatile topic of present times and is developing extremely fast at present time. Use of 3G and 4G is common hence their mobility control is also one of the major aspect to be considered. In fast moving world mobility of smart phones make us to compare the handovers of 3G and 4G network. There are various characteristics over which handover depends and in this paper implementation and elevation of QoS of handover between stations is stated.
Keywords: UMTS, 3G, 4G, LTE.

1. Introduction

The past decades have shown a great achievement in advancement of the mobile communication technologies. Since its development various versions of technology came like 2G, 3G, and 4G etc. [1] the end to end quality of the network becomes a major factor for choosing the network. There is difference in performance of the networks as moving 2G to 3G and so on. As we move from 2G to 4G the speed of data transfer their reliability and signal to noise ratio is significantly improved as infrastructure supporting these technologies is improved.

2. History of Networks

At the end of 19th century electromagnetic waves were found as communication medium, offering mobile communication services with single cell system that possesses restriction in mobility, poor voice quality and even the equipment were heavy and expensive. With time to time evolution in networks takes place and equipment become light weight and quality becomes good, below is some characteristics of networks evolved.

3. The First Generation (1G)

In late 19th century cellular communication era was started. 1G mobile system provides services which were based on analogue radio transmission. [2] First operational cellular system in world was introduced by Japan named Nippon telephone and telegraph (NTT). This technology consists semiconductors and microprocessors which were light weight and more sophisticated. 1G was totally based on analogue signals and possesses poor carrier aggregation. Its data bandwidth was in Kbps with a poor peak speed up to 1.9 Kbps. Its cells were very large ranging from 2-20 Km. As this was starting of Networks so its security was least considered hence resulted in poor or no security. [3]

4. The Second Generation (2G)

In the end of 1980's another generation of mobile networks came into existence which supports low bit rate data services along with speech services and uses Time division multiple access and code division multiple access. When compared with 1G, it provides better data services and more advanced roaming facilities. It was more secured than 1G and possesses digitally encrypted phone conversations. It was more efficient and offers wide spectrum. It was the generation that offered power saving and SMS facility and was considered as efficient technology. It is based on digital voice and have carrier bit rate of 270 kbps and speech coding bit rate

of 13kbps. Its channel bandwidth was 200 kHz in GSM with no QoS (Quality of Service).

5. The Third Generation (3G)

In 2000, 3G enters in the world of wireless mobile communication. EDGE make high-volume movement of data possible, but packet transfer on the air interface still behaves as circuits switch call. It was decided to have a network which serve services that are independent of technology platform and whose network design standards are same globally[1]. Besides these reasons in response to the subscriber growth and demand for data services that require high speed access, 3G came into existence. IMT-200 standards for 3G were defined by the International Telecommunication Union (ITU). Third Generation Partnership Project (3GPP) in an organization that has continued that work by defining a mobile system that fulfil the IMT-200 standards.in Europe it was called UMTS (Universal Terrestrial Mobile System) and CDMA is the name of the American 3G variant. This offers video calls, mobile TV, Location-based services and internet browsing at faster speed. It also provides variable transfer speed ranging between 128 Kbps and 3 Mbps depending on the speed with which mobile device is moving within the network. 3G also provides users with better security. Additional features of 3G upgradation are HSPA (High Speed Packet Access) which helps to improve performance of UMTS. It uses improved modulation scheme which refining the protocols that mobile devices and base station use to communicate. HSDPA (High Speed Downlink Packet Access) and (High Speed Uplink Packet Access) are 14.4 Mbps and 5.76 Mbps respectively. HSPA+ (High Speed Packet Access) which is able to deliver speeds up to 11.5 Mbps and the downlink and 2.8 Mbps on the uplink. [1]

3G network was delayed in same countries because of various reasons such as in many countries 3G network do not use the same radio frequencies as 2G, so building an entirely new network and license entirely new frequencies were the biggest issues. Beside these Licensing fees in some European countries were extremely high, other delays were due to the expense of upgrading equipment for the new system. United State is the exception of some of these reasons as there carrier operates 3G services in the same frequencies as other services. But 3G technology is much more flexible as it can support major radio technologies that operate under CDMA, TDMA and FDMA. The main aim of this technology is to allow much better coverage and growth with minimum investment [2].

6. The Fourth Generation (4G)

4G technology is evolving technology in field of mobile communication. Now the data requirement is increased with a huge pace, hence the development of rate of downlink and uplink throughputs becomes important and efforts are made for the same by applying higher modulation techniques. A LTE (Long Term Evolution) project was launched in November of 2004 to ensure competitiveness of UMTS for future prospect. LTE is considered as the evolution of UMTS. LTE is an all IP based system. An operator having GPRS/EDGE network or even a non-3GPP system can also connect to LTE network, as a result of such flexibility, LTE is popular choice of most of the operators worldwide. It uses Orthogonal Frequency Division Multiple Access (OFDMA) hence capable of providing download rates about 100 Mbps and is based on Multiple-Input Multiple-Output (MIMO). It provides better mobility with much efficient radio usage and possess a high level of security and is much cost efficient and it has significantly reduced delay. Voice quality in this network is extremely good with having a simple protocol structure.

7. Difference between 3G and 4G networks

3G is spreaded worldwide and is known to be the best network of past times but now 4G is a latest one and somewhat replaced 3G in terms of speed and quality. There are various technology resides in 3G like WCDMA, HSPA etc. whereas under 4G there resides WIMAX, LTE etc.[4]

They are compared in terms of speed and 4G is faster than 3G. This speed was only reachable from LAN but now 4G has a significant speed. [5] There's another significant difference between 3G and 4G, which says that 3G is based on circuit switching whereas 4G is based on packet switching. The circuit switching keep the connection tied to mobile through the communication whereas packet switching is not based on holding a connection, data reaches its destination in forms of packets and then combined to convey whole data. This makes the efficiency of 4G network greater than that of 3G.

8. Analysis

8.1 Packet Delivery Ratio: It is a ratio between the numbers of packets that are received to the number of packets that are sent.

PDR= (total number of packets received/total number of packets sent)*100 and shown in Table 1:

Table 1: Packet Delivery Ratio

Mobility	Total Packet sent	Received by 4G	Received by 3G
0-10	1200	1200	1199
10-20	1200	1199	1198
20-30	1200	1200	1197
30-40	1200	1200	1198
40-50	1200	1200	1198

8.2 Throughput

It defines the total number of sent bits in per second.

Throughput= (total number of bits received/total number of bits sent)*100 and shown in Table 2:

Table 2: Throughput

Throughput			
Mobility	Total Packet	4G	3G
0-10	1000	999	996
20-30	1000	997	996
20-30	1000	997	995
30-40	1000	995	993
40-50	1000	996	991

9. Conclusion

The performance of both the technology is analysed and the performance of 4G is found out to be optimal in case of high mobility. 4G id found to be the fast with least collision and hence it is concluded that 4G is better than 3G in terms of services.

References

[1] Kanupriya Singh, Sanjeev Thakur, Somya Singh, "Comparison of 3G and LTE with other Generation", International Journal of Computer Applications (0975–8887) Volume 121– No.6, July 2015.

[2] "3G and LTE", www.engineeringgarage.com, (last access) 13, 11 2013.

[3] BG Evans and K Baughan, "Visions of 4G", Electronics and Communication engineering Journal, Vol. 12 ,No. 6, pp 293-303,Dec. 2015.

[4] Arun Kumar, Suman and Renu, "Comparison of 3G Wireless Networks and 4G Wireless Networks" International Journal of Electronics and Communication Engineering. ISSN 0974-2166 Volume 6, Number 1 (2013), pp. 1-8.

[5] Shipra Gupta, Supriya Shakya, Himanshu Tyagi, "The 4G Technology V/S other G Technologies", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 3, Issue 3, March 2013.