DEPLOYMENT OF MESH AND MULTIHOP WIRELESS NETWORK FOR INDOOR SCENARIO

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Fakulti Kejuruteraan Elektronik dan Kejuruteraan Komputer
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Specially dedicated to

My beloved parents, brother, sister and my lover who have encouraged, guided and inspired me throughout my journey of education

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ABSTRACT

This project is about deploying a Mesh and Multihop Test-bed wireless network for indoor scenario. This test-bed using off-the-shelf equipments are Linksys WRT610n V2 Router and dd-wrt firmware. Usually LAN is a normal technology that used to create the network by using a lot of wire but this project used the technology of wireless as a medium communication and it will be reduced the cost of installation. The performance of throughput is evaluated between mesh and multihop to extend the LAN network coverage by using wireless technologies. Then, the performance of TCP and UDP throughput is investigated for mesh and multihop wireless network in indoor scenario. This project has been done successful for test bed performance for each router which has been located at multilevel FKEKK building. Lastly, from the analysis network performance, the results shown that mesh is better than multihop in term of stability and throughput for each router before deploy in real environment.

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ABSTRAK

Projek ini menjalankan sebuah rangkaian wayarles Mesh dan multihop yang di uji dalam kawasan tertutup (bilik). Ujian ini menggunakan Router Linksys WRT610n V2 dan juga Firmware DDWRT. LAN merupakan teknologi yang biasa digunakan untuk membuat sebarang jaringan dengan memerlukan banyak wayar tetapi untuk projek ini hanya menggunakan teknologi wayarles sebagai media komunikasi di mana ia akan mengurangkan kos pemasangan. Prestasi throughput di nilai di antara mesh dan multihop untuk memperluaskan liputan rangkai LAN dengan menggunakan teknologi wayarles. Kemudian, prestasi throughput TCP dan UDP diselidik untuk mesh dan multihop dalam kawasan tertutup. Projek ini telah berjaya dilakukan untuk ujian prestasi bagi setiap router yang telah berada di pelbagai tingkat bangunan FKEKK. Keputusan menunjukkan bahawa mesh lebih baik berbanding multihop dalam hal kestabilan dan throughput untuk setiap router sebelum disebarkan dipersekitaran yang sebenar.

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LIST OF ABBREVIATIONS

WMN	-	Wireless Mesh Network
LAN	-	Local Area Network
MAN	-	Metropolitan Area network
IP	-	Internet Protocol
DRAM	-	Dynamic Random Access Memory
PDA	-	Personal Digital Assistance
TV	-	Television
OLSR	-	*Optimized Link State Routing*
PoE	-	Power Over Ethernet
UDP	-	User Datagram Protocol
TCP	-	Transmission Control Protocol

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CHAPTER I

INTRODUCTION

This chapter will be explain about the background of project, objective of project, problem statement, scope of project, methodology and report outline.

1.1 Background Project

The purpose of this project is to research and deploy a mesh and multihop wireless network to extend the coverage using Linksys WRT 610n V2. This router provided dual band frequencies 5GHz and 2.4GHz. This project deploys for indoor environment with investigating the performance between two types of this network.

A wireless mesh network is a communication network made up of radio nodes organized in a mesh topology as shown in Figure 1.1. Every router can communicate each other in multiple paths. This method is used as backup network in case one of the routers is down and the network is still communicated. Similar with mesh, multihop is part of mesh wireless network whereby every router connected to another router in single path as shown in Figure 1.2.

Mesh and multihop often consist of clients, routers and gateways. Wireless networks are great for extending network and Internet connections through buildings, campuses, and other place.

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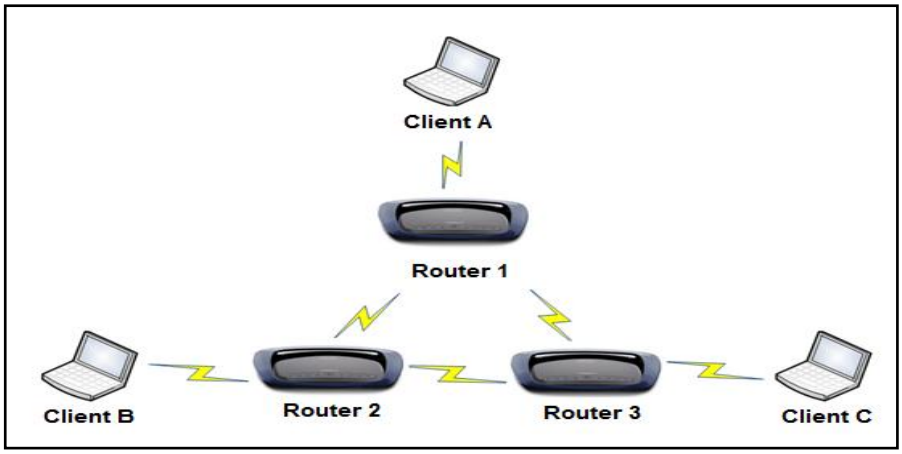

Figure 1.1: Wireless Mesh Network Topology

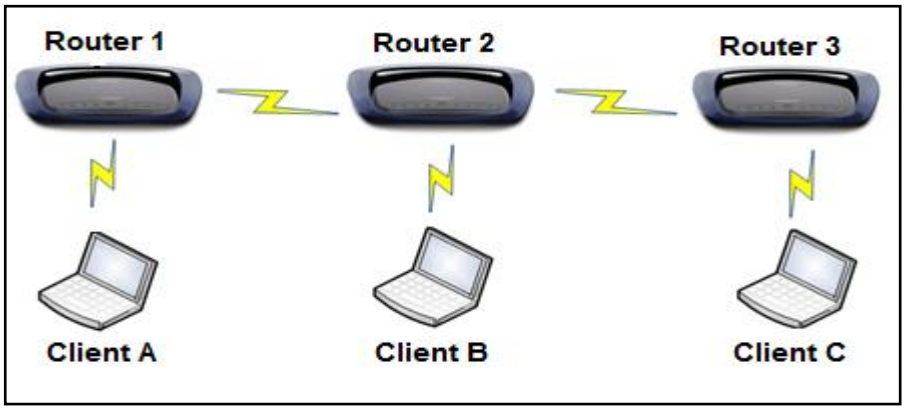

Figure 1.2: Multihop Wireless Network

Mesh and multihop are type of communication topology by using wireless as the transmission line. Previously, this communication use wired to connect each other but differ with the mesh and multihop that use wireless to connect and transmit the data. Advantages of using mesh wireless network because is low cost of infrastructure, self-forming and self healing. The important thing is create network more effective and increase the performance of wireless communication [1].

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1.2 Objectives

The objectives of the project are to:

i. create a 802.11 mesh and multihop wireless network test-bed using equipments Linksys Router and open source dd-wrt firmware.
ii. investigate the network performances in term of TCP and UDP protocol for indoor scenario.
iii. analyze the throughput for Mesh and Multihop wireless network.
iv. compare the throughput which one is the best before apply in real environment.

1.3 Problem Statement

This project is reviewed to reduce current problem where the usage a lot of wires in LAN network and only can apply in suitable location. The users need to find the socket RJ45 LAN that provided to connect the wire for access the internet, streaming and sharing data. So, it not practical by increase the socket or wired to support many users and surely that will be increased the cost to extend the coverage and users in the same time. The other problems is when one of the routers down or broken users can not access or will be disconnect to the server and need person to repair or reconnect that system. To solve this problem, by using the technologies without wire or wireless the users can access at any place which has exist the coverage area. Nevertheless, the coverage of wireless is limited but there are few method to extend the coverage. One of them makes router communicate each other; with this method users can connect to another router and access in same network. This technology called WLAN is consisting of Mesh and Multihop wireless network. The specials thing about one of this method (mesh) is self-healing mean that when one of node shutting down the others node will be reconnect automatically. So, the client will be disconnect in millisecond and reconnect again with another router in same coverage area. Client or users still can access or connect with router in

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movement. If client move to others router, handoff method will be applied and users still can access the data

1.4 Scope of Project

Scope for this project to deploy mesh or multihop for indoor using router Linksys model WRT610 version 2 which is provided two types of radio frequency 5GHz and 2.4GHz simultaneously. To deploy this project, the firmware or program that provided from factory must be change to support this system. This firmware can download from dd-wrt website and flashing into router. There are few configurations should be setup for each router and then need to test to make sure that all connectivity is done. Before deploys the testbed, the layout must be designed first and then determine the suitable place to put the routers. The suitable place in FKEKK building which are each router located at multilevel to ensure that all coverage router can covered the whole building. The distance between routers is importance to avoid interferent co-channel or overlapping by adjusting the power transmite in miliWatt (mW). Then, the network performance is measured for each router by using "IxChariot" sofware. This sofware able to measure the TCP and UDP protocol, time delay, connectivity between client and server. The other programs was involve for this project is "cmd" that provided by operating system "Window 7" and InSSIDer 2.0 to check the channel who exist in testbed enviroment. To measure the throughput one of the routers must be function as a server and another router as a client. So, the measurement is measure between server to client with different routers or hops. After measurement done, the results will be analyzed to know which one is better in term of stability and the throughput performance.

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1.5 Methodology

1.5.1 Flow chart description

This project starts with background study of the hardware. It is Linksys Router 610n and others topic that related to this project done by find out all the papers, journals and books that related to this project.

Next, study about suitable software, open source firmware and method of measurement throughput test-bed. Then, the routers are flashed by using open source firmware to make the mesh function. Figure 1.3 is the flow chart of the whole process of this project:

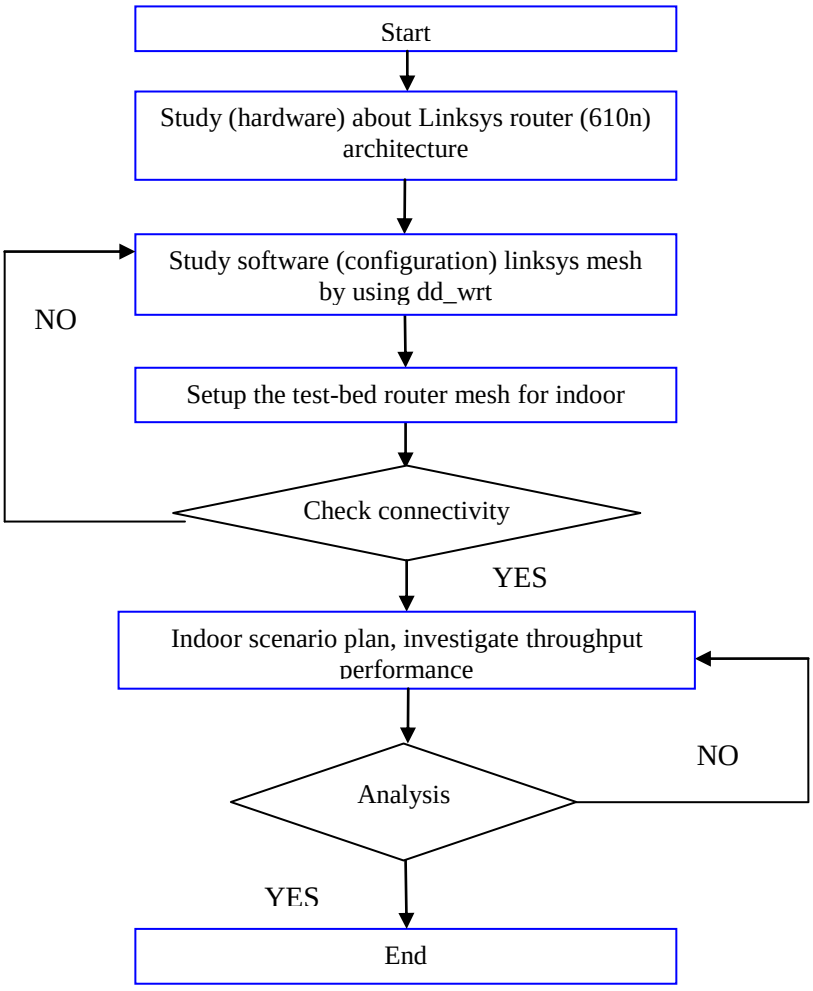

Figure 1.3: Flow Chart of Wireless Mesh Network

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1.6 Report Outline

This report represented by 5 chapters. The following paragraph below is the outline of Deployment of Mesh and Multihop for indoor scenario report:

Chapter I: This chapter discuss about the brief overview about the project such as project background, objective, scope of project, problem statement and methodology.

Chapter II: This chapter discuss about the information that have in project. This chapter discusses more about literature review for the hardware, software, throughput for indoor scenario and test-bed method.

Chapter III: This chapter discuss about the methodology of the project including the pre-deployment part of test-bed and planning indoor scenario including explanation.

Chapter IV: This chapter discusses about the result and analysis the deployment of this project. The comparison between mesh and multihop performance depend on throughput.

Chapter V: This chapter includes a conclusion, discussion and further work of the project.

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CHAPTER II

BACKGROUND RESERACH

This chapter is about theory of architecture mesh and multihop network and indoor scenario. The hardware and software that have been used in this project will be also discussed in this chapter.

2.1 Wireless Mesh Network

A wireless mesh network consists of mesh nodes that form the backbone of the network. The nodes are able to configure automatically and re-configure dynamically to maintain the mesh connectivity. This gives the mesh its "self-forming" and "self-healing" characteristics. This self-sufficient relationship between the mesh nodes removes the need for centralized management. Intelligent routing allows mesh nodes to route data packets for nodes that may not be within direct wireless range of each other. Thus information can be routed from source to destination over multiple hops. This has a potential advantage in terms of network reliability over traditional single hop networks, especially for backhaul communication [2].

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This feature brings many advantages to mesh, such as low up-front cost, easy network maintenance, robustness, reliable service coverage and so on. Therefore, in addition to being widely accepted in the traditional application sectors of ad hoc networks, WMNs are undergoing rapid commercialization in many other application scenarios such as broadband home networking, community networking, building automation, high speed metropolitan area networks, and enterprise networking [4].

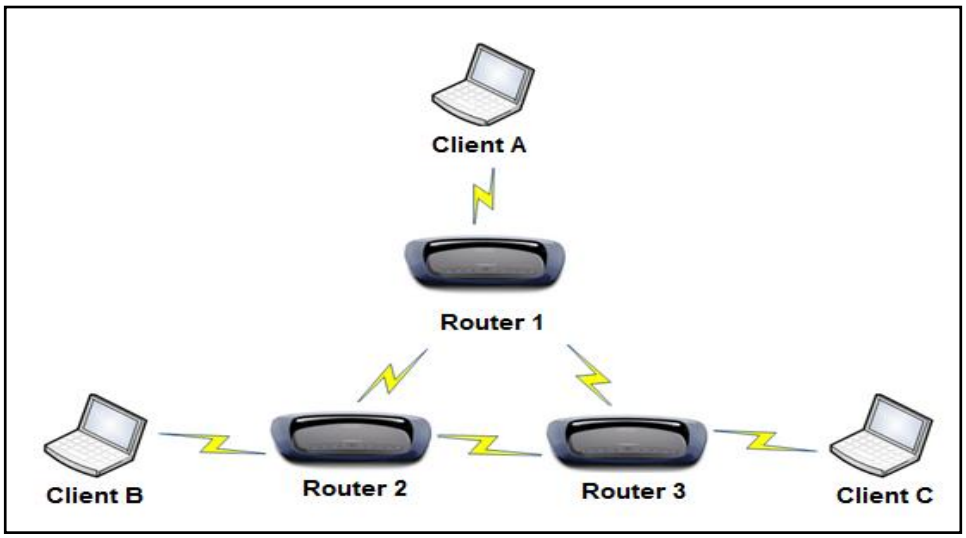

Figure 2.1: Wireless Mesh Network Topology

Figure 2.1 shows the basic network for mesh wireless network. Consist of 3 routers called hop which is connect with others router. Assume router 1 is a server connected wired RJ45 with internet access, all router in this topology can be access the internet from server router. That why mesh is reducing a cost because only use a single wired that connect to a router, all topology can access to internet.

The graphic in Figure 2.2 architecture of mesh network functions when sharing an Internet connection across a wireless local area network (WLAN). The only one node in the wireless mesh network needs to be directly wired to the Internet. That wired node shares the Internet connection wirelessly with the nearest cluster of nodes, which then share it with their nearest cluster of nodes and so on.

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