PERFORMANCE OF VOIP IN WIRELESS MULTI-HOP NETWORK

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Specially dedicated to
my supervisor, family and friend who have encouraged, guided and
inspired me throughout my journey of education

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ABSTRACT

This project is about deployment of Multi-hop Wireless Network (MWN) using MIMOS WiWi Access Point is a communications network made up of radio nodes organized in a multi-hop topology. After the multi-hop network was deployed using 3 access point, the next step is to analyze the performance of VoIP base on RTP header, CRTP header and differences voice codec compression G 711.1, G 723,1 and G 729.2. for additional the affect of signal strength for the VoIP performance also test in this project Usually MWN used to extend the network coverage and increase more clients that can connect to the network. Objective of this project is to deploy the 802.11 b/g Wireless Multi-Hop Network. Then, to study open source software to observe the performance of VoIP and lastly to observe the performance of VoIP base on the voice codec compression, differences header type and signal strength affect. From this project, the performance of VoIP for this access point can be determined and it can be use as a testimonial product that can be use for customer before using the MIMOS WiWi access point.

ABSTRAK

Projek ini adalah mengenai penempatan Multi-hop Wireless Network (MWN) menggunakan MIMOS WiWi Access Point adalah satu rangkaian komunikasi yang terdiri daripada nod radio yang dianjurkan dalam topologi berbilang-hop. Selepas rangkaian pelbagai-hop dikerahkan menggunakan 3 pusat akses, langkah seterusnya adalah untuk menganalisa prestasi VoIP asas pada tajuk RTP, CRTP tandukan dan perbezaan suara codec mampatan G 711,1, G 723,1 dan G 729,2. untuk memberi kesan kepada keselamatan tambahan kekuatan isyarat untuk prestasi VoIP juga menguji dalam projek ini Biasanya MWN digunakan untuk memperluaskan liputan rangkaian dan meningkatkan lebih banyak pelanggan yang boleh menyambung kepada rangkaian. Objektif projek ini adalah untuk menempatkan 802.11 b / g Wireless Multi-Hop Rangkaian. Kemudian, untuk mengkaji perisian sumber terbuka untuk melihat prestasi VoIP dan akhir sekali untuk memerhatikan prestasi VoIP asas pemampatan codec suara, perbezaan jenis header dan kekuatan isyarat yang menjejaskan. Daripada projek ini, prestasi VoIP untuk pusat akses ini boleh ditentukan dan ia boleh digunakan sebagai produk testimoni yang boleh digunakan untuk pelanggan sebelum menggunakan pusat akses MIMOS WiWi.

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MWN	-	Multi-hop Wireless Network
VoIP	-	Voice over Internet Protocol
DSL	-	Digital Subscriber Line
RSSI	-	Received Signal Strength Indicator
LAN	-	Local Area Network
WLAN	-	Wireless Local Area Network
VoWLAN	-	VoIP in Wireless Local Area Network
QoS	-	Quality of Service
RTP	-	Real Time Protocol
CRTP	-	Compress Real Time Protocol
IP	-	Internet Protocol
PSTN	-	Public Switching Telephone Network
TCP	-	Transmission Control Protocol
UDP	-	User Datagram Protocol

CHAPTER I

INTRODUCTION

1.1 Project Background

In recent years, we have witnessed a growing interest in the transmission of voice using the packet-based protocols. Voice over Internet protocol (VoIP) is a rapidly growing technology that enables the transport of voice over data networks such as the public Internet. The idea of VoIP has been discussed since the early 1970 s when the idea and technology were developed. However, at that time VoIP did not find wide acceptance and deployment both among users and telecommunication providers. This was mainly due to the lack of IP infrastructure and the fact that circuit-switched calling was still a much more reliable alternative, especially in the light of the poor quality of early VoIP calls.

However, following the rapid growth of the Internet and the Web in the mid 1990 s along with the large investments in the IP networking infrastructure by businesses, vendors and carriers, VoIP is increasingly becoming a viable alternative to send voice over public switched telephone networks (PSTNs). The basic idea behind VoIP involves the transmission of voice as data packets using IP. The user's voice is converted from analogue form into a digital signal, compressed (or uncompressed) and broken down

into a series of packets. These packets are then routed through private or public IP networks from one user to another and reassembled and decompressed (if compressed) at the receiving side. Several factors are influencing the adoption of VoIP technology. Some of the major ones include cost savings and improved network utilization.

A Multi-hop Wireless Network (MWN) is a communications network made up of radio nodes organized in a mesh topology. The MWN often consist of clients, routers and gateways Wireless networks are great for extending network and internet connections through buildings, campuses, and other spaces. But even though the technology frees users from needing to connect wires from their computer to the network, the wireless routers and access points must ultimately connect to the underlying network over Ethernet cables. Thus, a big challenge in any wireless deployment is running the wires to the wireless equipment, often in areas without power and certainly without Ethernet connections. This project basically to deploy the Multi-hop Wireless Network and the important is to test the performance of VoIP in this network.

1.2 Objectives project

Objective of this project is to deploy the 802.11 b/g Wireless Multi-Hop Network. Then, to study open source software that use to analyze the performance of VoIP and lastly to determine the performance of VoIP base on the voice codec, header compression and signal strength effect.

1.3 Problem Statement

The Multi-hop Wireless Network (MWN) is the network that consist the multiple hops that connection each other by using wireless medium. The main objective of MWN topology is to extend the coverage of LAN network. But extend the network using LAN is expensive because need to spent to the equipment and overhead cost such cable cost. This is not practical for long distance deployment. Before this, coverage for wireless network is limited and the signal is low for some placed. So this problem comes out with MWN as solution. Besides that, the deployment of MWN maybe effect to the network performance. Interference is the major factor the influencing the performance of VoIP. So, to make sure the MWN is good or not, the performance of VoIP must be analyzed in this network.

1.4 Scope of project

This project was deployed at outdoor environment which is at the Cafeteria Cubic UTeM Campsus. By using 3 access points as access point with 802.11b/g wireless system, the Wireless Multi-hop Network was deployed. each aceess point must be connected by using differences channel to make sure channel not overlaping with each other. Beside that, System requirement for configured this access point is the computer with Terminal at Linux operating system. Other than that, the performance of VoIP was analyzed by using open source software which is DITG.

1.5 Report Outline

This report is consisting of 5 chapters. The following paragraph will elaborate briefly about the content of each chapter. Chapter I of this report explains the project overview, problem statement, objectives, and scope of project. Chapter II gives the literature review on the importance source that is related to the project and explanation of each software and method used in project. Chapter III is the methodologies that describe the flow chart of the project implementation and explanation of process to measure the performance of VoIP in multi-hop network. Chapter IV is the project main focus which explained and showed the project result and analysis. Chapter V point out the conclusion of the project including the problem encountered throughout the project implementation and the future work consideration.

CHAPTER II

LITERATURE REVIEW

3.1 Multi-Hop Wireless Network (MWN)

Multi-hop wireless networks typically use routing techniques similar to those in wired networks. These traditional routing protocols choose the best sequence of nodes between the source and destination, and forward each packet through that sequence. In contrast, cooperative diversity schemes proposed by the information theory community suggest that traditional routing may not be the best approach. Cooperative diversity takes advantage of broadcast transmission to send information through multiple relays concurrently. The destination can then choose the best of many relayed signals, or combine information from multiple signals. These schemes require radios capable of simultaneous, synchronized repeating of the signal, or additional radio channels for each relay.

2.1.1 Multi-Hop Network Topology

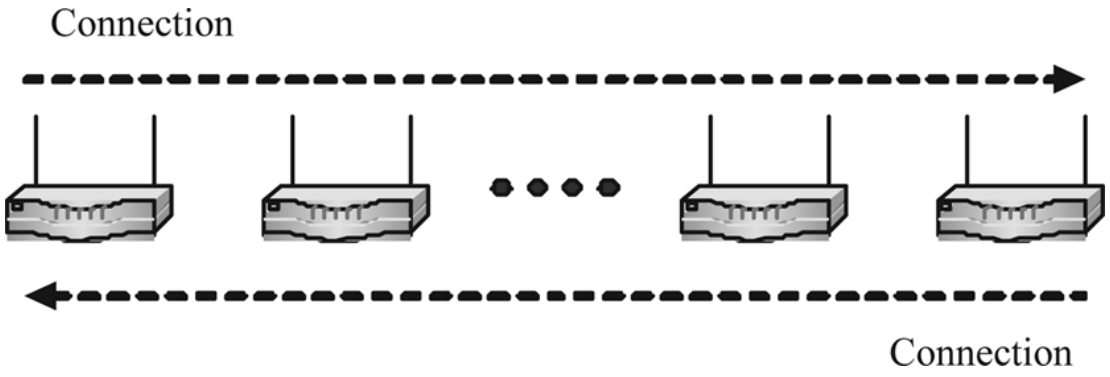

Figure 2.1: Multi-hop Network Topology

2.1.2 Advantages of MWN

The principle is similar to the way packets travel around the wired Internet data will hop from one device to another until it reaches its destination. Dynamic routing algorithms implemented in each device allow this to happen. To implement such dynamic routing protocols, each device needs to communicate routing information to other devices in the network. Each device then determines what to do with the data it receives either pass it on to the next device or keeps it, depending on the protocol. The routing algorithm used should attempt to always ensure that the data takes the most appropriate (fastest) route to its destination. MWNs offer considerable advantages as an Internet broadband access technology:

i. Extended geographic coverage.
ii. Easy network expansion: adding a new node to an existing network only requires line-of-sight to another node already in the network. And the new node now provides coverage for future nodes further downstream.
iii. Long Links: use a directional antenna to reach a far away parent. The radios come with a dual antenna port that lets you deploy a second antenna to provide access to downstream nodes.

iv. Roaming: combine the tree topology with our roaming feature to allow radios to change their access points if the link to the parent drops or is impaired.

v. Using fewer wires means it costs less to set up a network, particularly for large areas of coverage.

vi. The more nodes you install, the bigger and faster your wireless network becomes.

vii. They rely on the same Wi-Fi standards (802.11 b and g) already in place for most wireless networks.

viii. Wireless multi-hop nodes are easy to install and uninstall, making the network extremely adaptable and expandable as more or less coverage is needed.

2.2 Voice over Internet Protocol (VoIP)

VoIP services convert your voice into a digital signal that travels over the Internet. If you are calling a regular phone number, the signal is converted to a regular telephone signal before it reaches the destination. VoIP can allow you to make a call directly from a computer, a special VoIP phone, or a traditional phone connected to a special adapter. In addition, wireless hot spots in locations such as airports, parks, and cafes allow you to connect to the Internet and may enable you to use VoIP service wirelessly.

2.2.1 VoIP Equipment Requirement

A broadband (high speed Internet) connection is required. This can be through a cable modem, or high speed services such as DSL or a local area network. A computer, adaptor, or specialized phone is required. Some VoIP services only work over your computer or a special VoIP phone, while other services allow you to use a traditional phone connected to a VoIP adapter. If you use your computer, you will need some software and an inexpensive microphone. Special VoIP phones plug directly into your broadband connection and operate largely like a traditional telephone. If you use a telephone with a VoIP adapter, you'll be able to dial just as you always have, and the service provider may also provide a dial tone.

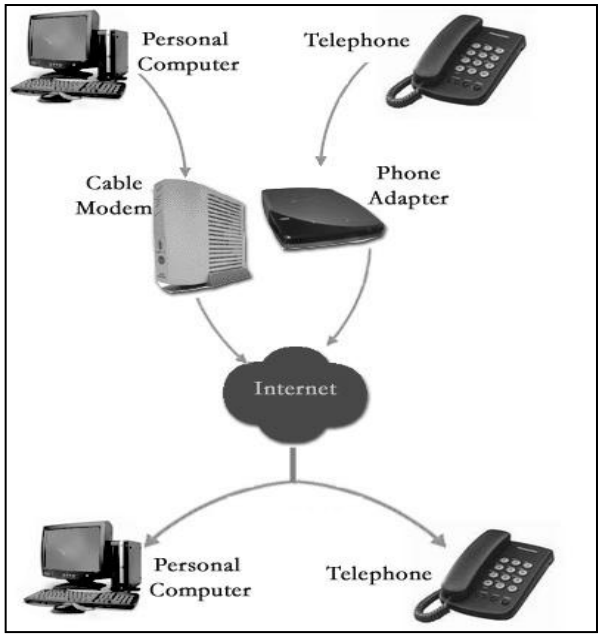

Figure 2.2: VoIP Equipment

2.2.2 Advantage of VoIP

Some VoIP services offer features and services that are not available with a traditional phone, or are available but only for an additional fee. You may also be able to avoid paying for both a broadband connection and a traditional telephone line.

2.2.3 Disadvantages of VoIP

If you're considering replacing your traditional telephone service with VoIP, there are some possible differences:

i. Some VoIP services don't work during power outages and the service provider may not offer backup power.
ii. Not all VoIP services connect directly to emergency services.
iii. VoIP providers may or may not offer directory assistance page listings.

2.3 VoIP in Wireless Local Area Network (VoWLAN)

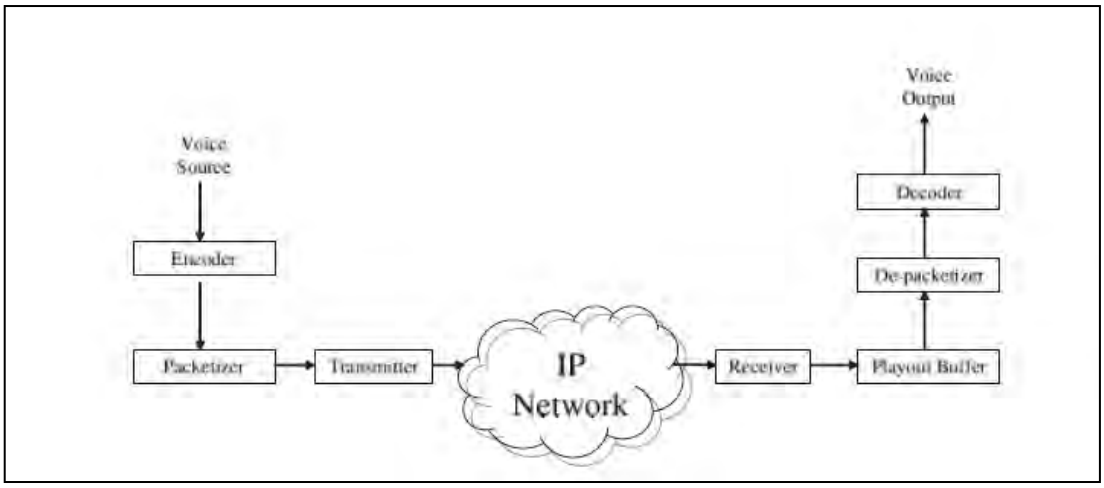

Figure 2.3: VoIP System