3.1 Introduction

In this chapter OPNET 17.5 is used to simulate different scenarios namely IEEE 802.11a and n for three parameters in IPv4 and IPv6 environment (Throughput, delay and jitter) has considered to evaluate the network performance for IPv4 and IPv6 which are all Quality of services Measures.

3.2 Simulation Scenarios

To test our previous QoS strategy as a comparative method, in this study:

- Using OPNET 17.5 to implement our VoIP network.
- Setting up several nodes.
- Use an exponential traffic source to re-create a typical voice conversation over VoIP.
- Different protocols will be use.
- Measuring throughput, end-to-end delay, packet loss and jitter.
- Plotting our results and comparing them to our theory based predictions.

In our deployment all nodes configured to use the G.711 codec, Its formal name is Pulse code modulation (PCM) of voice frequencies, it is commonly used in VoIP application., this codec transmits information at a rate of 64kbps [18]. The network infrastructure is WLAN. OPNET 17.5 was used to simulate four different scenarios namely IEEE 802.11a, and n According to traffic analysis, three parameters: Throughput, delay and jitter has considered to evaluate the network performance IPv4 and IPv6. In each scenario there a small network represents light traffic and a large network with background traffic to generate the VoIP.
3.2.1 Network Designed Components:

This section discusses the main network components used in the suggested network models running on OPNET 17.5 and the devices used in. The **small network**: 8 WLAN work station, SIP server, 16 port switch Ethernet, Firewall, router, and 100 Base T full duplex for wired connection where used to build IP backbone for ipv4 and ipv6.

For the **large network**: 11 WLAN work station, two wired IP phone, two servers (HTTP server, video conference server for background traffic), SIP server, 16 port switch Ethernet, Firewall, router, and 100 Base T full duplex for wired connection where used to build IP backbone for ipv4 and ipv6.

**Scenario (1)**

Data rate 54 Mbps, Data rate 600 Mbps and numbers of nodes that use technology 802.11a, n using IPV4 small and large network in 240sec. see Figure (3.1) and Figure (3.2)

![Figure (3.1) The configuration of IPV4 Network showing VoWiFi small network](image-url)
**Figure (3.2)** The configuration of IPV4 Network showing VoWiFi large network

**Scenario (2):**
Data rate 54 Mbps, Data rate 600 Mbps and number of nodes that use technology 802.11a ,n using IPV6 small and large network in 240sec.see **Figure (3.3)** and **Figure (3.4)**
Figure (3.3) The configuration of IPV6 Network showing VoWiFi small network
Figure (3.4) The configuration of IPV6 Network showing VoWiFi large network

3.2.2 Application parameter configuration

The Application _ Configuration include a name and a description table that specifies various parameters for the VOIP application see Figure (3.5). The specified application name is used while creating user profiles on "Profile_ Configuration" object. The Profile_ Configuration is used to create user profiles. These user profiles can be specified on different nodes in see Figure (3.6).

![Profile_Config attribute dialogue box](image)

Figure (3.5) Profile_ Config attribute dialogue box
3.2.3 Simulation To Measure QoS

OPNET is the simulator tool used for designing the network and deploying VOIP technology, used to simulate two different scenarios namely IEEE 802.11 a, & n according to traffic analysis, for three parameters: Throughput, End To End Delay and jitter has considered to evaluate the network performance for IPv4 and IPv6 using UDP as transmission protocol.

In figure (3.7) from the start the first event the program read the parameter from the initial value and create an array parameter: amount of data transferred from the first time to the last time of the simulation and send it with no of node (flow ID) this data can used to calculate and plot, to get the throughput for VoIP node filtered the received packet and it occur time using the mathematical equation to get throughput $E (2.1)$ that mentioned in chapter 2.
In figure (3.8) start the first event the program read the parameter from the initial value and creates an array parameter: Delay at the source, Delay at the receiver, Network delay from the first time to the last time of the simulation based on the time interval and the event of nodes queuing packet and nodes receiving packet. End To End Delay calculate using mathematical equation \( E(2.2) \) that mentioned in chapter 2.

In figure (3.9) start the first event the program read the parameter from the initial value and creates an array parameter: random jitter, deterministic jitter, bit error rate from the first time to the last time of the simulation depend on different between delay packet and time. Jitter can calculate using mathematical equation \( E(2.3) \) that mentioned in chapter 2.
Figure (3.7): Simulation flowchart Throughput vs. simulation time
Figure (3.8): Simulation flowchart End To End Delay
Figure (3.9): Simulation flowchart jitter

\[ T = \left( D_{\text{peak-to-peak}} + (2 \times n \times R_{\text{max}}) \right) \]
3.2.4 Simulation Parameters:

The Simulation environment setup parameters which affect the performance of our system are depicted in Figure (3.10). Figure (3.11) and Table (3.1)

![Simulation Parameters Example](image)

**Figure (3.10): Example for Wireless network parameters**
Figure (3.11): Codec and transmission protocol configuration

Table (3.1) Simulation Environment parameter

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numbers of nodes</td>
<td>10 nodes</td>
</tr>
<tr>
<td>Network scale</td>
<td>Office</td>
</tr>
<tr>
<td>Specify size</td>
<td>100*100 m2</td>
</tr>
<tr>
<td>Technology</td>
<td>IPv4 and IPv6 Wi-Fi (IEEE802.11 a, n)</td>
</tr>
<tr>
<td>Data rate</td>
<td>54, 248 Mbps</td>
</tr>
<tr>
<td>Link model</td>
<td>100 Base T full duplex</td>
</tr>
<tr>
<td>Application</td>
<td>Voice over IP call (PCM Quality)</td>
</tr>
<tr>
<td>Voice encoding</td>
<td>G.711</td>
</tr>
<tr>
<td>Duration of simulation</td>
<td>180 second</td>
</tr>
</tbody>
</table>