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Comparison between IPv4 and IPv6 VoIP over WiMAX Traffic

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ABSTRACT

The objective of this paper is to study and analyze IPv4 and. IPv6 using Voice over Internet Protocol (VoIP) system using over WiMAX. OPNET simulation model was developed and the results showed some advantages for IPv4 against IPv6 concerning the throughput and traffic sent and received and some advantages for IPv6 against IPv4 concerning the MOS.

Keywords: Session Initiation Protocol, IPv4, IPv6, H.323, MGCP

I. INTRODUCTION

Voice over internet protocol (VOIP) is the easiest way to make a phone call because Voice over internet protocol (VOIP) send the data as a packet in packet switch in state of circuit switch. Basically, there are two categories for voice based on the IP network, Internet technology and is VoIP, the connection called internet technology when the voice transmitted over public internet network and called VoIP when the voice is transmitted over managed IP network.[1], over broadband [2].

Protocols and Quality of Service: VoIP uses 3 widely used protocols: H.323, Session Initiation Protocol (SIP) and Media Gateway Control Protocols (MGCP). H323 protocol: It's a protocol specified by international telecommunication union (ITU)[3], consists of a family of protocols for call set-up, call termination, registration and other functions transported over TCP and UDP protocols.[2]

H.323 protocols are: H.225 which is responsible for registration, admission state and call signalling, H.245: which is responsible for channel negotiation, H.235 provides security [3], and H.248: "control protocol for media gateway across a converged internet work" [4]. H323 components: Terminal: which represents the end user equipment. Gateway: which is used to communicate with the other networks. Gate keeper: which provides services such as authentication and call routing [3]

Table 1: H.323 protocol codec and channel (kbps)

H.323 Codec	G.711	G.723	G.728	G.722	G.829
Channel (Kbps)	64	5.3, 6.3	16	48, 56, 64	8

Session Initiation Protocol (SIP): Defined by the Internet Engineering Task Force (IETF)[3] for making, maintaining and clearing call requests between users in the network. It operates on the application layer, uses TCP which can provide SSL/TLS, UDP to provide the fast connection.[3]

SIP components: User Agent (UA): It is the device which makes or receives calls. Proxy Server (PS): which is responsible for routing SIP request in SIP network. Registers: it's responsible for linking and binding the user agent (UA) IP address to URL. Location Server (LS): it works with the proxy server to locate the receiver (RX) user agent. SIP gateway: which converts the data format when communicating with different IP voice [1].

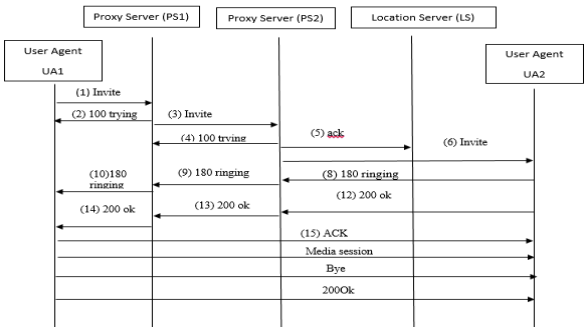

Figure 1: SIP protocol signalling

SIP Signaling process: User Agent 1 (UA1) sends an invite acknowledgement(ack) to Proxy Server 1 (PS1), the PS1 responses by sending 100 trying ack and sends invite ack to PS2 which sends 100 trying ack to PS1, the PS2 sends to location server to locate UA2, after locating UA2, PS2 sends invite ack to UA2, UA2 starts ringing and sends 180 ringing to PS2 which sends it to PS1 to get UA1, while UA2 picks-up it sends 200ok ack the, same way 180 ringing ack has been sent, UA1 send ack when receiving 200ok, the RTP start, when ending

the call, bye ack send and 200ok send back replaying of bye ack, each invite ack include session description protocol (SDP), the session description include type, format, transport protocol, media multicast address and transport port for media [5].While connecting with PSTN, the session description protocol (SDP) converted into ISUP which relays call signalling between switches and RTP converted into TDM to transmit voice signal [1].

Table 2: The SIP2 codec, frame length.[6]

Codec	G.711	G.722	G.726	G.728	G.729
Channel (Kbps)	64	48,56, 64	16,24, 32,40	16	8
Frame length (MS)	0.125	30	0.125	2.5	10

Media Gateway Control Protocols (MGCP): Media gateway control is a signalling and call controlling communication protocol used in voice over IP".[7]. It was developed by Bellcore and Cisco, it is also known as H.248. The protocol defines a means of communication between a media gateway which converts data from circuit switching to packet switching, MGCP can be used to set up, maintain and terminate calls between multiple endpoints.

Mean Opinion Score (MOS) is a technique that compresses audio and video file to check the codec, from a range of 1(unacceptable) to 5(excellent).[8].

II. WiMAX

WiMAX stands for "World Interoperability for Microwave access"[9]. It is a wireless digital communication system, also known as IEEE 802.16 that is intended for wireless "metropolitan area networks". "WiMAX can provide broadband wireless access (BWA) up to 30 miles (50 km) for fixed stations, and 3 - 10 miles (5 - 15 km) for mobile stations. In contrast, the WiFi/802.11 wireless local area network standard is limited in most cases to only 100 - 300 feet (30 - 100m). provides fixed and mobile Internet access", WiMAX uses smart antenna and OFDMA which allow a better application of the spectrum resources[10].

Mathematical Model: Throughput =total number of bit successfully transmitted during some period [t, t+T] divided by T. Number of packet losses =Expected Number of Packets-Received Number of Packets [11]. Expected Number Of Packets = Extended Highest Sequence Number Received (EHSNR)- Initial Sequence Number of Packet (ISN) Number of packet losses =Expected Number of Packets-Received Number of Packets [11].

The wireless deployment wizard was used to create three WiMAX 1km radius, each cell has five users (WiMAX_wkstn_adv) in random possession, (WiMAX_bs_router_adv) was used as BTS of the OPNET simulation and the router was used is (ethernet4_slip8_gtwy), in WiMAX config. the class service was set to gold and scheduling type used was (UGS) with 384 as maximum reserved traffic rate and maximum sustained traffic rate, A trajectory bath time was set by movement speed 50km/h as in Table 3

	1	2	3	4
Wait time	0	10m00.90 s	10m00.0 0s	10m00.00s

Furthermore, duplicated scenario was made, the first for IPv4 and the second was for IPv6, For IPv4 subnet, all devices in the network were given an IPv4, in the cell which the subscriber (workstation) start the movement from, the BTS was given a class C IP address (IP-IP routing parameter-interface information-IF32), was set as home agent in interface IF32 (mobile IP router-mobile IPv4 parameter).

The other BTS's were given a class C IP addresses and IF32 as was set in all of them as foreign agent, the router was given a class C IP address, the router IP was set for all four BTSs (WiMAX parameter –bs parameter –ASN gateway address), A subscriber (workstation) was given a trajectory and the same IP used for IF32 (the same IP address of BTS which the workstation should start movement from), OSPF was set as routing protocol.

IPv6 subnet, all subscribers (workstations) were given IPv6 (protocol-IPv6), all BTS's were set as (IP-mobile IP router parameter-mobile IPv6 parameter- the number of rows was set to one, interface name IF24 as home agent), OSPF was set as routing protocol.

III. RESULT

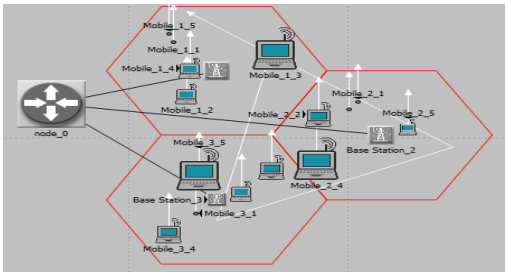

Figure 2: WiMAX network and define the workstation movement.

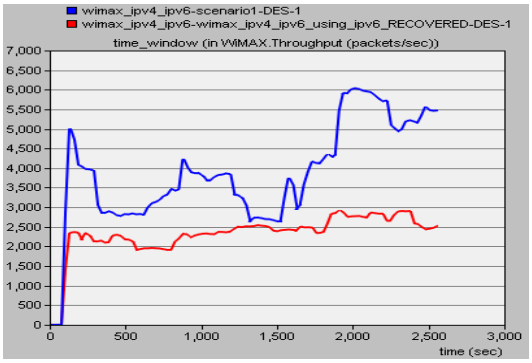

Figure 3: throughput (packet/sec) in IPv4 vs. IPv6 (blue curve is IPv4, red varve is IPv6), the sample mean for IPv4=3,846.62713178 and for IPv6=2,315.15891473

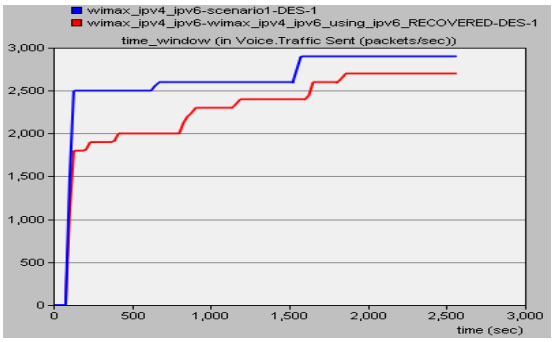

Figure 4: Traffic send of IPv4 vs. IPv6 (blue curve for IPv4, the red curve for IPv6), the sample mean for IPv4=2,582.77790698 and for IPv6=2,252.29457364

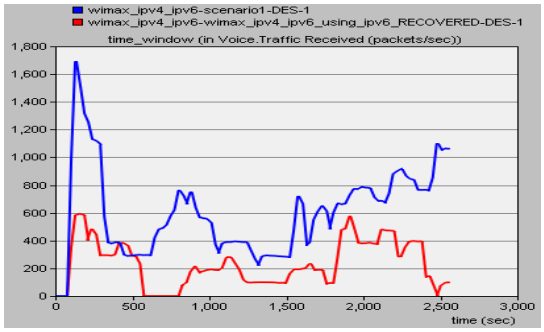

Figure 5: traffic received IPv4 vs. IPv6 (blue curve for IPv4 and red curve for IPv6), the sample mean for IPv4 =597.321705426 and for IPv6=225.940310078

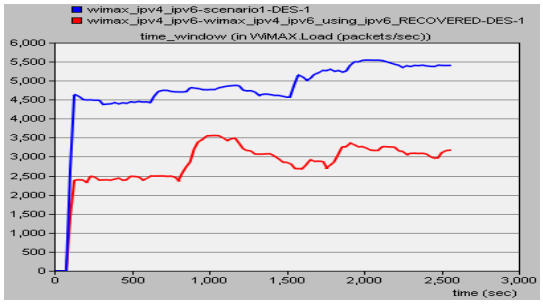

Figure 6: IPv4vs. IPv6 (blue curve for IPv4, the red curve for IPv6) load, the sample mean for IPv4=4,710.70465116 and for IPv6=2,786.67984496

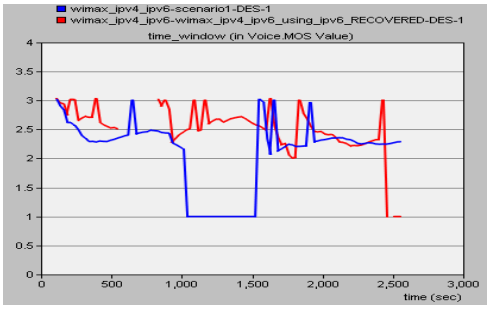

Figure 7: IPv4 vs.IPv6 Voice MOS (blue curve is IPv4, the red curve is IPv6), samples mean for IPv4=2.10268590457, and for IPv6= 2.50075838371s

IV. CONCLUSION

The study of traffic, MOS, load and throughput was made using OPNET using VOIP over WiMAX and it was a comparison between IPv4 and IPv6, the results were found that IPv4 had a better mean sample throughput (packet/sec) than IPv6, IPv4 had a better traffic sent and received than IPv6 and the MOS value of IPv6 was better than IPv4. All the results were in the situation mentioned in the method, any other parameter wasn't mentioned in the method was as the default as it in OPNET simulator and wasn't changed. Change the antenna power and data rate and to compare the result with Li-Fi.

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