COMPARISON BETWEEN IPv4 AND IPv6 OVER WLAN TECHNOLOGY

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DEDICATION

I dedicate this project,
To my precious god for all I've got,
To my parent and all my family for being such a supportive to me,
To my lectures for teach me since the beginning until this final year,
To my supervisor for guide my towards this project,
To my evaluator for your advice,
And also to all my friends for become my partners and my competitors,
Thank you for become the best of who you are,
Which obliquely assist me in completing my degree's final project

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ABSTRACT

Wireless technology is one of demand and famous transmission technique in networking field and services. IPv4 is widely used address format since the networking is being used but after IPv6 address format being introduced and implemented nowadays, it produce huge impact in networking usage and function. But an implementation IPv6 address format through wireless technology seems quite slow compare than wired technology due to device support and configuration matters. Since we have two options for wireless network connectivity which are IPv4 through wireless and IPv6 through wireless, this project take the responsibility to simulate and compare the difference between both IP address formats through wireless technology but focuses on multi - hop technique. The goal of project was to identify the difference in term of performance between IPv4 and IPv6address format over wireless technology which focuses on multi- hop technique. The measurement criteria that will implement within the project are delay, jitter, throughput and packet properties. Network simulator version 2 which known as NS-2 installed in LINUX FEDORA 9 is responsible in creating and generating the four types of wireless network environments which divided by IP address format and layer four transport protocols (MIPv6TCP, MIPv4UDP, MIPv6TCP, MIPv6UDP). These environments that create using tcl language will produce another two file which represent the animation and network behaviour storage file that will be integrate with awk file in order to calculate and categorize the result by measurement characteristics. At the end of the project, we will decide which address formats afford more performance for wireless multi - hop transmission technology.

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ABSTRAK

Teknologi rangkaian tanpa wayar kini merupakan salah satu teknologi yang menjadi keperluan sebagai teknik transaksi data dan telah dikenali di dalam bidang rangkaian sejak sekian lama. Jenis alamat IPv4 telah diaplikasikan sejak bidang rangkaian tanpa wayar mula diperkenalkan dan digunakan bagi membantu mendapatkan capaian rangkaian lebih mudah di mana saja tetapi sejak alamat IPv6 diperkenalkan dan mula diaplikasikan kini, alamat ini telah memberi impak yang besar dari segi pembangunan dan penggunaan teknologi rangkaian. Akan tetapi, penggunaan alamat IPv6 melalui rangkaian tanpa wayar kelihatan agak perlahan sambutan dan penggunaannya disebabkan kekangan perkakas rangakain bagi mengaplikasikan alamat berjenis tersebut selain masalah configurasi yang terbatas. Tetapi sejak ia mula diperkenalkan, pengguna telah mempunyai dua pilihan dalam menggunakan penyambungan transaksi rangkaian tanpa wayar, projek yang dijalankan bertanggungjawab dalam menghasilkan simulasi rangkaian serta membuat perbandingan antara kedua- dua junis alamat rangkain tersebut dimana memfokuskan transaksi yang melibaktan teknik *multi-hop*. Tujuan asas projek ini adalah untuk mengenalpasti perbezaan dari segi tahap prestasi antara alamat IPv4 dan alamat IPv6 melalui rangkaian tanpa wayar yang lebih focus pada teknik *multi-hop* tersebut. Krateria - krateria pengukuran yang akan diterapkan dan menjadi panduan kepada perjalanan projek adalah seperti *delay, jitter, throughput* dan ciri - ciri paket yang lain. Perisian pensimulasi rangkaian versi ke-2 yang lebih dikenali sebagai NS-2 yang di pasang di dalam LINUX FEDORA 9 adalah bertanggungjawab untuk menghasilkan empat jenis situasi rangkaian tanpa wayar yang dibahagikan mengikut jenis alamat IP dan lapisan keempat OSI iaitu protokol pengangkutan menghasilkan (MIPv6TCP, MIPv4UDP, MIPv6TCP, MIPv6UDP). Situasi rangkaian tanpa wayar ini dibina menggunakan bahasa tcl yang pada akhirnya akan menghasilkan dua lagi jenis fail yang merupakan fail animasi dan penyimpan maklumat perilaku rangkaian yang akan di diintegeasikan bersama fail berbahasa awk untuk tujuan mengira dan mengkategorikan hasil keputusan simulasi berdasarkan krateria-krateria pengukuran yang telah ditetapkan. Di akhir projek, kita akan memutuskan mana antara jenis alamat IP yang mampu memberikan prestasi terbaik untuk rangkaian tanpa wayar berjenis *multi-hop* di dalam dunia teknologi penghantaran maklumat.

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LIST OF ABBREVIATIONS

ACRONYM	WORD
IP	Internet Protocol
IPv4	Internet Protocol Version 4
IPv6	Internet Protocol Version 6
NS-2	Network Simulator Version 2
WLAN	Wireless Local Area Network
UDP	User Datagram Protocol
TCP	Transfer Control Protocol
OSI	Open System Interconnection
IETF	Internet Engineering Task Force
MN	Mobile Node
FA	Foreign Agent
LAN	Local Area Network
MIPv4	Mobile Internet Protocol Version 4
MIPv6	Mobile Internet Protocol Version 6
MIPv4TCP	Mobile Internet Protocol Version 4 for TCP
MIPv4UDP	Mobile Internet Protocol Version 4 for UDP
MIPv6TCP	Mobile Internet Protocol Version 6 for TCP
MIPv6UDP	Mobile Internet Protocol Version 6 for UDP
QoS	Quality of Service
TCL	TCL language
AWK	AWK language
FTP	File Transfer Protocol
CBR	Constant Bit Rate

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CHAPTER I

INTRODUCTION

1.1 Project Background

This project is about running a research on comparison between IPv4 and IPv6 address format over WLAN technology which focuses on multi-hop ad hoc environment. The goal of this project is to differentiate and compare both address formats in several aspects which are focusing on transmission characteristics such as delays, throughput, packet fraction and transmission properties so at the end the analyzer are able to decide which IP address format produce more advantages and efficiency through the wireless environment. Typically this project is done by simulate the numbers of network that will be generate by NS-2 software which integrate with awk script to display network statistical view. 4 type of network environment were designed which are:

1. Wireless IPv4 for UDP (MIPv4UDP)
2. Wireless IPv6 for UDP (MIPv6UDP)
3. Wireless IPv4 for TCP (MIPv4TCP)
4. Wireless IPv6 for TCP (MIPv4TCP)

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The idea of separating the network by OSI layer four transport protocols for both IPv4 and IPv6 format is because generally UDP and TCP protocol was developed to produce different method for different purposes. Basically UDP perform transferring services more often to multimedia network while TCP was develop to perform transferring services which more concerned in reliable and secure data transfer. Both protocol nowadays become a demand especially for UDP after the implementing of IPv6 and High Speed Network (Fiber Optic) in users networking area.

Project conclusion explain the differentiation in term of function, packet loss rate, packet transmit rate, average delay, average throughput, packet delivery fraction, packet transmission properties and speed performance between both technologies while concluding by selecting the best approach according to the research result. Project duration will take around 14 week where running by a few project phase including planning, analyzing, designing, implementing and testing before it complete.

IPv6 implementation is still quite new but it growth rapidly nowadays, It was because the advantages produce by this IP address format is quite impressive like support huge amount of IP address means it has the ability to provide a unique address for each device around the globe. Also more advance in term of security, performance and reliability. However, IPv4 address format still being widely implement especially by the end user. Mobile IP, the current IETF proposal for IP mobility support, represents a key element for future all IP wireless networks to provide service continuity while on the move within a multi-access environment [1]. Hence, by integrating both IP address format with mobile IP service, it able to supports communication, downloading and accessing the internet anytime at everywhere. 802.11 technologies that nowadays commonly known as Wi-Fi is one of famous technology in wireless LAN which provide network mobility connection in limited area.

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Mobile IPv4 (MIPv4) contains a Mobile Node, Home Agent that exists in home network and maintains mobility information on a MN while Foreign Agent provides Care-of-Address for the MN. FA periodically broadcasts the agent advertisement message. MN receives such the message if MN enters the range managed by FA. MN initiates location registration procedure by sending the registration request message with COA from FA to HA to update mobility information on the MN by send the registration response and binding message [2].

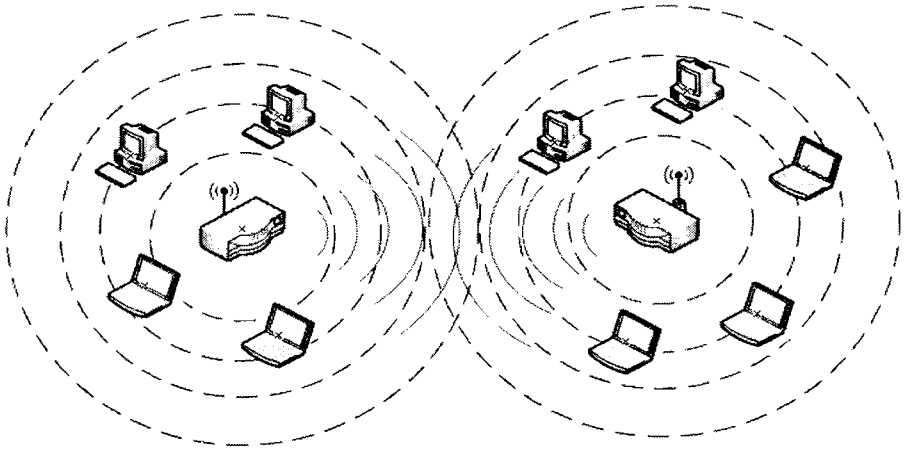

Figure 1.1: Multi-hope ad hoc IPv4 WLAN simulation network

Mobile IPv6 (MIPv6) allow a mobile node to maintain connection transparently while moving from its network to foreign network. MIPv6 define three network entity which are Mobile Node (MN), Home Agent (HA) and Correspondent Node (CN) besides required 2 kind of address in order to solve the mobility problem which are Care-of-Address (CoA) and Home Address (HoA). Mobile Node that currently located within the network will periodically receive the Router Advertisement (RA) from Home Agent in order to announce it existence. Since the mobile node move to foreign network, it will directly form new Care of Address based on Router Advertisement and when it's been confirmed receive unique Care of Address, the mobile node send Binding Update to Home Agent while it reply with Binding Acknowledgment to update current Mobile Node location in Home Agent and Correspondent Node binding caches [2].

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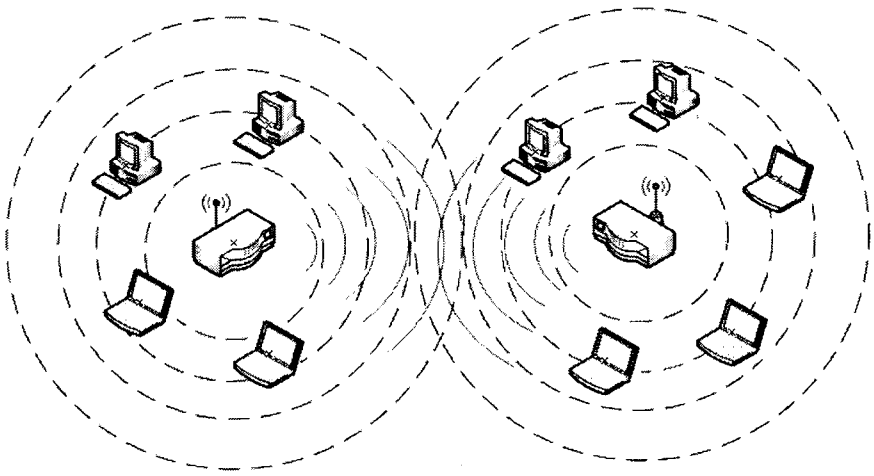

Figure 1.2: Multi-hope ad hoc IPv6 WLAN simulation network

The simulation scenario shows on figure 1.2 was comprises IPv4 and IPv6 mobile network that communicate in accordance with its own standard via wireless transmission. The study about the concept of the project provides quantitative results of the performance improvements obtained by the proposed enhancements as observed by a single mobile user with respect to handoff latency, packet loss rate and achieved bandwidth per station. As a complementary part of the study, the signalling load costs associated with the performance improvements provided by the enhancements has been analyzed. The simulation environment also allowed investigating the behaviour of the protocol, performance and details connection access technique.

Ad hoc networks mechanisms make sense when needing to build a small because it this technique was built to adapt all-wireless LAN quickly and spend the minimum amount of money on equipment. Ad hoc networks also work well as a temporary fallback mechanism if normally available network infrastructure was fail or broke down during its daily services [3]. The difference between IPv4 and IPv6 address format of multi-hop network environment will be describe briefly in this project.

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1.2 Problem Statement

1. Networking customer especially the end user has lack of knowledge about the contribution of both address formats in their daily operation. Plus, with an IPv6 address format implementation with wireless technology that quite new. The network user involving the network provider also network customers were unable to define the best approach to be apply base on their needs.

2. The dilemmas suffered by network provider in supplying the best network services to their customer according to their requirement and company's budget.

3. Increasing the number of user cause an increasing traffic bandwidth that force the user to choose the best IP address format for them on their point of view.

4. Both wireless IPv4 and IPv6 produce their own strength and weakness based on network situation but its about time to define those matter especially for wireless ad-hoc network.

5. Since the current IPv4 address format was replace visibly by IPv6 format especially in wireless network which provide more efficient and advantages, it will effect massively to an initial network including device, address and service configuration.

6. Less of research doing that focusing on the difference between transmission characteristics such as delay, throughput, packet delivery fraction and packet properties which is important to ensure the accuracy and efficiency of measurement.

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1.3 Objective

1. To develop four different simulations network that represents Mobile IPv4 and Mobile IPv6 network that use UDP and TCP as layer 4 transferring protocol using NS-2 software.

2. To study the differentiation between Mobile IPv4 and Mobile IPv6 over IEEE 802.11 wireless LAN technologies in term of function, packet loss rate, average handover delay, average end-to-end delay, handoff latency, throughput and speed performance.

3. To identify the strength and weakness of both IPv4 and IPv6 address through fully wireless transmission network simulations in term of performance.

4. To conclude and propose the best address format approach over wireless technology in real world environment.

5. To apply and improve student knowledge in networking field.

1.4 Scope

The project is focuses on discovering the differences between IPv4 and IPv6 address format operate via wireless transmission technologies which also categorize by transport layer protocols. Number of wireless topology will being experiment to generate approximate result. Furthermore, the studies will explain addresses function, packet loss rate, average delay, average throughput, packet delivery fraction and packet transmission properties. Simulation network generate by NS-2 tend to build in order to represent the implementation of different technology on both IP address format. Then the trace files which contain raw information that captured during the simulation process will be managed to integrate with awk script to produce statistical view of result.

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1.5 Project Significant

This research project will explain one of important network element which is an IP address format. Some studies and few experiment will be manage then follow by a conclusion about which IP address format were the best approach for wireless network base transmission besides divided the research by UDP and TCP transfer protocol. From the result gathered at the end of the simulation, the details of network behaviour captured converted into statistical representation for analyzing and differentiation step in order to assist the analyzers for comparison purposes. As the project only done by simulation, the expectation at the end of the project is able to provide clear and specific overview between both IPv4 and IPv6 address format over wireless technology in real life environment beside able to fulfill project objective that stated at the earlier of the project successfully. At the end of the project, one of the address formats will be decide as the best approach for wireless multi-hop network.

1.6 Expected Output

By the end of this research project, the end user or network developer will be more confident in developing a network that implementing the best address format to be implemented via wireless transmission technology in real environment. Plus, by developing the simulation environment that quite similar to the real world scenario, the outcomes from the research will be relevant to become a guide which one of address format is the best approach in order to provide the best services to our customer while fit with our budget.

Hence, the paperwork are about to define the best address format to be part of solution for wireless transmission which IPv4 or IPv6 the latest version which also categorize by transport layer protocol. All the result that has been documented will explain briefly about all the aspect that has already been specified before between both address formats.

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1.7 Conclusion

For the conclusion, this chapter covers the basic principle of IPv4, IPv6, mobile IP address and wireless technology. It also defines the objectives, project significant and expectation at the end of the project that must be complete in a period of time.

The next chapter, literature review will explain more details about research element based on literature resources. It also discusses about project methodology, project requirement and project estimated schedule.

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