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Rapidly IPv6 multimedia management schemes based LTE-A wireless networks

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Article Info

ABSTRACT

Ensuring the best quality of smart multimedia services becomes an essential goal for modern enterprises so there is always a need for effective IP mobility smart management schemes in order to fulfill the following two main functions: (I) interconnecting the moving terminals around the extended indoor smart services. In addition, (II) providing session continuity for instant data transfer in real-time and multimedia applications with negligible latency, efficient bandwidth utilization, and improved reliability. In this context, it found out that the Generalized Multi-Protocol Label Switching (GMPLS) over LTE-A network that offers many advanced services for large numbers of users with higher bandwidths, better spectrum efficiency, and lower latency. In GMPLS, there is an elimination of the routing searches and choice of routing protocols on every core LTE-A router also it provides the architecture simplicity and increases the scalability. A comparative assessment of three types of IPv6 mobility management schemes over the LTE-A provided by using various types of multimedia. By using OPNET Simulator 17.5, In accordance with these schemes, it was proven that the IPv6-GMPLS scheme is the best choice for the system's operation, in comparison to the IPv6-MPLS and Mobile IPv6 for all multimedia offerings and on the overall network performance.

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1.   INTRODUCTION

Nowadays, by the use of advanced smartphones a serious issue could be noticed clearly with the currently using of Long Term Evolution Advanced (LTE-A) networking approaches that are very limited with regard to high mobility, increased offering of larger bandwidth and higher acceptable values demand of multimedia quality of service (QoS). In addition, the wide spread of new advanced devices and services are making mobile networking even more complex also causes network congestion problems . For example, the emerging end-user applications such as video streaming, voice and web browsing have to fulfill certain QoS requirements, such as low latency and guarantees of constant data rate. In this regard, the IP traffic management process represents a major issue in mobile communication [1]; thus, the IP management scheme has a major role regarding the service performance and the overall network performance. Furthermore, there is no doubt that the transmission speed of wireless communications is constantly increasing with the appearance of new advanced and enabling technologies [2].

Therefore, many researchers have proposed several significant modifications that have been demanded in order to attain robust next generation LTE-A architecture. Hence, the IP mobility management

(i.e. IP handover/handoff management) is considered to be the main concern in LTE-A architecture with regard to bringing mobility [3]4]. In this sense, Meenakshi Sundaram R. proposed a new integrated IPv6-MPLS architecture that offers IP-integration, end-to-end quality of service, security, scalability, resiliency and management enhancements for the deployment of data, voice and video services. In addition, they have established a test bed in order to test the performance of their proposed architecture [5]. Furthermore, Dr. S. Thabasu kannan and T. Vengatesh provided an unprejudiced experimental performance analysis between the two protocol stacks (IPv4 and IPv6), focusing on how it related to the performance on identical settings. They found out that the network performance does not depend only on the IP version and traffic type, but also on the choice of the OS. This experimental assessment proved beyond any doubt that the IPv6 is not yet a mature enough technology; thus, in many cases, the performance of IPv6 proved to be worse than IPv4, enduring an overhead that is much higher than its expected theoretical counterpart [6]. J. Amutha, et al,. proposed an Integrated Secure Architecture for IPv4/IPv6 Address Translation between IPv4 and IPv6 Networks, with an IPv4/IPv6-Enabled Gateway Translator (IP46EGT); and that is in order to attain MAC-level, VPN-IPSec and Certificate level security. In this regard, they evaluated the network performance and tabulated the acquired results. This newly suggested architecture provided data integrity, availability and authentication, hence providing end-to-end secure communication between the source and the destination [7]. Within the same context, Yunes Abdussalam Amgahd and Raghav Yadav provided a detailed study about the current state-of-the-art Mobile IP protocols in Mobile IP networks. First, they discussed the existing works on routing and handoff; then, they analyzed the existing security mechanisms by categorizing the security mechanisms as follows: security on route optimization and security during handoff. After that, they provided an overview for the key concept, used metrics, and the advantages and drawbacks of each mechanism [8].

Moreover, Walaa F. Elsadek and Mikhail N. Mikhail addressed the assessment of IP mobility and the difficult challenges before global mobility in real 4G LTE deployments. In this regard, the focus of researchers has always been attracted by software defined networking (SDN) with its logical centralized control plane; and that is in order to affect the decision directly during real time motion. Therefore, some SDN researchers have suggested several attractive ideas in order to enhance the mobility performance in real deployments with seamless expansion cross providers; while other researchers had fears about the performance degradation, as the controller represents a single point of failure. On the other hand, other researchers oversimplify the existing challenges in mobility, and offer non-feasible solutions [9]. A. Elakkiya and P. Selvaraj, on the other hand, introduced new SDN-based architecture for the LTE packet core network, in order to enhance the QoS management. In this context, they suggested a dynamic QoS-based IP handoff management procedure with the purpose of handling the application-centric mobility management. This QoS-based handover process is meant to ensure the required level of quality for the on-going connections in accordance with the policies enforced by the SDN controller. Although the same IP handover mechanism may not able to fulfill the various requirements of the applications or the several networking scenarios in an optimal manner, the introduction of SDN in LTE network has enabled the management of mobile networks with utmost flexibility in lower cost [10].

According to the previous studies mentioned above, this current case study will modify on the weakness points provided through the use of Mobile IPv6, Mobile IPv4 and IPv6-MPLS schemes on the core infrastructure of 4G networks in the previous studies by using two implemented IP traffic management schemes the IPv6-MPLS and IPv6-GMPLS based the 4.5G networks. this current paper aims to add new ideas and contributions regarding the following: *(I) Throughput:* Usually, a high amount of data drops during the process of multimedia streaming transmission, leading to the low quality of the received data; nonetheless, higher throughput rates could be achieved through the use of IPv6-GMPLS based LTE-A network. In addition, *(II) Delay Reduction:* The issue of higher delay ranges during the process of data transmission is present at all multimedia applications; nonetheless, the delay rates could be decreased under conditions of increasing the coverage and mobility, through the use of IPv6-GMPLS over LTE-A. Furthermore, *(III) Increasing Coverage Area:* We can solve the delay issue providing high performance, through the use of IPv6-GMPLS that enables us accessing multimedia anywhere and increasing the distance. In addition, *(IV) Bandwidth:* The issue of bandwidth limitations faced by multimedia during the process of transmission could be solved through the use of IPv6-GMPLS based LTE-A network.

That is to say, an improvement of the multimedia QoS parameters, as well as increasing the speed of multimedia access, with higher rates of SNR and lower rates of BER could be achieved. In this regard, this current paper suggests a new approach represented in the proposed metrics for evaluating the QoS performance of the LTE-A network; and that is by covering the IPv6-labeling mechanisms in networks beyond 5G that occur between the eNBs. In addition, no all previous studies addressed the impact of using the proposed schemes compared to the other traditional mobile IPv6 scheme on the multimedia and the overall network performance. That is to say, in this current paper, the researcher will provide a comparative study between the MiPV6 scheme, IPv6-MPLS scheme and the IPv6-GMPLS scheme through the

measurement cases. Hence, the main objective of this current research is to analyze, characterize and differentiate between the performance of the three schemes based on the LTE-A network, resulting in the decrease of the packet loss during the process of transmission, as well as the improvement of the overall network performance through the use of IPv6-GMPLS scheme. The rest of research is: section 2 which discusses the research methods used in this paper and the QoS matrics used in our framework. Then section 3 which illustrates the simulations results and the general discussion of results. Finally, section 4 which includes the conclusion of research and future remarks.

2. RESEARCH METHOD

2.1. Mobile IPv6

MIPv6 permits path optimization that allows the central node to perceive the location of the mobile nodes after sending its first packet; i.e. whilst the central Node (CN) transmits the primary packet to the mobile Node (MN). The mobile IPv6 packet as shown in Figure 1 could be transmitted to the home agent of the MN that forwards it to the overseas agent serving the MN at this actual time [11-17].
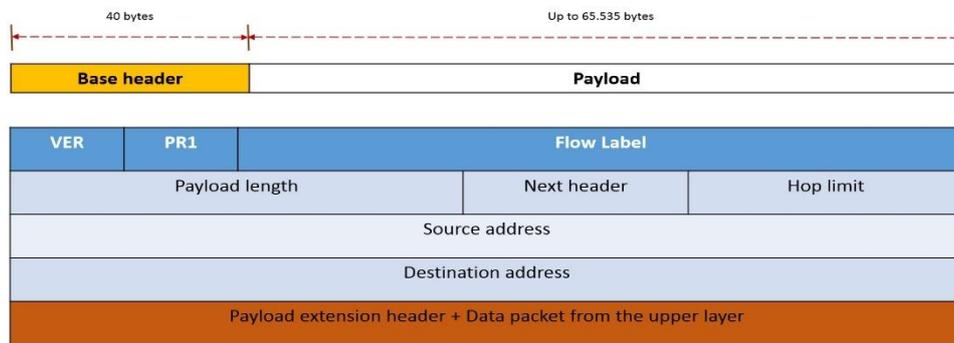

Figure 1. Mobile IPv6 header

2.2. MPLS

Not like the IP protocol, MPLS reduces the quantity of routing searches and gets rid of the need to have a specific routing protocol on every router. With the aid of assigning a label to every packet, it's far feasible to keep the simplicity of an structure and additionally to growth its scalability. Multi-protocol label switching (MPLS) is a generation for integrating the distinctive sorts of information including net textual content, audio (voice), video and many others. from numerous assets, e.g., Ethernet, WLANs and ATM; within the other phrases, it lets in the MPLS traces to extend the traffic handling abilities of the second layer (in line with open system Interconnection (OSI) model) [18-22], e.g., Asynhcrouns transfer mode (ATM) and frame Relay networks. Consequently, MPLS traffic generation could be very vital for multimedia service carriers and typically internet provider companies (ISPs) considering backbone or core networks have to assist an to be had high bandwidth for those usages, so the networks should be very stable, reliable and excellent quality of service (QoS) assured wherein they are able to resist conversation link or node disasters. QoS may additionally have many unique sorts of meanings in every application, as an example a network may be put off aware (for real-time usages), bit rate-aware and so forth. As illustrated in Figure 2, whilst a Label switching router (LSR) gets a packet, it performs one or extra of the subsequent movements: (I) *push:* provides a label. That is normally carried out with the aid of the ingress router. Additionally, (II) *swapping:* Replaces a label. That is normally done by means of LSRs among the ingress and egress routers. Moreover, (III) *pop*: eliminates a label. That is most usually done with the aid of the egress router. This diagram illustrates how an easy MPLS network works as shown in Figure 3 [23-27].
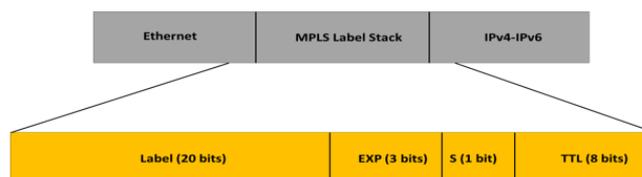

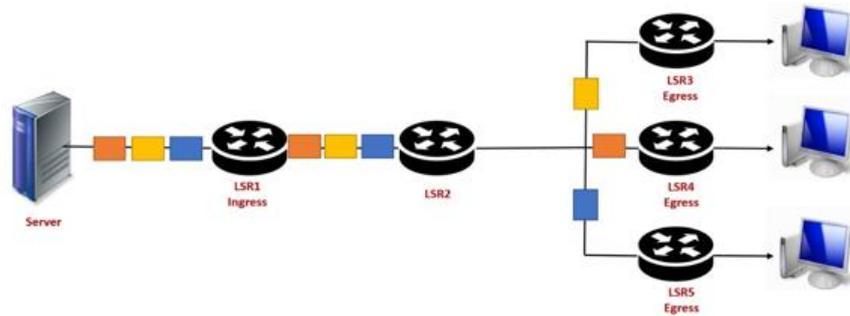Figure 2. MPLS label components

Figure 3. MPLS operation

2.3. GMPLS

GMPLS is conceptually just like MPLS, but rather than the use of a specific label to differentiate an LSP at every LSR, a few physical assets of the obtained data flow is used to infer which LSP it belongs to. The maximum generally used schemes are (I) the timeslot usage to become aware of the LSP, by using the time division multiplexing (TDM). Also (II) the wavelength usage to pick out the LSP, through the use of wavelength division multiplexed (WDM). Finally, (III) fiber or port on which a packet is obtained. LSPs are consequently implicitly labeled in a GMPLS network. GMPLS may be used to set up LSPs for circuit traffic (similarly to packet traffic). The usage of the TDM and WDM examples above, the LSP traffic is switched primarily based on continuous, steady assets of the information flow. The information flow is not always switched one packet at a time. This permits for a totally efficient implementation inside the data plane with 0 in keeping with-packet lookups, making GMPLS a exceptionally suitable protocol to run in excessive bandwidth networks. Beside this, GMPLS forwarding operation of the LSRs is much like the MPLS example mentioned above in Figure 3. At every LSR, the implicit label on obtained data determines the outgoing interface and the implicit label with which to transmit onwards data [28-30]. As shown in Figure 4, for MPLS, one in every of three vital signaling protocols label distribution protocal (LDP), resource reservation protocol for traffic engineering (RSVP-TE) and border gateway protocal (BGP) are used, relying at the application [31-32].
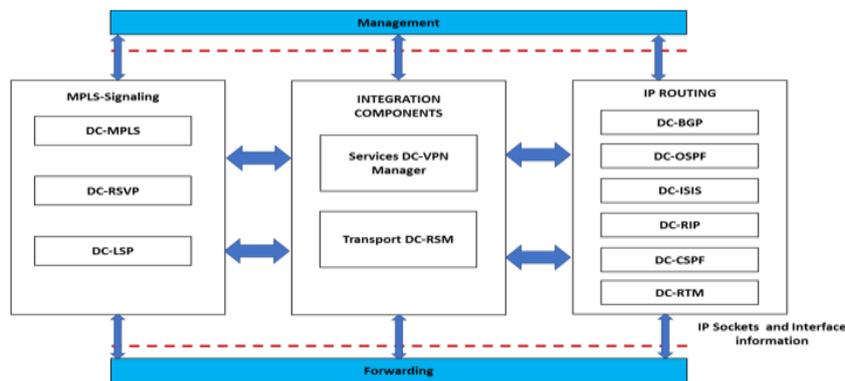

Figure 4. MPLS and GMPLS protocols

2.4. LTE-A overview

This section is concerned with the required basic knowledge and information, in order to fully understand the nature of the attacks on LTE-A networks. In this context, this section will provide an overview about the LTE-A network architecture as well as its security mechanism. Figure 5 illustrates the structure of the LTE-A network in detail. it is particularly consisted of a radio access network and a core network. As for the radio get right of entry to network, it's miles referred to as the E-UTRAN; as it developed from the original 3GPP UMTS terrestrial radio access network (UTRAN); consequently, the abbreviation (UMTS) refers back to the universal mobile telecommunication system. on this regard, the E-UTRAN includes multiple evolved-NodeBs (e-NodeBs), that have the identical features of the NodeBs, additionally, to many features of the Radio Network Controller within the UTRAN. Furthermore, the user equipment (UE)

and the e-NodeB are connected via the air interface (Uu interface) [33]. Moreover, the e-NodeBs are linked to every other via the X2 interface, as they're especially involved with the subsequent features: radio resource management, IP header compression and encryption for the user information, connection to the Mobility management Entity (MME) through S1-MME interface (to be able to achieve mobility management, paging customers, and passing None access Stratum (NAS) signaling, and many others.), and connection to the Serving Gateway (SGW) with the aid of the S1-U interface. Moreover, the LTE-A additionally helps HeNBs and relay node (RN); consequently, whilst a wide variety of HeNBs are deployed, home Base Station Gateway shall be deployed [34]. Figure 5 illustrates the structure of the LTE-advanced for the E-UTRAN. It is especially consisted of P-GW, S-GW, MME, S1-MME, eNB, HeNB, HeNB-GW and relay node as follows [35-37].
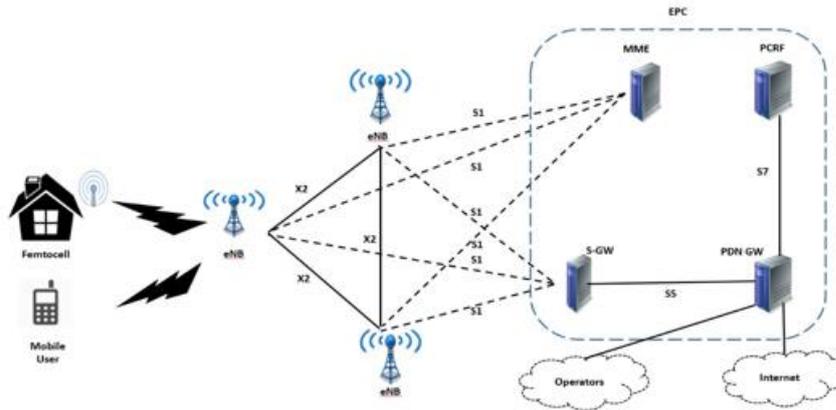

Figure 5. Architecture of the LTE-A network

2.5. QoS Performance Metrics
2.5.1. End to end delay

As illustrated in (1) and (2), the delay for one manner shall be much less than 200ms; in any other case, any E2E delay extra than 400ms shall be taken into consideration as unacceptable. Certainly, this component expresses an accurate estimation, for this reason, every router has its very own dtrans, dprop, dproc [38].

$$d_{E2E} = N[d_{trans} + d_{prop} + d_{proc} + d_{queue}] \tag{1}$$

$$N = Number\ of\ Links\ (Number\ of\ Routers - 1) \tag{2}$$

Where: (I) $d_{end-end}$ is referring to the end-to-end delay; also (II) d_{trans} is referring to the transmission delay; (III) d_{prop} is referring to the   propagation delay; (IV) d_{proc} is referring to the   processing delay; and (V) d_{queue} is referring to the queuing delay.

2.5.2. Packet delay variation

PDV should be less than 60ms; therefore, there are a subsequent 4 parameters which recognized so to calculate PDV: (I) Timestamp of the second transmitted packet; (II) timestamp of first transmitted packet; (III) timestamp of the second one arriving packet; and (IV) timestamp of the primary arriving packet. That is to mention, if the packet latency is constant value, PDV will equal zero because the difference in latency does no longer change from packet to packet, as illustrated in (3) [39].

$$PDV = |(R_{XA}) - (T_{XA}) - (R_{XB}) - (T_{XB})| = |(T_{XB}) - (T_{XA}) - (R_{XB}) - (R_{XA})| \tag{3}$$

2.5.3. Mean opinion score

MOS value refers the degree of the high-quality excellence of every voice and video telecommunication cellular offerings, the numerical value of MOS shall variety from 1 to 5; 1 being the worst quality and 5 being the great high-quality, as proven in (4) a procedure that could be highly time-consuming Where R are the individual ratings for a given stimulus by N subjects [40].

$$MOS = \frac{\sum_{n=0}^{N} R_n}{N} \tag{4}$$

2.5.4. Verage throughput

Throughput is the measure of overall quantity of packets which have efficiently reached the opportunity destination node inside a wireless network. On this context, the numerical value of the throughput shall usually be high, because it directly impacts the overall performance and class of offerings stated within the 4.5G networks. In this sense, calculate the physical layer information throughput for a few instances, as shown in (5) [40].

$$Throughput = Data\,[frames]\,/\,Time\,[s] \tag{5}$$

2.5.5. Signal-to-noise ratio

The SNR can be described as the ratio among the power strength of the original signal and the power strength for the unwanted noise. Further, it's also used to discover the sensitivity common overall performance of the destination. consequently, the appropriate values of the SNR for alerts shall be above 25 dB for the multimedia services, as illustrated in (6); where: 'P' stands for the strength of the incoming signal; 'I' stands for the interference power of the interfering signals inside the network; and 'N' stands for some noise terms that could be constant or random [41].

$$SNR(x) = P/(I + N) \tag{6}$$

2.5.6. Bit error rate

The BER can be described as the ratio between the overall numbers of errors to the complete quantity of transmitted bits. In this sense, if the channel among the deliver and the destination is at an excellent state with better SNR, the BER is probably very small and will realize the excellent quality and offerings; as a result, the video and voice signals are inside the best case, as described in (7) [42].

$$BER = Errors/Total\ Number\ of\ Bits \tag{7}$$

3. SIMULATION, RESULTS AND ANALYSIS
3.1. Simulation of scenarios

In the presented case, three identical scenarios have been implemented in order to differentiate between three IP traffic management schemes MiPV6, IPv6-MPLS and the IPv6-GMPLS schemes based on the LTE-A network. In addition, as shown in Figure 6, one mobile user has been used in the three networks rotating around three eNodes with the mobility feature with a high coverage-rotating radius. The path loss fading effects around three eNodes at the simulation runtime, which equals 482 seconds. In addition, shown in Tables 1, 2 and 3 that the three traffic management scenarios that three types of application used voice, video, and HTTP traffic by using three application servers. The OPNET Modeler 17.5 (Version 8) simulator is used for modeling the three scenarios. Furthermore, critical performance matrices are used to examine the performance of the overall LTE-A network such as (PDV, E2E delay, MOS, Jitter, Traffic Sent Received and the PLR) in the voice, video and HTTP heavy browsing data. Additionally, the BER, SNR, Downlink Packet Drop, Throughput used for measuring the performance of the overall LTE-A network.
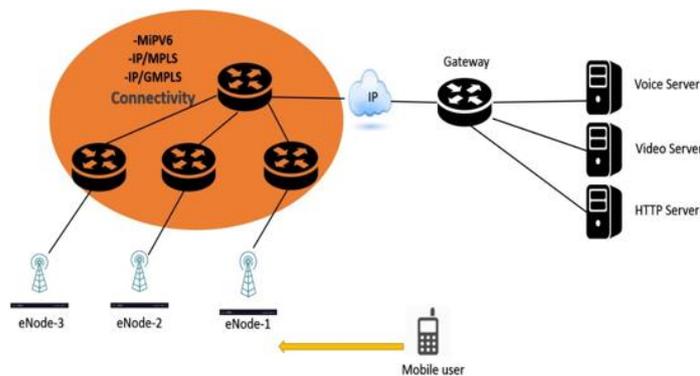

Figure 6. Network topology of the three IP schemes

Table 1. Voice parameters

Parameter	Value
Application Silence Length (s)	Mean 0.65, Exponentially distributed,
De-Compression Delay (s)	0.03 second
Talk Spurt Length (s)	Mean 0.352, Exponentially distributed
Encoder Scheme	PCM
Type of Service	Best effort (0)

Table 2. Video parameters

Parameter	Value
Frame inter-arrival time information	16 frame/sec
Frame size information(bytes)	128*240 pixels
Type of Service	Best effort

Table 3. LTE-A network parameters

Parameters	Value
SC-FDMA (UL) Frequency	1710 MHz
Hybrid OFDMA (DL) Frequency	2110 MHz
Transmission Power	26 dBm
Gain Antenna	17 dBi
Antenna Height	40m
Radius Coverage	25Km
Propagation Model	Urban
Duration of simulation	482s

3.2. Simulation results
3.2.1. Case-1: voice

As shown in Figure 7, there is an immense variation in the voice quality according to the MOS; thus, using the MiPV6, the value of MOS is about 1.12. In addition, there is degradation up to 2.6 on the quality of voice using IPv6-MPLS then it will increase to 4.2 all over the simulation after the use of the IPv6-GMPLS scheme. Therefore, based on the resulting high quality for voice, we conclude that using IPv6-GMPLS scheme is preferred. Morever, as illustrated in Figure 8, in case of using the three schemes, the variation of packet delays satisfies lower values that verify 0.000001 second by using IPv6-GMPLS. In case of using the IPV6-MPLS and MiPV6, packet delay variation will differ from 0.0002751 to 0.0008 respectively by using MiPV6.
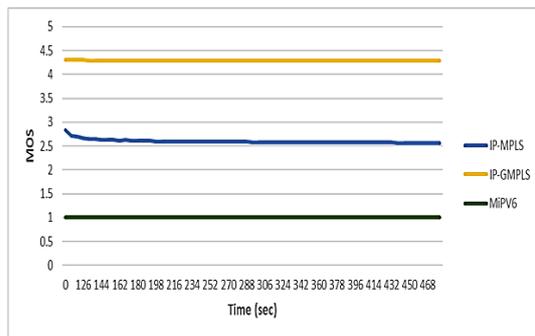

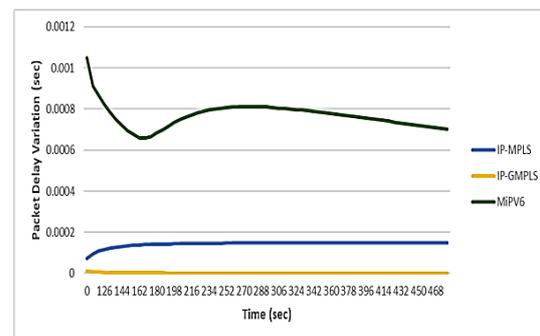Figure 7. MOS using three IP schemes

Figure 8. PDV using three IP schemes

According to Figure 9, a small voice jitter value approximately equals zero, after the use of IPv6-GMPLS scheme, compared to -0.00000124 sec with the IPv6-MPLS; then by using the MiPV6 the value will increment up to 0.00002 sec. Then will decrease to 0.0000042 sec at the end of simulation this shall in turn influence the overall transmitted voice traffic. In addition, Figure 10 illustrates that the value of the E2E delay satisfies values near to 0.10376 and 0.61034 seconds in case of using the IPv6-GMPLS and IPv6-MPLS enabled respectively. On the other hand, it will be equal to 3.278 seconds by using the MiPV6 at the end of the simulation.
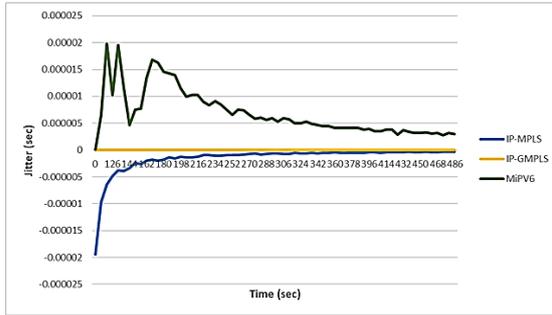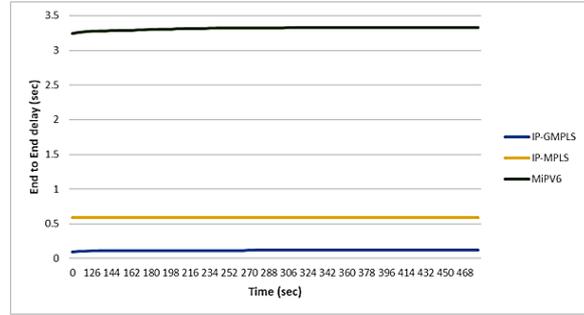
Figure 9. Jitter using three IP schemes

Figure 10. E2E Delay using three IP schemes

Figure 11 shows that the average traffic sent over the three schemes respectively equals 26000 (bytes/sec) at 482 seconds. However, Figure 12 illustrates that the traffic received through the use of IPv6-GMPLS approximately equals about 26000 (bytes/sec), and there are no losses with the IPV6-GMPLS. Nonetheless, in case of using MiPV6, there is a big packet drop in the traffic received, thus, approximately greater than 50% of the voice traffic dropped. On the other hand, approximately 40 % of the traffic dropped using IPV6-MPLS scheme hence, the packet loss ratio can be accumulated for each type, which equals 0.00523%, 42.308%, and 57.7 % respectively for the IPv6-GMPLS, IPv6-MPLS and MiPV6 schemes at the end of the simulation.
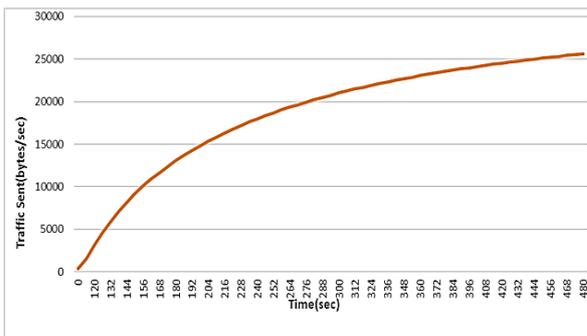

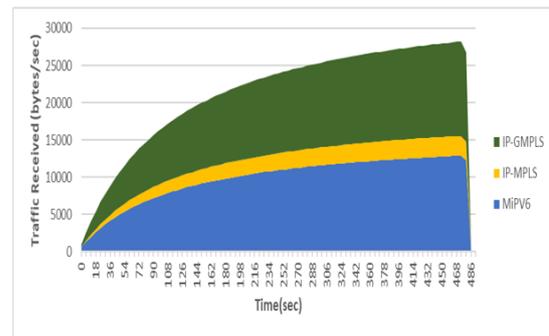Figure 11. Traffic sent using three IP schemes (bytes/sec)

Figure 12. Traffic received using three IP Schemes

3.2.2. Case-2: video streaming data

According to Figure 13, the values of the video E2E delay satisfy values after using the three mobile IP schemes, enabled respectively at the end of the simulation. However, the video E2E delay with the MiPV6 has a very high value under the condition of mobility and high coverage area approximately equal 2 seconds, it is a very big value for the delay, which will have a great effect on the quality of received traffic compared to the IPv6-MPLS, which approximately equal 0.9523 seconds. On the other hand, the IPv6-GMPLS is the best end-to-end delay value, which equals 0.000231 second, which is an acceptable value less than 500msec from the beginning to the end of the simulation time.

As shown in Figure 14, packet variation will be a very high value according to the high coverage area, hence, the accumulated value by using MiPV6 is 0.7102 second, it is a very big value and will effect on the traffic quality. Additionally, IPv6-MPLS packet delay variation will be decremented to 0.3 seconds .om the other hand the IPv6-GMPLS is the lowest packet delay value approximately equal 0.241 at the start of simulation then will be decreased to 0.002451 seconds and that is an acceptable PDV value.

Figure 15 shows that the traffic sent using the three IP mobility schemes over the LTE-A network using approximately equals 520000 (bytes/sec). Illustrated in Figure 16, it will be a big traffic loss using the MiPV6 scheme, which is due to the high values of the E2E delay and packet delay variation. Traffic received by using MiPV6 280000 bytes per second, then will increment by using the two other methods IPv6-MPLS and IPv6-GMPLS, which will equal 519500 and 505340 respectively. Therefore, the metric of PLR accumulated for the IPv6-GMPLS, IPv6-MPLS, and MiPV6 will equal 0.0961%, 2.819%, and 46.15% respectively.
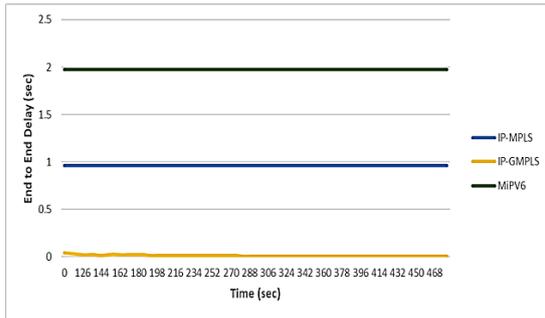
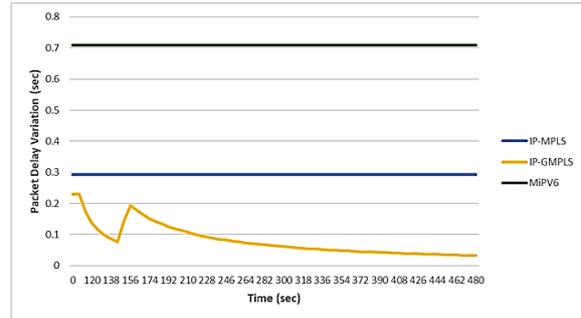Figure.13 E2E Delay for three IP schemes
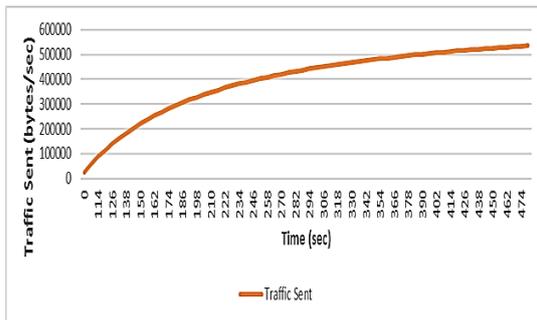

Figure 14. PDV for three IP schemes

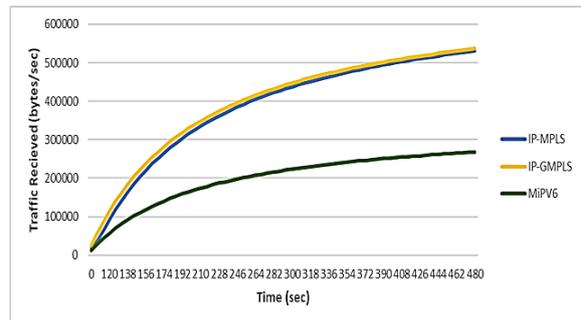Figure 15. Traffic sent using three IP schemes (bytes/sec)

Figure 16. Traffic received using three IP schemes

3.2.3. Case-3: HTTP

In Figures 17 and 18 shown that for the HTTP web browsing traffic the MiPV6 satisfied higher delay object and page response values approximately equal 6.9 seconds then increase up to 13 seconds and 0.39 second respectively. This will cause a bad influence directly on the traffic received quality compared with IPv6-MPLS and IPv6-GMPLS respectively these object response time values accumulated to be equal 2 seconds and 0.00012 seconds also the page response time approximately equal 0.05 and 0.01 second respectively. Additionally, In Figures 19 and 20, illustrated HTTP traffic sent at the start of simulation will be 63 bytes sent per every second then will decrement to 15 bytes per second at the end of simulation time, there are huge bytes dropped in the traffic received by using MiPV6 due to high response delay values. On the other hand, by the use of IPv6-MPLS and IPv6-GMPLS bytes received increased to 44 bytes per every second then decreased to 12 bytes per second and 59 bytes per second to 14.5 bytes per second at the end of simulation. The PLR values equal 1.6%, 26.6% and 80% respectively for IPv6-GMPLS, IPv6-MPLS and MiPV6.
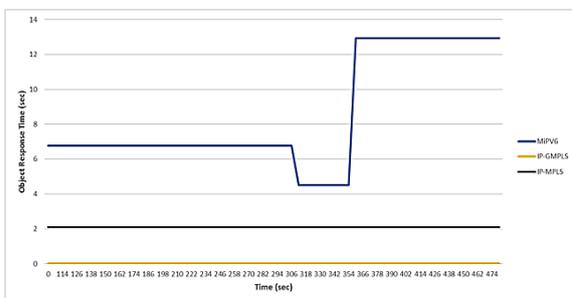

Figure 17. Object response time using three IP schemes (sec)
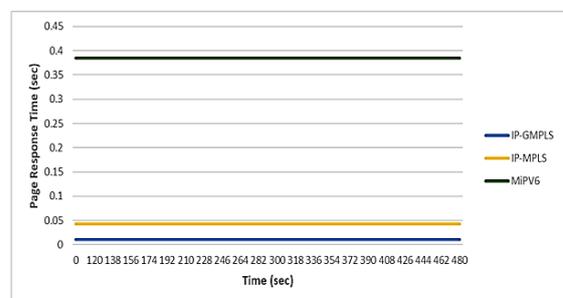

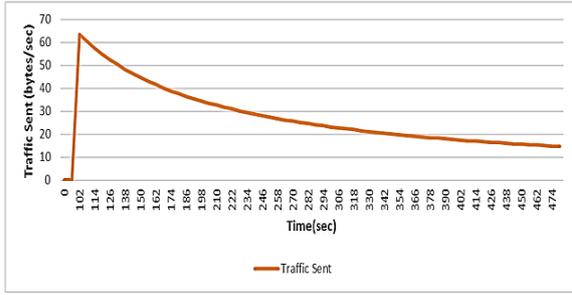Figure 18. Page response time using three IP schemes (sec)
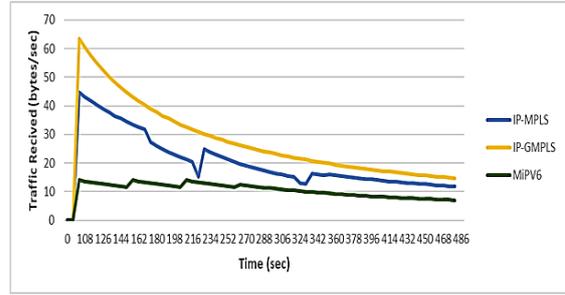
Figure 19. Traffic Sent using three IP schemes

Figure 20. Traffic received of three IP schemes

3.2.4. Case-4: network performance

The overall downlink packet dropped over the LTE-A network and by using the three schemes according to Figure 21 approximately 0.1, 0.26 and 0.512 packets per second by using IPv6-GMPLS, IPv6-MPLS and MiPV6 respectively. Hence shown there is a huge effect on the multimedia streaming by the use of IPv6-GMPLS on the LTE-A networks. In addition, according to our framework and as shown in Figure 22, the accumulated bit error rate values in case of using the IPv6-GMPLS are very small (about zero) over the downlink which will have an excellent influence on the multimedia streaming over the LTE-A networks compared with the other schemes. According to the simulated system and as shown in Figure 23, with using the IPv6-GMPLS scheme there was a very good throughput value accumulated approximately equal 6000000 bits per seconds at the end of simulation time compared with 4500000 bits per second by using IPv6-MPLS. On the other hand, the worst values accumulated by using MiPV6 which affected the overall multimedia streaming shown in the previous results. Illustrated in Figure 24, all the three schemes satisfy the acceptable values of the signal to noise ratio, the acceptable values of SNR must be larger than 23 dB in general.
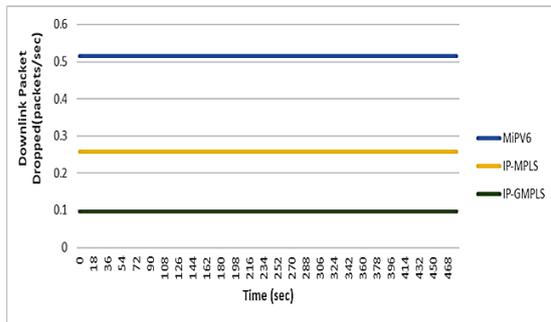

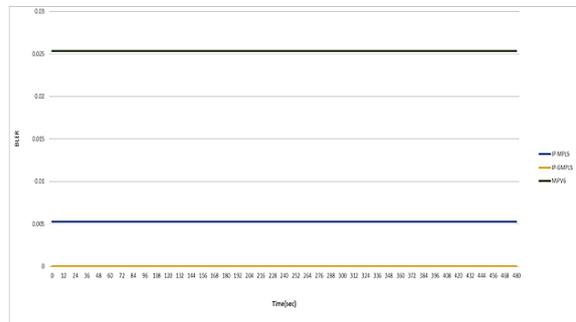Figure 21. DL Packet drop using three IP schemes

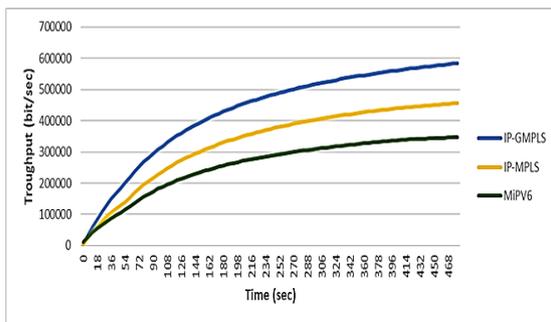Figure 22. DL BLER using three IP schemes
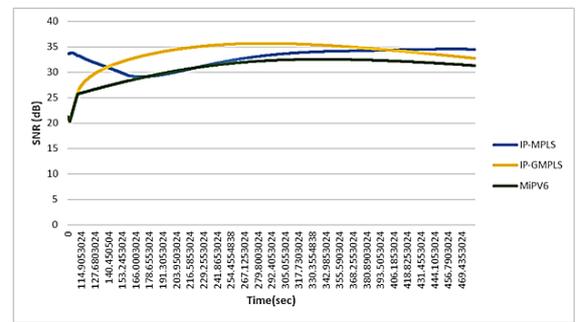

Figure 23. Throughput using three IP schemes

Figure 24. Downlink SNR of three IP schemes

3.2.5. General discussion

In this current case study, three IP traffic management schemes discussed the Mobile IPv6, IPv6-MPLS and IPv6-GMPLS, thus a complete comparison was provided between the three types of traffic management proposed schemes to maintain which one is better for the multimedia data streaming and totally LTE-A network performance under conditions of higher coverage, fading effects and mobility. According to results obtained, we found out that IPv6-GMPLS is an excellent choice for transferring heavy loads of traffic such as HTTP browsing, voice and video streaming. Usage of the IPv6-GMPLS in the core routers of the entire LTE-A network has an excellent impact on a critical voice performance matrices such as higher MOS values, lower packet delay variation, lower end-to-end delay, lower jitter, lower packet loss ratio values and higher bytes received compared with MiPV6 and IPv6-MPLS as mentioned in Figure 25, 26. Additionally in case of video streaming, the accumulated results showed a great influence by using IPv6-GMPLS compared with other IP schemes as illustrated in Figure 25, 26. Furthermore, IPv6-GMPLS effected on the quality of HTTP traffic, lower PLR value, lower delays and higher traffic received compared with MiPV6 and IPv6-MPLS as stated in Figure 25, 26. On the other hand, we have addressed the influence of the three schemes on the overall performance of the LTE-A network. The accumulated results illustrated that there is a great impact of using IPv6-GMPLS over the LTE-A performance such as higher SNR values, lower BER, lower downlink packets dropped per second and higher throughput bits per every second as shown in Figure 27. All of these obtained results preferred using IPv6-GMPLS in the entire LTE-A network than other methods.
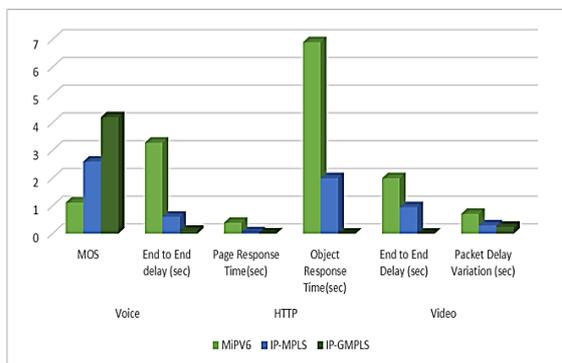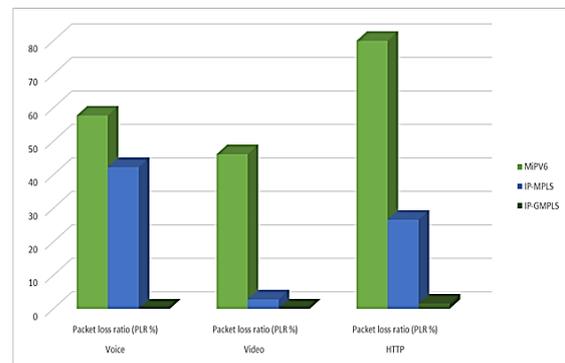

Figure 25. Multimedia results chart

Figure 26. PLR results chart
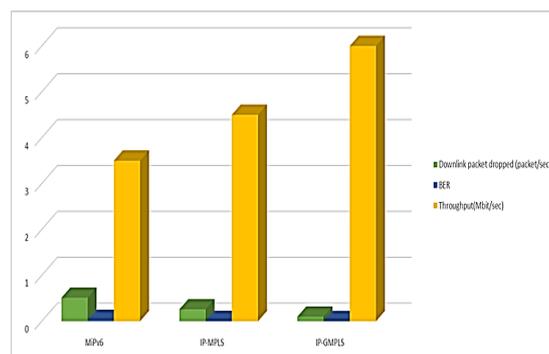
Figure 27. Overall network performance chart

4.   CONCLUSION AND FUTURE REMARKS

Due to incrementing of the mobile client service needs, with the network use growth and traffic hugeness. Mobile operators be to have the capacity to use new labeling techniques in the core to increase the overall quality of service. In this paper, we have introduced a real-time simulation; and the results showed that the Mobile LTE-A network could deliver sufficient bandwidth, while guaranteeing that the packet delays and jitter will fulfill the required parameters of multimedia streaming. In other words, we have addressed the OPNET simulated networks in order to identify the impact of IP mobility schemes across the LTE-A networks on multimedia streaming, with the objective of accomplishing a good empirical quality value on

both multimedia and the overall performance. For this end, we have presented an analysis for a number of critical parameters such as the end-to-end delay, packet delay variation, throughput, MOS, SNR, BER and PLR. Thus, after performing the simulation, the obtained results proved that through the use of the IPv6-GMPLS scheme, a great influence on both the transmission quality and the overall performance was noticed; and that is in comparison to the other IP schemes. Therefore, in light of this study, we recommend conducting further future studies for more models for smart transmission as well as its effect on data streaming across the mobile networks. Taking into consideration the various types of network connections and the impact of the several fading effects as well as the different conditions of the network shall be studied in detail, with the main objective of providing the best quality at all times of the service's access.

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