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Comparison of Hop Count on Wireless Mesh Network

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Abstract

Wireless Mesh Network (MWN) is a self-configured and self-organized network that can typically be implemented on 802.11 hardware. It consists of several nodes that make up the network backbone in a multi-story and sealed room, in contrast to building a hall or a place without bulkheads. This experiment uses an odd and even number scheme with a maximum number of routers of 8 pieces. In a sealed room, the performance of the method of installation of the number of strange Hops is better than the number of even Hops, with throughput calculation of 2665.19 KB, delay 0.25 s, data lost 0.60 %, and jitter 0.01 s and the best scheme that is with the number of Hops as much as five pieces, with the calculation of the number of throughput 7001.88 KB, delay 0.51s, data lost 0.47%, and jitter 0.002 s. In the free spaces, it can produce the better performance of the even hop count calculation scheme than the odd hop count by building throughput 16709.8 KB, delay 0.2 s, data lost 0.08 %, and jitter 0.03 s. and the best scheme that is with the number of throughput 68975,2 KB, wait for 0.0148 s, data lost 0 %, and jitter 0.0014 s. WMN performance in unshared space is more maximized than the version in a sealed area, with throughput values of 11786.82 kbps, delay of 2.08 ms, and data lost by 0.08 %, and jitter 0.03 s.it can produce the better performance of the even hop count calculation scheme than the odd hop count by producing throughput 16709.8 KB, delay 0.2 s, data lost 0.08 %, and jitter 0.03 s. and the best scheme that is with the number of throughput 68975,2 KB, wait for 0.0148 s, data lost 0 %, and jitter 0.0014 s. WMN performance in unshared space is more maximized than the version in sealed space, with throughput values of 11786.82 kbps, delay of 2.08 ms, and data lost by 0.08 %, and jitter 0.03 s. and data lost by 0.08%, and jitter 0.03s.

Keywords

Wireless Mesh Network, Self-Confident, Hop Count, Sealed Areas.

1. Introduction

Information technology is a tremendous research area in the current years [21][22][23] and several active topics [18][19][20]. Wireless Mesh Network is a network technology widely used as a replacement for regular Wireless LAN networks which can self-configure, self-organizing, and not dependent on the server (autonomous). It comprises several Hops that are a backbone network, where each Hop can configure and organize itself automatically implemented. Spatial design is one of the factors that affect the WMN; for instance, a small number of Hops is the biggest obstacle to understanding WMN. Aspects influenced by space design constraints and Hop jump include the magnitude of Throughput, Delay, Data Loss, and Jitter. This research implements WMN with Mesh Made Easy (MME) protocol to access the network using WMN and Controller Access Point System Manager (CAPSTAN) controller centrally to control the network. Network Development Life Cycle (NDLC) is used in the WMN network development phase to control the network. Network Development Life Cycle (NDLC) is a method used in the WMN network development phase [5].

WMN builds radio nodes that are arranged in a mesh topology when in use. The mesh

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topology of a network is the interconnection of all nodes in the network. Nodes, customers, routers, gateways, and other hardware make up the network. Mesh networks are typically less mobile because rerouting is less complicated in delving into the reroute results because the nodes are entirely bonded [16]. WMN is a multi-hop wireless network made up of many stationary wireless mesh routers. A mesh-like backbone structure connects these routers wirelessly. Some routers serve as wireless access points, allowing clients (such as laptops and smart devices with wireless access) to connect to the network. The clients use the backbone mesh network to send and receive data. One or more routers are connected to the wired network and serve as gateways to connect to external networks such as the Internet. The study discussed the security performance of the OLSR and SOLSR protocols on mesh networks [8].

The capacity of efficient throughput to customers is a significant challenge in implementing wireless mesh networking. Signals sent from different devices over the same channel (frequency band) can collide, resulting in data loss due to the wireless medium's broadcast nature. As a result, methods like time division multiple access and, To coordinate transmissions over the channel, frequency multiple access or random access is required. The efficiency of random-access methods used in IEEE 802.11 networks is well known to deteriorate as the number of devices increases. The device devices can transmit over various non-overlapping channels defined in the IEEE 802.11 standards. In other words, it can increase a wireless mesh network's capacity by equipping the routers with multiple radio interfaces, each of which is tuned to a different channel. Research [3] examines the QoS performance of WMN when scheduling distribution [4] or implementation of WMN in building squares [9]. This paper examines Swarm Optimization simulations to solve router path problems on WMN and focuses on hop installation's influence with odd and even amounts on QoS.

2. Literature Review

Predicting the performance of ad hoc networking protocols for mesh networks has typically been performed by making use of software-based simulation tools. Experimental study and validation of such predictions are vital to obtaining more realistic results but may not be possible under network simulators' constrained environment. Several papers presented the comparison of OLSR and SOLSR routing on WMN configuration to measure the reliability of the security performance of OLSR and SOLSR protocols on mesh networks. This study's result is that the overall addition of security mechanisms in SOLSR affects routing protocols lower than OLSR protocol. This study aims to measure the reliability of the security performance of OLSR and SOLSR protocols on mesh networks. This study's result is that the overall addition of security mechanisms in SOLSR affects routing protocols lower than OLSR protocol [8].

Research related to distribution scheduling on WMN is research on the use of Spatial Time Division Multiple Access (STDMA). Scheduling is one of the most critical aspects that will impact system performance. There are two scheduling mechanisms, namely centralized scheduling, and distributed scheduling. Distributed scheduling is divided into 2, namely coordinated, broadcast, and uncoordinated distributed. This final task presents the basic schema algorithm's performance, an algorithm for coordinated, distributed, and scheduling. The use of STDMA is a solution to the limited number of slots for allocating nodes. The system design scheme in this study started with random node settings. This set node has a random location. Then on the set will be calculated the distance from each node will be done SNR calculation of each node raised. From the SNR value, modulation will be selected that will be used for each node. After selecting modulation, then each node will be scheduled with a basic schema—the basic schema allows the allocation of emptying slots in order. The use of STDMA to be occupied by several nodes and do the calculation and the fairness index of this system [17]. The allocation of emptying slots is occupied by several nodes and does the calculation and fairness index of this system [17].

The research is related to case studies on on-campus environments to identify the impact of regular WLAN networks' replacement into WMN. The analysis implemented WMN, which uses the Mesh Made Easy (MME) protocol to access networks using WMN to be accessed by mobile. Controller Access Point System Manager (CAPSTAN) is a Wireless network controller that is done centrally, making it easier for administrators to control the network. Network Development Life Cycle (NDLC) is a method used in the research phase of the WMN network. From the simulation results that have been done can be concluded that by implementing a WMN network and using CAPSTAN Wireless network can be accessed using only one SSID can be accessed mobility and can facilitate administrators in network control conducted centrally [5]. It can be implemented in public areas, for example, the implementation of hotspot connection in Purworejo square [4]. Only one SSID can be accessed mobility and can facilitate administrators in network control conducted centrally [5]. It can be implemented in public areas, for example, the implementation of hotspot connection in Purworejo square [4].

The current study implemented a simulation system based on Particle Swarm Optimization (PSO) to solve router mesh placement in WMN. Four methods of replacing mesh routers include: Constriction Method (CM), Random Inertia Weight Method (RIWM), Linearly Decreasing Vmax Method (LDVM), and Linearly Decreasing Inertia Weight Method (LDIWM). The simulation results showed that CM coalesced very quickly but had the worst performance among the four methods. Performance metrics considered are the Giant Component (SGC) size and the Number of Covered Mesh Clients (NCMC). RIWM convergence is fast and performs well. LDIWM is a combination of RIWM and LDVM. LDVM converged after 170 phase counts but performed well [9].

3. Proposed Method

In this experiment, we undergo our method in several stages, including data collection WMN design through an experiment. Then, we collect literature by searching and reading literature and references about computer networks, Wireless LAN, and WMN. In addition, at this stage also conducted the selection of hardware suitable for a WMN. The data collected in the form of numbers and graphs, the acquisition of data taken is real-time, resulting from wireless mesh network experiments. The work process carried out took the results of the network scenarios. The method includes the number of Hops and the placement of Hops on the existing layout. The spatial design consists of two models, namely the model of a multi-story room and a hall.

We conduct the design of WMN by adding the odd Hop Count scenario and the even Hop Count scenario in the sealed space and the unpatented space will use the techniques that will be applied. Next, the implementation of the resulting method has been created. From these results also conducted testing with RTP, FTP, and Video Streaming packages. The analysis was born in this research by calculating the average of throughputs, delay, data lost, and jitter on each Hop. Once the results of each Hop are known, then a comparison is made between the number of odd Hops and the number of even Hops.

4. Experimental Setup

At this stage, a wireless mesh network with several Topology and room designs is carried out.

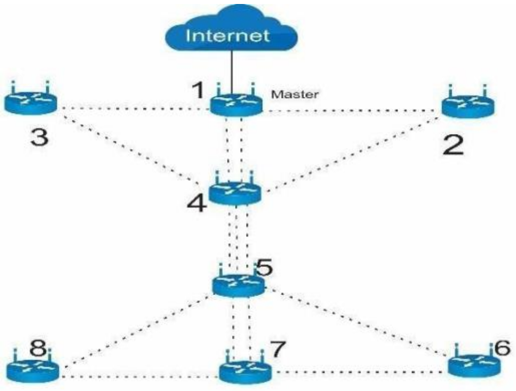

Fig.1 Topology on Multi-Store Buildings

Fig. 1 explains the topology that is used in multi-story buildings. In this wireless mesh network design using eight routers, routers 4 and 5 are linked between the 1stand2ndfloor.

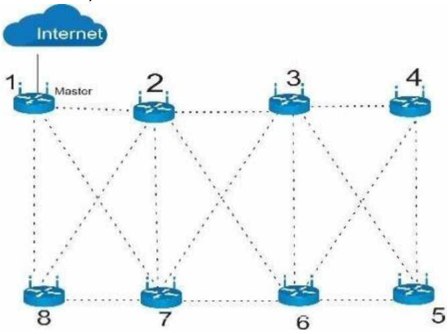

Fig. 2 Topology in The Hall

Fig. 2 described the hall's topology, the router used as many as eight pieces are installed in an unceded and unlevel room.

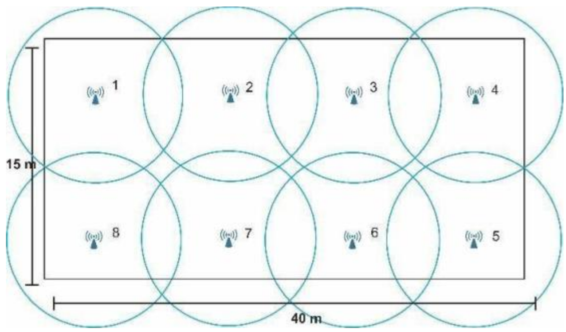

Fig. 3 Upper and Lower-Level Room Design

Fig. 3 explained topology's implementation in a multi-story room and shown the radiance of signals coming out of each router. From the beam of the movement can be known about the limitations of the call.

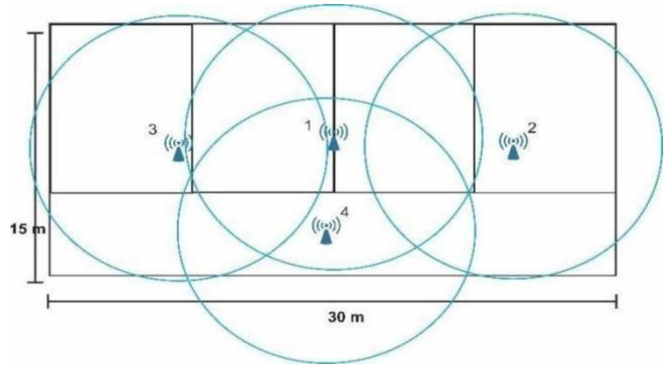

Fig. 4 Hall Room Design

5. Result & Analysis

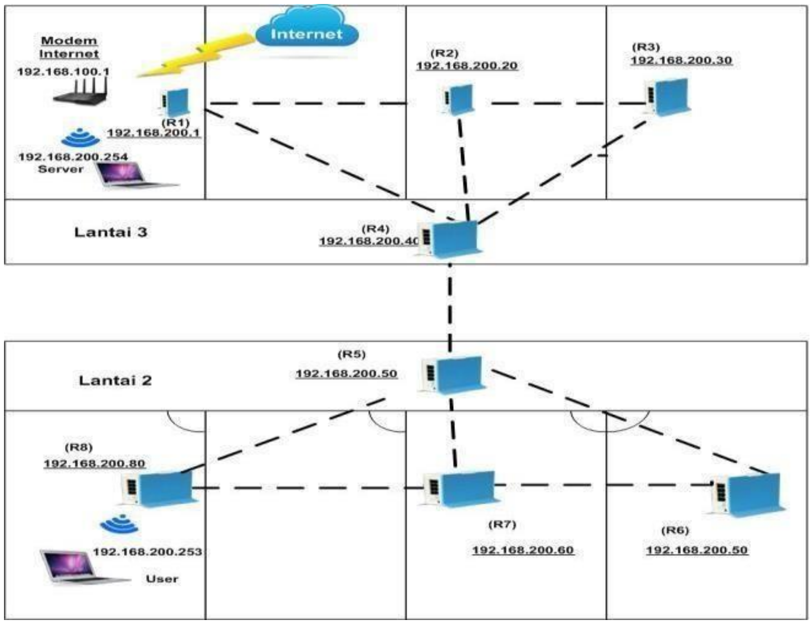

Fig. 5 Data Retrieval Design in Sealed Space

In this Topology, there are 8 Hops placed in a sealed and terraced room. Data retrieval through Hop 1, Hop 2, Hop 3, Hop 4, Hop 5, Hop 6, Hop 7, and Hop 8, where the server computer is connected to Hop 1, and the user computer is connected to Hop 8. Data retrieval in the form of RTP is by providing ping load from user computer 192.168.200253 to server computer 192.168.200.254. FTP data retrieval is by copying files from server computer 192.168.200.254 to user computer 192.168.200.253. To retrieve streaming data by accessing www.youtube.com from the user's computer 192.168.200.253.

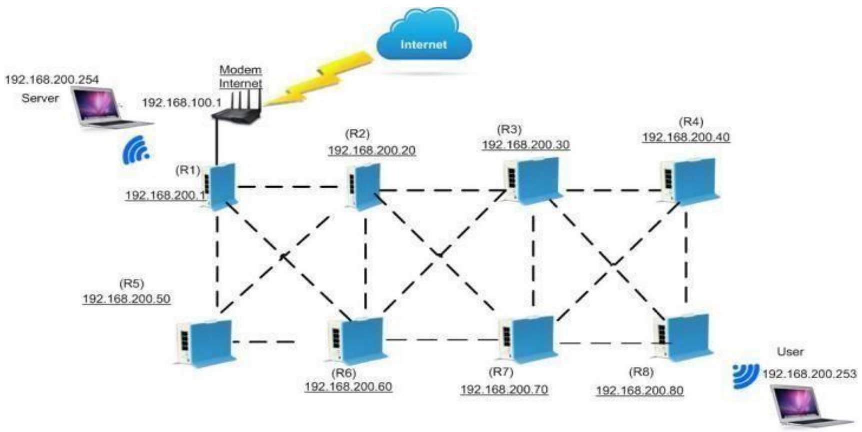

Fig. 6 Data Retrieval Design in Un-aggregated Spaces.

In this paper, we experiment 8 Hops located in the unceded space or hall, so that data retrieval through Hop 1, Hop 2, Hop 3, Hop 4, Hop 5, Hop 6, 7 Hop, and Hop 8, where the server computer is connected to Hop 1 and the user's computer is related to Hop 8. Data retrieval in the form of RTP is by providing ping load from user computer 192.168.200253 to server computer 192.168.200.254. FTP data retrieval is by copying files from server computer 192.168.200.254 to user computer 192.168.200.253. To retrieve streaming data by accessing www.youtube.com from the user's computer 192.168.200.253. Fig. 7 displays Odd, and Even Comparison Results in Confined Spaces.

Testing	Number of Routers				Aver age
	1	3	5	7	
Throughput t (KB)	473 ,4	1184, 4	7001, 8	1960, 9	**2655,1**
Delay (s)	0,0 9	0,15	0,51	0,26	**0,25**
Data Lost (%)	0,3 1	0,15	0,47	1,48	**0,60**
Jitter (s)	0,0 0	0,003 4	0,02	0,01	**0,01**

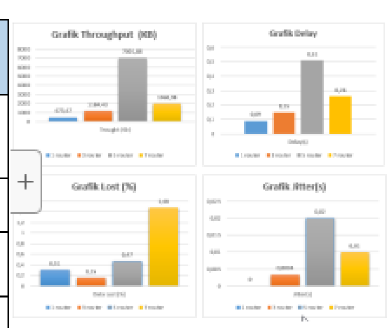

Fig. 7 Even Sum Calculation Graph on Sealed Space

Testing	Number of Routers				Average
	2	4	6	8	
Throughput (KB)	2350,60	473,03	4010,55	637,55	1867,93
Delay (s)	0,06	0,10	0,65	0,4909	0,33
Data Lost (%)	0,01	0,00	0,42	4,42	1,21
Jitter (s)	0,00	0,01	0,86	0,0485	0,23

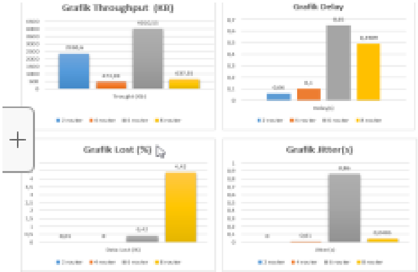

Fig. 8 Comparison graph Results in Unsealed Spaces

Testing	Number of Routers		Aver age
	Odd	Even	
Throughput (KB)	6863,8	2778,06	2261,56
Delay (s)	3,96	0,27	0,29
Data Lost (%)	0,08	0,14	0,91
Jitter (s)	0,02	0,29	0,12

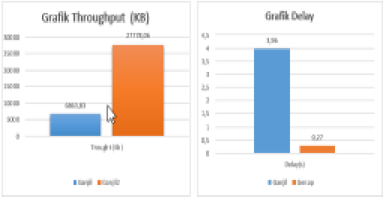

Fig. 9 Graph of Calculation of Odd Sums in Confined Spaces

Testing	Number of Routers				Average
	1	3	5	7	
Throughput (KB)	321,5	779	23683,5	2671,3	6863,83
Delay (s)	0,0137	0,1462	15,5211	0,1558	3,96
Data Lost (KB)	0,01	0	0	0,3	0,08
Jitter (KB)	0,0018	0,0658	0,0076	0,005	0,02

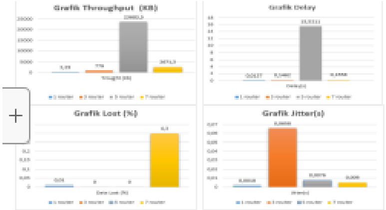

Fig. 10 Even calculation graph Comparison Graph On Un-Confined Spaces

Testing	Number of Routers				
	2	4	6	8	
Throughput (KB)	58975,2	710,4	4808,6	2345	16709,80
Delay (s)	0,0148	0,0697	0,5272	0,1929	0,20
Data Lost (%)	0	0	0	0,33	0,08
Jitter (s)	0,0014	0,0076	0,0827	0,0173	0,03

Fig. 11 Blocking and Un-Sealed Space Comparison Graph

To summarize the result, we can conclude that the design of the number of even Hops obtained that the best scheme is with the amount of throughput 68975.2 KB, delay 0.0148 s, data lost 0%, and jitter 0.0014s. Thus, performance WMN in the free spaces more than the sealed areas, with a throughput value of 11786.82 kbps, delay 2.08ms, data lost 0.08%, and jitter 0.03s. The number of even Hops' design obtained that the best scheme is with the amount of throughput 68975.2 KB, delay 0.0148 s, data lost 0%, and jitter 0.0014s. Thus, performance WMN in the free spaces more than the sealed spaces, with a throughput value of 11786.82 kbps, delay 2.08ms data lost 0.08%, and jitter 0.03s.

6. Conclusion

Based on the experiment result, the number of odd Hops' installation scheme is better than the number of even Hops, with the throughput calculation up to 2665.19 KB, delay 0.25 s, data lost 0.60 %, and jitter 0.01 s. The number of odd Hops obtained the best scheme with the number of Hops as much as five pieces, with the calculation of the number of throughput 7001.88 KB, delay 0.51s, data lost 0.47%, and jitter 0.002 s. In non- sealed spaces, the even hop count calculation scheme's performance is better than the odd Hop count installation scheme, with the calculation of the number of throughput 16709.8 KB, delay 0.2 s, data lost 0.08 %, and jitter 0.03 s. From the design of the number of even Hops obtained that the best scheme is with the amount of throughput 68975.2 KB, delay 0.0148 s, data lost 0%, and jitter 0.0014s. Thus, performance WMN in the free spaces more than the sealed areas, with a throughput value of 11786.82 kbps, delay 2.08ms, data lost 0.08%, and jitter 0.03s. The number of even Hops' design obtained that the best scheme is with the amount of throughput 68975.2 KB, delay 0.0148 s, data lost 0%, and jitter 0.0014s. Thus, performance WMN in the free spaces more than the sealed rooms, with a throughput value of 11786.82 kbps, delay 2.08ms data lost 0.08%, and jitter 0.03s.

Acknowledgment

Use the singular heading even if you have many acknowledgments. Sponsor and financial support acknowledgments are placed in the unnumbered footnote on the first page, not here.

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