Design of 4G – Long Term Evolution (LTE) based Architecture for m-Health Application

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Abstract- LTE is becoming an ultimate choice for 4G services around the world due to its higher data rates and lower latency objectives. E-Health services comprise a wide range of healthcare services delivered by utilizing information and communication technology. In order to help existing and emerging e-Health services over converged next generation network (NGN) architectures, there is a need for network QoS control mechanisms that meet the often stringent requirements of such services. However, there are several challenges and issues that need to be addressed. In this paper we have proposed m-health care system based on 4G LTE network communication instead of existing 3G communication system. We have provided a comparison of QoS parameter evaluation of 4G LTE and 3G network. The experimental results shows better throughput and delay in proposed methodology as compared to existing 3G and 4G implementations of m-health systems.

Keywords- NGN, QoS, 4G, LTE, Health Care

I. INTRODUCTION

Portable WiMAX and LTE innovations have been considered for remote broadband access as they develop towards the 4G systems that can convey up to 100Mbps and past. Versatility support and arrangement of high information rates settle on 4G systems the decision of things to come broadband Internet get to. In rustic zones where just the sending of remote is possible and practical the 4G systems are inescapable. The remote broadband part of the NBN covers numerous country networks of various shapes and sizes from the little regions with high populace thickness to tremendous topographical territories that are meagerly populated. Unmistakably, fitting dimensioning of the entire access organize is urgent to guarantee the general expense is limited under an imperative that the predetermined information rates are ensured to every one of the clients paying little mind to their land areas. When the system has been dimensioned, its qualities may change. For example, the heap at the center system, which associates a base stations to the Internet increments or the activity request of a cell increments past the conjecture because of changes in populace thickness or application circulations. In these circumstances, a system without proper QoS plans will most likely be unable to deal with these dynamic changes and thus QoS of associations corrupts. Subsequently, it forces a necessity on the system administrators to re-measurement the system. Though, with the work of proper QoS plans the system administrators can oversee increment in the information request and the heap at the center system to a specific degree, without the need to measurement.

The idea of m-wellbeing was first presented and characterized in these trades as "versatile processing, therapeutic sensor, and correspondences advances for social insurance" [2]. From that point forward, it has turned out to be one of the key spaces inside the e-wellbeing and remote telemedicine, joining real scholarly research and industry disciplines around the world. This fundamental idea of the main meaning of m-wellbeing is outlined in Fig. 1. One of the key notes expressed that the "union of data and broadcast communications around telemedicine and portable telecare frameworks is encouraging a decent variety of monetarily shrewd and productive versatile applications and will give another measurement to the primary definition and idea of telemedicine as 'drug rehearsed at separation' that will visualize new portability bearings in reshaping the structure of human services conveyance extensively into the following thousand years." [1].This intense expectation was the way to the huge triumphs of m-wellbeing frameworks that we witness today. Besides, from that point forward real advances in these m-wellbeing sub disciplines were presented inside the overall research network. In particular, significant advances were presented in the versatile broadband and remote web m-wellbeing frameworks [4]. Comparable advances in wearable and body territory sensor systems and difficulties were also announced [3].

One of the significant leaps forward and extremely important occasions in this development is the introduction of the fourth-age (4G) portable correspondence systems.[5],[6],[7]. The introduction of 4G advancements and systems in this decade will bring new administrations and buyer use models that will be perfect with these rising portable system designs. It is convenient that such significant development is in like manner reflected in relating m-wellbeing frameworks and benefits and presented as 4G wellbeing. This new idea is characterized as "The development of m-wellbeing towards focused customized medicinal frameworks with versatile functionalities and similarity with the future 4G systems."

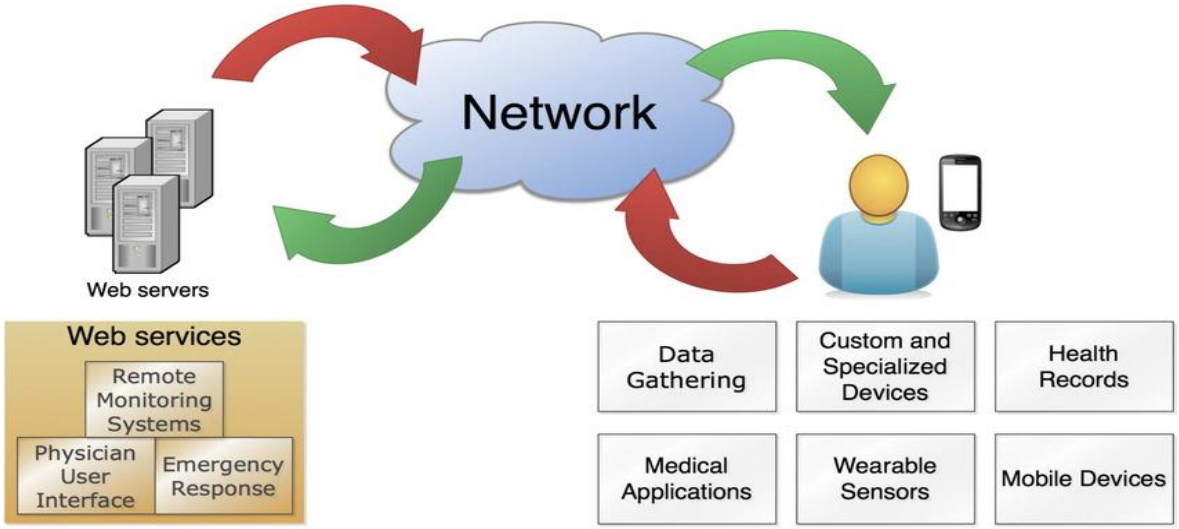

Fig.1: Concept of m-Health

II. LITERATURE REVIEW

QoS courses of action proposed for 4G system can be ordered dependent on the layer in which the component works. In spite of the way that exploration to give QoS in 4G organize has occurred in data associate, physical, transport and application layer, dominating structures are accessible in system layer. An alternate methodology is cross layer structure for giving QoS in 4G systems where it attempts to enhance engineering transversely over nearby layers. Customary methodology has been to regard the layers as various elements. A higher layer tradition just makes utilization of administrations at lower layers and isn't worried about the execution of administration.

Marques et al. proposed an IP-Based QoS Architecture which reinforces numerous entrance systems and various specialist organization situations. It is an incorporated administration approach to manage benefit by virtue of heterogeneous system. Portable system get to depends on the connection between QoS intermediaries and Authentication, Authorization, Accounting and Charging frameworks (AAAC) [3]. QoS hailing design which incorporates asset administration and versatility administration is similarly exhibited. Engineering is created with the idea of space asset administrator and equipped for supporting distinctive handover types [4]. Hardly any methodologies consider center issues in the structure of QoS component (e.g. [5]). Regardless, they disregard to give a totally incorporated QoS approach to manage IP-based correspondence for assortment of usages and traditions. Ordinarily versatile applications are dismissed and portability issues are not taken consideration.

Rui et al proposes a conclusion to-end QoS respond in due order regarding 4G IPbased systems equipped for supporting an extensive variety of administrations, from heritage to versatile sight and sound. It in like manner supports client versatility, both intra-and between area across over various access advances [6]. It is an adaptable game plan, in light of DiffServ to give layered asset control. Asset administration is performed on a for each total commence in the center. A few access organizes (A), which are fit for supporting distinctive access advancements, are available in each Administrative Domain (AD). A center subdomain is also present inside every AD to give interconnection between the entrance arranges through Subdomain Routers (SR). Association with other authoritative spaces is given through Edge Routers (ER). To give QoS to assortment of administrations, novel functionalities are added to the Access Routers (AR). ARs stamp and perceive particular streams. ARs in like manner decipher different QoS reservation instruments, for instance, the IntServ [7], Resource Reservation Protocol (RSVP) [8] into Differentiated Service Code Point (DSCP) markings and QoS Broker solicitations. Gathering of all of these limits is called Advanced Router Mechanisms (ARM) [9]. In every space, an Authentication, Authorization, Accounting, Auditing and Charging (A4C) server is accessible.

III. PROPOSED METHODOLOGY

In proposed work we are using 4G LTE networks for data communication in m-heath devices. We will be comparing QoS parameters of 3G and 4G LTE network with respect to Delay, Jitter, Throughput, Energy efficiency and Packet Data Rate (PDR). The below figure demonstrates the working of proposed system.

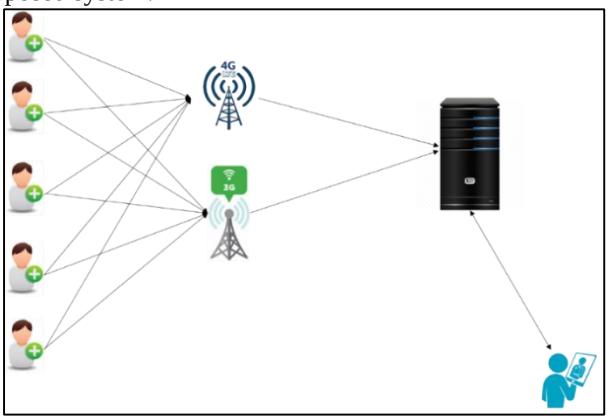

Fig.2: Proposed System Workflow

In proposed system N number of patient health monitoring devices are connected to both 3G and 4G LTE network. Using such system we can easily compare the working of both networks and their QoS parameters. The system indicates a server that is used to receive and transmit data from patient devices to the application available with doctors that are monitoring the status of patients.

The simulation of the system will be done in NS3 with required setup like number of client nodes and application nodes with server and bandwidth configuration. Below are various configurations that needs to be done in 4G LTE network.

```
default ns3::LteHelper::Scheduler "ns3::PfFfMacScheduler"
default ns3::LteHelper::PathlossModel "ns3::FriisSpectrumPropagationLossModel"
default ns3::LteEnbNetDevice::UlBandwidth "25"
default ns3::LteEnbNetDevice::DlBandwidth "25"
default ns3::LteEnbNetDevice::DlEarfcn "100"
default ns3::LteEnbNetDevice::UlEarfcn "18100"
default ns3::LteUePhy::TxPower "10"
default ns3::LteUePhy::NoiseFigure "9"
default ns3::LteEnbPhy::TxPower "30"
default ns3::LteEnbPhy::NoiseFigure "5"
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The QoS parameters that we will be monitoring are briefed in below section. It will provide a brief overview of what we need to compare in 3G and 4G LTE Networks.

a) Throughput: It is the data rate (bits per second) of the successfully received traffic on the network.

b) Queuing Delay: It indicates delay of packets at the queue of a base station's buffer. In situations, when the packets departure rate from the buffer is less than the arrival rate to the buffer, the queuing delay increases. Queuing delay has a significant impact on the performance of real time applications, such as voice, live streaming and online gaming.

c) Packet Loss: In this thesis it refers to the packet loss at the output buffer due to an overflow. It happens only when the rate at which packets arrive in the buffer is more than the rate at which they leave the buffer. Similar to queuing delay, packet loss has a significant impact on the QoS of real time applications.

IV. CONCLUSION

In this paper, we analyzed the performance of the LTE network using ns3 network simulator. The performance of the LTE network is analyzed on the basis of the QoS parameters such as latency, packet loss and delivery ratio. These parameters vary depending upon the traffic and the type of application the user interacts with the network. The traffic variations are done mainly with the packet sizes of the data to be transmitted in the network. The variations in the packet sizes and the distance of the users from the node can be satisfied to achieve the desired QoS in the LTE network with minimum losses and delay. Using the proposed system we are able to enhance the working of 4G LTE network for m-health system for moving nodes.

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