SITE PLANNING FOR WIRELESS MESH NETWORK

VISNU VARADA

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Tajuk Projek : SITE PLANNING FOR WIRELESS MESH NETWORK

Sesi Pengajian

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Signature : …….
Supervisor : Mr.Mohd Riduan Bin Ahmad
Date : …….

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ABSTRAK

Projek ini pada dasarnya adalah tentang perancangan Jaringan Wireless Mesh menggunakan perisian ramalan Winprop di tempat kajian yang dibuat dalam bangunan FKEKK. Dengan menggunakan perisian ini dibuat rangkaian Mesh menerima kuasa (RSSI) disimulasikan dengan menggunakan 5 model yang berbeza yang terutama dibahagikan kepada tiga kategori utama (empirik, deterministik, dan semi-deterministik). Dari hasil simulasi, rangkaian sebenarnya adalah dibangunkan. Kemudian, dengan menggunakan Wi-Fi Xirrus Inspektor, RSSI pada setiap titik diukur. Kemudian menggunakan data pengukuran dan data simulasi, analisis data dilakukan untuk mendapatkan ketepatan setiap model simulasi.

ABSTRACT

Basically this project is about planning the real network site (wireless mesh network) by using related planning tools such as WinProp prediction software, IxChariot measurement software and measurement apparatus (mesh routers, mesh clients, gateways and server). The processes involve network planning, monitoring, data collection, analyses and optimization of wireless mesh network in order to maximize the usage of the network. Two parameters will be observed namely Received Signal Strength Indicator or RSSI (can be translated to Signal-to-Noise ratio or SNR) and network Throughput.

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dBm	Decibel mili
GUI	Graphical user interface
Kbps	kilobits Per Second
MAC	Media Access Control
RF	Radio Frequency
RX	Receive
TX	Transmit
WLAN	Wireless local area network
WMN	Wireless mesh network

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CHAPTER I

INTRODUCTION

1.1 Background

This project is basically focused on network deployment for providing a Wi-Fi access for a selected test-bed. In this project, FKEKK building area is taken as the test-bed. Thesis process involves network planning, monitoring, data collection, analyses and optimization of wireless mesh network in order to maximize the usage and quality of the network. Two parameters will be observed namely Received Signal Strength Indicator or RSSI (can be translated to Signal-to-Noise ratio or SNR) and network Throughput.

Wireless mesh networks [1] can easily, effectively and wirelessly connect entire cities using inexpensive, existing technology. Traditional networks rely on a small number of wired access points or wireless hotspots to connect users. In a wireless mesh network, the network connection is spread out among dozens or even hundreds of wireless mesh nodes that communicate to each other to share the network connection across a large area.

Information travels across the network from point A to point B by hopping wirelessly from one mesh node to the next. The nodes automatically choose the quickest and safest path in a process known as dynamic routing. Mesh nodes are small radio transmitters that function in the same way as a wireless router. Nodes use

the common Wi-Fi standards known as 802.11a, b and g to communicate wirelessly with users, and, more importantly, with each other.

In a wireless mesh network, only one node needs to be physically wired to a network connection like a DSL Internet modem. That one wired node then shares its Internet connection wirelessly with all other nodes in its vicinity. Those nodes then share the connection wirelessly with the nodes closest to them. The more nodes, the further the connection spreads, creating a wireless connectivity that can serve from a small scale geographical area to big scale geographical area.

1.2 Problem Statement and Objective

Normally wireless network is deployed considering only the higher layer information and neglect lower layer information such as RSSI (Radio signal strength indicator) during the planning process. Most of the propagation effects at lower layer such as fading and multipath are not considered. By considering the relationship between Throughput and lower layer information such as RSSI and SNR, we reckon that the wireless network performance can be optimized.

This project aims to:

1. To plan wireless mesh network.
2. To simulate Received Signal Strength (RSSI) using WinProp.
3. To deploy wireless mesh network test-bed.
4. To evaluate the performance of wireless mesh network in terms of RSSI and Throughput.

1.3 Scope of Work

This project basically involves four main scopes that are network planning, network monitoring and data collection, data analysis and finally is network optimization.

Network planning basically involves 2 parts namely frequency planning and IP assignment planning. Frequency planning related with operating frequency configuration of the mesh routers and IP assignment planning related with sub-

netting the wireless mesh network according to the number of required users. Network monitoring and data collection involves measurement campaign to collect RSSI. Data analyses involve creating models for the collected data to show the relationship between predicted model and RSSI (proportional to SNR).

1.4 Project Significant

The significant of this project is making a major contribution to the wireless service provider. This because this project will analyze about all received power models and finally come to a conclusion which model is the best model to use in desired criteria that is in indoor criteria in this project.

1.5 Contribution of the Project

Basically in this project, my contribution is to plan, simulate, deploy, and measure the real value of RSSI, and finally created a graphical user interface in order to show the accuracy of every prediction model the wireless network.

1.6 Thesis Organization

This thesis basically has 5 different chapters that is divided from chapter I to chapter V. Chapter I covered about introduction of the project. Chapter II contains of literature review of the project. This chapter covered all the studies done before start this project. Then this thesis continues with chapter III. This chapter contains methodology of the project. This chapter explains all the working that is planned to implement this project. Then this thesis continues with chapter IV that is covered all the result and analysis of the project. Final chapter of the thesis is chapter V that is covered conclusion of the project and future work related to the project.

CHAPTER II

LITERATURE REVIEW

2.1 Wireless Mesh Network

A wireless mesh network (WMN) [2] 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 term of network reliability over traditional single hop networks, especially for backhaul communication. Figure in the next page shows a general overview about wireless mesh network.

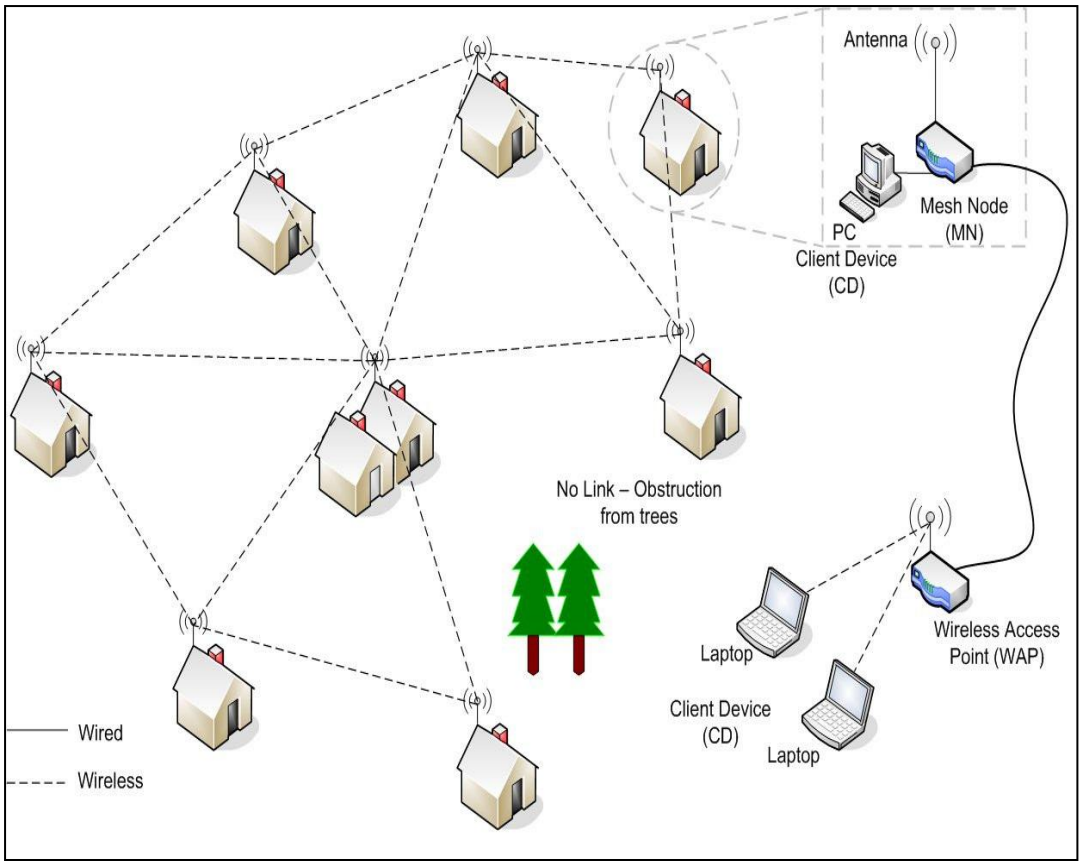

Figure 2.0: General overview about wireless mesh network

2.1.1 Wireless Mesh Node

A wireless mesh node consists of a wireless router and an antenna. The mesh node could be installed indoors or in a weather-proof enclosure outdoors. The antenna could be the standard indoor Omni-directional antenna (give coverage in 360°). A mesh node communicates only with other wireless mesh nodes.

2.1.2 Wireless Access Point

A wireless access point consists of a wireless router and an antenna. The wireless access point could be installed indoors or in a weather-proof enclosure outdoors. The antenna could be the standard indoor Omni-directional. A wireless access point creates a hotspot where any Wi-Fi enabled device can connect to the wireless access point.

2.1.3 Advantages of Mesh Networking

- Self-forming: The wireless mesh network forms automatically once the mesh nodes have been configured and activated.
- Self-healing: Once restored, a node rejoins the mesh network seamlessly.
- Fault tolerance: If redundant routes exist in the network, information flow is not interrupted in the rest of the network when one node fails. The network will dynamically reroute the information via the next available route.

2.1.4 Important Wireless Mesh Networking Principles

- Communication between mesh nodes are based on Wi-Fi radios (IEEE 802.11 a/b/g) attached to Omni-directional antennas.
- All radios are set to ad-hoc mode (not client mode or infrastructure (access point) mode).
- Each node in the WMN has the same SSID (name) and BSSID (number) the BSSID should be fixed to prevent partitioning of the wireless network and prevent handover of mobile client from one node to another node.
- In an ideal WMN, each node should be able to communicate at least two other nodes in the WMN.
- All nodes in the WMN (in one cluster) will operate on the same channel (frequency).
- A mesh routing protocol, like OLSR, will route IP traffic between the wireless interfaces of the mesh nodes. Each node will communicate to listening to the routing information exchanged in the network to select the best route to transfer data. So via this OLSR protocol each node not only have one route but many available route. If any node fail to communicate (device failure), other neighbor node is available to transfer the data to gateway.
- All nodes (in one cluster) in the WMN will operate on the same channel (frequency).
- Each IP address in the mesh network should be unique to allow any computer in the network to connect to any other computer in the network.

2.1.5 Important Consideration

- Telecommunications Regulations: in our country MCMC is takes roles for all wireless communication frequency licenses. So, refer to MCMC 2.4GHz band is unlicensed frequency spectrum that can be used as channel allocation in Wi-Fi network.
- Wireless network planning: As known 2.4GHz band is unlicensed ISM spectrum frequency, many Wi-Fi channels is overlap with other wireless device that will cause interference that will decrease performance of the network. Common device that interfere with Wi-Fi network is such as Microwave ovens, air-conditioners, cell phone Bluetooth device and other radio device. So there only three non-overlap channels that is 1, 6, and 11. Channel allocation for Wi-Fi network is shown below.

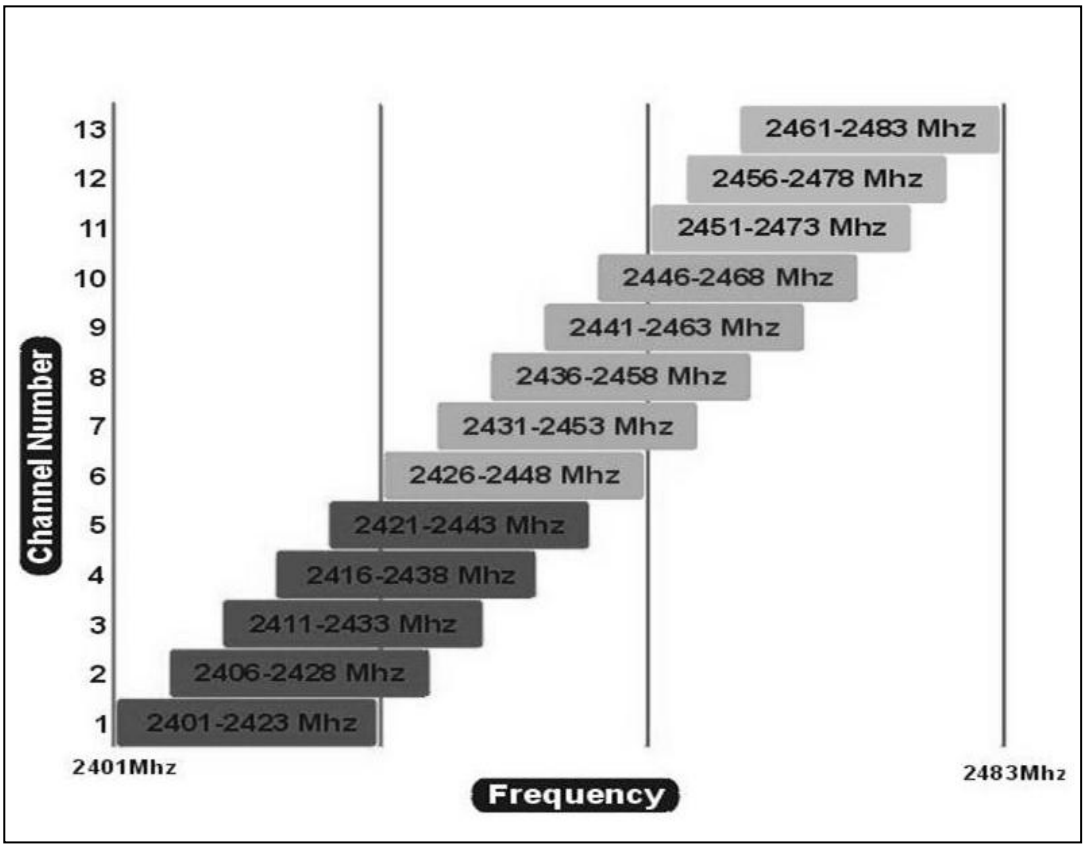

Figure 2.1: Channel allocation for Wi-Fi network