Improving Quality of Service (QoS) in VoIP by Using Queue Technique

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Abstract

Voice over Internet Protocol (VoIP) is developed for voice packets transmitted over IP network in real-time communications by using the Internet protocols. Quality of Service (QoS) mechanism is applied to guarantee successful voice packets transmitted over IP network to reduced delay or drop according to assigned priority of voice packets. The objective of this research is to propose the approach of WIMAX network scenario for VoIP. In comparison to improving quality of service (QoS), this paper demonstrates the simulation framework based on OPNET Modeler version 14.5. In VoIP process, the performance analysis is divided into queuing namely: FIFO, WFQ, and PQ. This implemented within the OPNET simulator along with the parameters like delay, jitter and packet loss. The performance of the proposed algorithm is analyzed and compared with the quality of service for VoIP. The final simulate result shows the priority of voice traffic and weighted-far queues were improved in the quality of service for VoIP.

Keywords: VoIP, QoS, FIFO, PQ, WFQ, WIMAX

I. INTRODUCTION

Voice over Internet Protocol (VoIP) is developed for voice communications system based on voice packets transmitted over IP network with reduced communication costs. It provides real-time communications of voice across networks using the Internet protocols. In VoIP process, the voice stream from the voice source is first taken and compressed by the encoder. Then, server coded speech frames are packetized to form payload part of a packet. The headers are added to the payload and these form a packet which is then sent to IP network.

Quality of Service (QoS) mechanism is applied to guarantee successful voice packets transmitted over IP network with reduced delay or drop according to assigned priority of voice packets.

This objective of this paper is to create Ethernet network scenario for VoIP and compare queuing for improving quality of service (QoS) with the simulation results by using OPNET.

This article is organized in four sections. Section 1 introduces the work. Section 2 gives the Materials and Methods for improving quality of service (QoS). Section 3 shows the results and analysis based on the simulation study and describes the experimentation carried out in this work. Section 4 conclusion of the paper.

II. MATERIALS AND METHODS

A. Quality of Service (QoS)

One can broadly divide QoS in two types: QoS for network and QoS for user. QoS for network guarantees that the packet for the voice communication shall not be delayed or dropped. A QoS for user corresponds to the degree of user satisfaction in service. These parameters are explained below:

1. Delay takes place when the packets of data that contain the voice in digital form take more than estimated time in order to reach the destination. Delay can be caused by a number of factors, including, type of network, queuing discipline and type of voice packet traffic [1].

2. Jitter take place while transporting the voice and packet over switched network, the data may have a time variation in order to reach the destination. When some of data packets take more time in order to reach the destination the effect of this variation shall result into a jitter, for the listener at the destination [1].

3. Packet loss shall take place when the network is congested or when the buffer is over-loaded. In such a situation, the transported packets shall not be able to reach the destination and will be lost [1].

4. Throughput shall take place when the total received packets is given to each traffic class and measured as the mean of the number of packets produced per unit time. Throughput is inversely proportional; robust network has a lower degree of packet drop [1].

B. Queue Techniques

When the packets transmitted over network, each router must implement some queuing discipline that governs how packets are buffered while waiting to be transmitted. Various queuing disciplines can be used to control which packets get transmitted and which packets get dropped. The queuing discipline also affects the latency experienced by a packet, by determining how long a packet waits to be transmitted [2] the three most commonly used queuing disciplines are FIFO (First in First Out), WFQ (Weighted Fair Queue) and PQ (Priority Queuing). FIFO queuing is the first packet that arrives at a router is the first packet to be transmitted. Given that the amount of buffer space at each router is finite, if a packet arrives and the queue is full, then the router discards that packet. This is done without regard to which flow the packet belongs to [2].
The principle idea of PQ is a simple variation of the basic FIFO queuing. The idea is to make each packet with a priority; the mark could be carried, for example, in the IP Type of Service (ToS) field [1]. As shown in the figure 2. The queue discipline allows high priority packets to cut to the front of the line [2].

The basic principle of the WFQ allows a weight to be assigned to each flow (queue). This weight effectively controls the percentage allocated to each flow from the links’ bandwidth [2]. As shown in the figure 3.

C. WiMAX Network

Worldwide Interoperability for Microwave Access (WiMAX), is a standard based on IEEE 802.16 broadband wireless access metropolitan area technology. It is an air-interface standard for microwave and millimeter-wave band. This server can act as a wireless extension cable and DSL technology, enabling wireless broadband access. The signal cover of WiMAX technology ups to 50 km, WiMAX data rates between 1.5 to 75 Mbps. Also, it supported multimedia applications such as voice over IP (VoIP)[8].

III. SIMULATION MODEL

OPNET (Optimized Network Engineering Tool) is a tool to simulate the behavior and performance of VoIP network, Quality of Service (QoS) analysis of and performance of VoIP network, Quality of Service (QoS) analysis of simulator of network communication and network device and protocols. OPNET provides performance analysis of computer network and applications.[3] through this we can design;

A. Simulation Model

The following figure 4 present the network model. This simulation model was run in different scenarios to determine the best audio encoding schemes and queuing schemes of utilizing VoIP over integrating wireless (WiMAX). All the scenarios follow the similar structure and the similar topology. Each scenario is implementing with queuing disciplines such as FIFO, WFQ and PQ. Various comparisons are conducted to fine the value of various parameters.

B. Simulation Parameter Setup

VoIP in Fixed WiMAX network Base Station (BS) were simulated with fifteen (15) mobile devices, where mobile devices subscriber’s stations are place around each BS. All BSs were connected to the IP back bone (internet) using point-to-point protocol (PPP) without any server BS. Basic parameters associated with VoIP in WiMAX Configuration attributes, application’s configuration, application profiles, task’s definition, BSs and SSs for the model were configured as show in figure 4.

<table>
<thead>
<tr>
<th>TABLE I.</th>
<th>SUBSCRIBER STATION PARAMETERS</th>
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<tbody>
<tr>
<td>Parameter</td>
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<td>IP</td>
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<tr>
<td>Match Value</td>
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<tr>
<td>Server ice das s Name</td>
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<tr>
<td>Parameter</td>
<td>Value</td>
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<tr>
<td>Max Transmission Power</td>
<td>Adaptive</td>
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<td>PHY Profile Type</td>
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<tr>
<td>Terrain Type</td>
<td>Terrain Type A</td>
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### TABLE II. BASE STATION PARAMETERS

<table>
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IV. SIMULATION RESULTS AND DISCUSSION

This paper investigates the performance of WiMAX network using different quality of service (QoS) with are explained below.

A. Quality of Service (QoS)

Quality of Service (QoS) represents the who performance of a WiMAX network, witness by the users of the network. To evaluation the quality of service, various related aspects of network service are often considered, for example error rates, bandwidth, throughput, load, transmission delay, availability, jitter etc.

B. Performance Parameters

The performance parameters are used to analyze simulation with based on the simulation results; a comparison between the effects of different queuing duplicates namely FIFO, PQ and WFQ on QoS of VoIP. As stated earlier, four QoS measurements, such as voice packet end to end delay (sec), voice packet jitter (sec), voice traffic sends (packet/sec) and voice traffic received (packet/sec)

In figure 5, the delay of FIFO, PQ and WFQ decrease and become very close to 0.10 (sec).

In figure 6, the (jitter = 0) using FIFO, PQ and WFQ; the three queuing discipline value are closed to zero.
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Figure 7. Voice Throughput (packet/sec) under various queuing disciplines

The simulated voice throughput in figure 12 both PQ and WFQ have the same throughput value and this value is more than FIFO.

**CONCLUSION**

Three QoS parameters (end to end Delay (sec), Jitter (sec), and Throughput (packet/sec) for VoIP over WiMAX Network with difference queuing disciplines (FIFO, PQ and WFQ) using OPNET.

PQ and WFQ give good quality of service for VoIP. Also, PQ and WFQ are the queuing disciplines that give good quality VoIP with low end to end delay and low jitter rate.

Form these observations, voice traffic based on the priority and weighted-far queues are improving the quality of service for VoIP

**REFERENCES**


