Analysis of Node Router Performance with Babel and OLSR Protocol on MANET in Disaster Area

Kelfin Agung Satriawan[1], Nugroho Suharto[2], Putri Elfa Mas'udia[3]
[1]Digital Telecommunication Network Study Program, Department of Electrical Engineering,
State Polytechnic of Malang, 65141, Indonesia.
[2,3] Telecommunication Engineering Study Program, Department of Electrical Engineering,
State Polytechnic of Malang, 65141, Indonesia

[1]kelfinsatriawan@gmail.com, [2]nugroho.suharto@polinema.ac.id, [3]putri.elfa@polinema.ac.id

***Abstract*— Natural disasters are events caused by nature, including earthquakes, tsunamis, volcanic eruptions, droughts, hurricanes, and landslides. Natural disasters can cause telecommunications infrastructure to become damaged or malfunction. Therefore, flexible network technology is needed and does not depend on infrastructure, so that when the existing infrastructure is not functioning, humans can still communicate. One of the network technologies that is flexible and has infrastructure less characteristics, or basically does not require infrastructure, is Mobile Ad-hoc Network (MANET) technology. So that MANET technology becomes an option that can be a solution to existing problems, namely when a natural disaster occurs and the existing telecommunications infrastructure doesn't function. In the MANET network to communicate data between nodes that are far apart, it takes hops to a node in order to communicate, when a node is selected as a hop, the node will automatically act as a router node, the role of the router node is as a successor or communication liaison from a node to other nodes. In a router node, the parameters that are considered are CPU usage and RAM usage, because with increasing communication the router will process more data so it will take time to process the data, this will cause delay process. In this study, the performance of router nodes on Babel and OLSR will be discussed on the performance of router nodes on a fixed network with a stationary, moving and swapping node testing scheme. The parameters used in this study are CPU usage, RAM usage, and delay process.**

***Keywords*— Mobile ad-hoc Network (MANET), Babel, OLSR, CPU Usage, RAM Usage, Process Delay.**

I. INTRODUCTION

Natural disasters are events caused by nature, including earthquakes, tsunamis, volcanic eruptions, floods, droughts, hurricanes, and landslides. Natural disasters can cause telecommunications infrastructure to become damaged or malfunction. When the telecommunications infrastructure is not functioning, it will be difficult for humans to communicate. Therefore, network technology is needed that is flexible and does not depend on infrastructure, so that when the existing infrastructure is not functioning, humans can still communicate [1].

One of the network technologies that is flexible and has infrastructureless characteristics, or basically does not require infrastructure, is Mobile Ad-hoc Network (MANET) technology [2]. So that MANET technology becomes an option that can be a solution to existing problems, namely when a natural disaster occurs and the existing telecommunications infrastructure does not function [3]. The MANET network allows multi-hop communication to occur so that the coverage area of the MANET network can be very wide [4].

In the MANET network to communicate data between nodes that are far apart, it takes hops to a node in order to communicate, when a node is selected as a hop, the node will automatically act as a router node, the role of the router node is as a successor or communication liaison from a node to other nodes [5]. A routing protocol is needed that has the ability to pass through many points or nodes (multihop) to take advantage of other nodes as intermediaries if the communication range is outside the destination of the node [6,7]. Routing protocol is communication between nodes to share data or information related to a network and connections from one node to another [8].

An increase in the number of communications will increase the load on the router node, so that the performance of the router node must be considered so that communication can run well [9]. In a router node, the parameters that are considered are CPU and RAM usage, because with increasing communication the router will process more data so it will take time to process the data, this will cause process delays [10].

So in this study, the performance of router nodes in the Babel [11] proactive protocol and the proactive OLSR (Optimized Link State Routing Protocol) [12] protocol will be discussed on the performance of router nodes with a stationary and moving node testing scheme [13]. The parameters used in this study are CPU usage, RAM Usage, and process delay.

II. LITERATURE REVIEW

A. Wireless Network

Wireless technology (wireless) is a technology development of computer networks that previously used cables as a connecting medium. Wireless uses air or electromagnetic waves as a medium for data exchange traffic. The wireless network model consists of two types, one of which is an ad-hoc network. An ad-hoc network is a network consisting of two or more wireless devices that communicate

directly with each other [14]. The form of the Ad-hoc network is shown in Fig. 1.

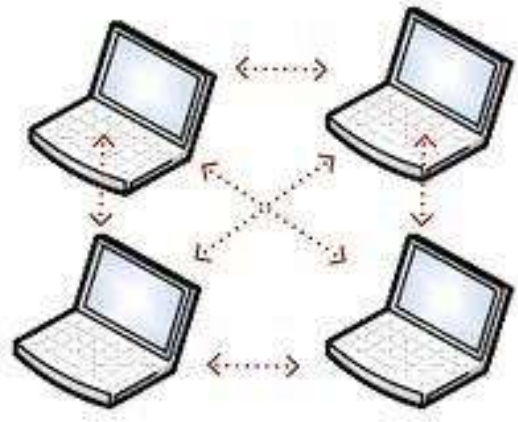

Figure 1. Ad-hoc network [2]

B. Mobile Ad-hoc Network (MANET)

Mobile Ad Hoc Network (MANET) is a collection of several wireless nodes that can be set-up dynamically anywhere and anytime without using the existing network infrastructure [9]. MANET is also a temporary network formed by several mobile nodes without an administrative center and cable infrastructure [10]. In MANET, the mobile nodes connected to the wireless network can move freely and also act as routers. The nodes in this network are responsible for finding and handling routes to each node in the network.

C. Babel

Babel is a proactive routing protocol that has several mechanisms to ensure that there will be no routing loops and accelerate convergence by utilizing its route selection mechanism [3]. Routing loop is one of the problems that occur when the routing information is spread to other routers. When there is a broken path between routers, then information about this path break must be disseminated to all routers so that all routers do not use the broken path. If the rerouting is late, then the data going to the broken line will always circle around the broken line.

D. Optimized Link State Route (OLSR)

The Optimized Link State Routing Protocol (OLSR) is an IP routing protocol optimized for ad hoc mobile networks, which can also be used on other wireless networks [4]. This network is structured using dynamic Multi Point Relays (MPRs) to increase data throughput by creating efficient network routing schemes [2]. OLSR also uses hello and topology control (TC) messages to find and then disseminate link state information across the ad hoc mobile network.

E. Ubuntu Linux

Linux is the name given to the Unix-type computer operating system. Linux is one example of the results of free and open software development. Like most free and open source software, the Linux source code can be freely modified, used and redistributed by anyone. The name "Linux" comes from the name of its creator, which was introduced in 1991 by Linus Torvalds. The system, system tools and libraries are generally derived from the GNU operating system, announced in 1983 by Richard Stallman. The contribution of GNU is the basis for the emergence of the alternative name GNU/Linux [15].

III. RESEARCH METHODS

A. System Planning

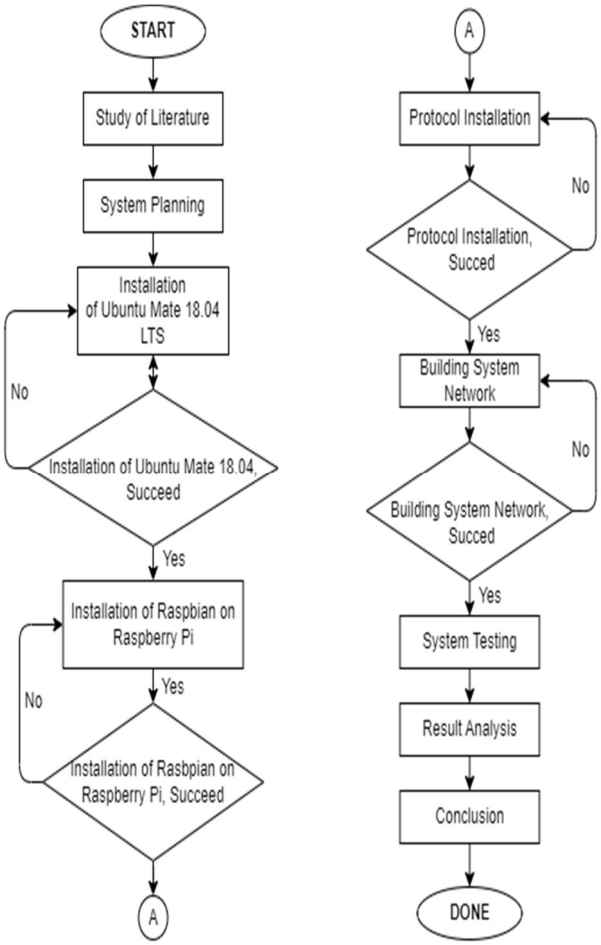

Figure 2. Flowchart of research stages

The initial stage is looking for literature studies regarding the Mobile Ad-hoc Network (MANET), the routing protocol used is Babel and OLSR (Optimized Link State Routing). Next, determine the scenario that can meet the parameters to be tested, in this case, the scenario is focused on getting the results of a comparison between the implementation of the two protocols on the effect of data communication passing through the router node with the parameters tested for process delay, CPU usage and RAM usage. After testing the two protocols with the predetermined scheme successfully, then an analysis will be carried out for the data that has been obtained so that comparisons and conclusions can be drawn.

B. Test Scenario

The test scenario design in this study consisted of 6 nodes using 3 types of schemes as shown in Fig. 3, Fig. 4, and Fig. 5.

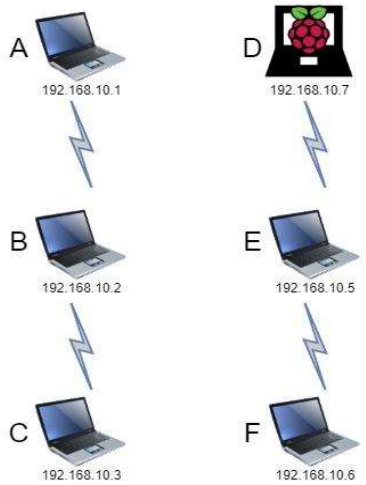

Figure 3. Schematic design 1

Fig. 3 shows that there are 6 nodes that have been assigned IP addresses manually with Node A (192.168.10.1), Node B (192.168.10.2), Node C (192.168.10.3), Node D (192.168.10.7), Node E (192.168.10.5), and Node F (192.168.10.6) which is connected to the MANET network, each node using a flash drive that has been installed with Ubuntu Mate 18.04 LTS OS with Babel and OLSR protocols installed. In the test, two communications have been determined, namely Node A (192.168.10.1) communicating with Node C (192.168.10.3) through Node B (192.168.10.2) and Node D (192.168.10.7) communicating with Node F (192.168.10.6) bypassing Node E (192.168.10.5).

The communication is in the form of sending data, and the Wireshark application is used to capture the delay in processing data passing through the network and the Top application to capture CPU and RAM usage.

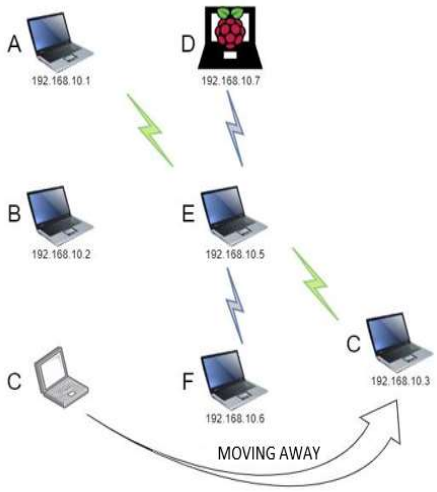

Figure 4. Schematic design 2

In Fig. 4 is the second test scheme which is a continuation of the first scheme, with the position of Node C communicating with node A and then moving away from Node B to approach Node E which is positioned as a router node by Node C.

Fig. 5 is a continuation of the first and third schemes, where when communication is in progress, Node A exchanges positions with Node E, where Node A, which was previously a client, now acts as a router node and one additional communication Node D communicates with Node F.

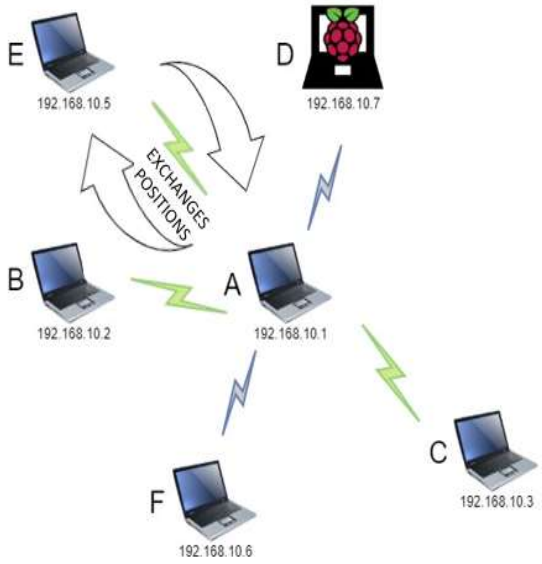

Figure 5. Schematic design 3

C. Tools and Materials

The materials and tools needed in this study are shown in Table I and Table II.

TABLE I
RESEARCH MATERIALS

No.	Software	Version	Description
1	Ubuntu Linux	Mate 18.04 LTS	As OS on Laptop
2	Raspbian	5.10	As OS on Raspberry Pi
3	BABEL-D	1.7.0	As a protocol that will be used for data communication
4	OLSR-D	0.6.6.2	As a protocol that will be used for data communication
5	Wireshark	11.1	To find out the process delay during data communication
6	Top	-	To find out CPU usage and RAM usage during data communication

TABLE II
RESEARCH TOOLS

No.	Hardware	Specification	Total
1	Laptop	Version 64 Bit	6 pieces
2	Raspberry Pi	Raspberry Pi 3 Model B	1 piece
3	Flash disk	16 GB	6 pieces

D. Test Parameters

The parameters used in this study are as follows:

1) *Process Delay:* Testing the process delay is to get the length of time it takes for a node that functions as a router to process data packets that pass through the node before the data packets are rerouted to the destination node when data communication has been carried out.

2) *CPU Usage dan RAM usage:* Testing CPU usage and RAM usage is to see the effect of the protocol when communicating data on devices that function as router nodes.

IV. RESULTS AND DISCUSSION

A. Testing Results of Babel Protocol and OLSR Implementation in Scheme 1

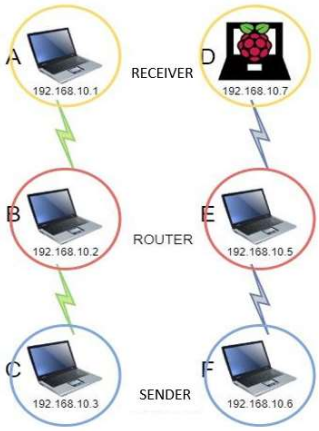

Figure 6. Implementation of test scheme 1

Fig. 6 shows the implementation of test scheme 1 with Node C and Node F as the sender, Node B and Node E as router nodes, Node A and Node D as receiving nodes. This scheme is positioned in a silent scheme where the test is carried out with 2 communications.

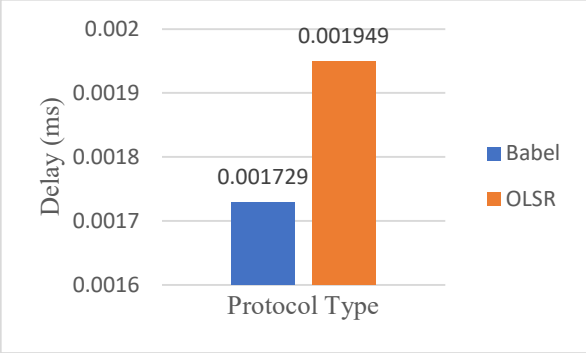

Figure 7. Average process delay scheme 1

Fig. 7 is a graphic result of the average process delay in the silent scheme test, the results show that the process delay of the Babel protocol is 0.001729ms and the OLSR is 0.001949ms. The results show that the Babel protocol process delay is better than OLSR.

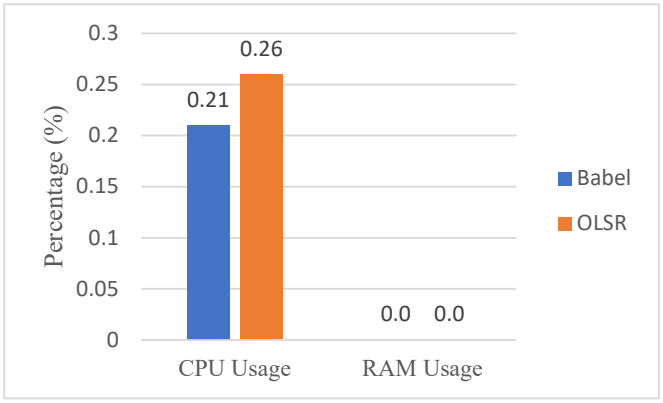

Figure 8. CPU usage and RAM usage scheme 1

In Fig. 8 is a graphic result of the average CPU usage and RAM Usage in the silent scheme test, the results show that the CPU usage of the Babel protocol is 0.21% and the OLSR is 0.26%. The results show that the CPU Usage of the Babel protocol is better than OLSR. RAM usage on both protocols does not increase.

B. Testing Results of Babel Protocol and OLSR Implementation in Scheme 2

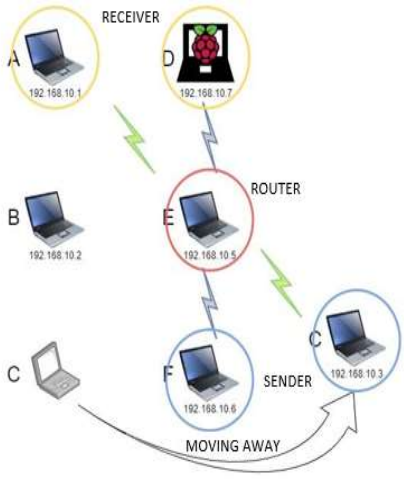

Figure 9. Implementation of test scheme 2

Fig. 9 is the result of the implementation of the moving scheme, where the position of node C, which previously communicated with Node A through Node B as a router, moved to the coverage area of Node E so that a new communication route, Node C, passed through Node E as a router to continue the connection communication goes to Node A. This new route also increases the number of communications that passthrough Node E.

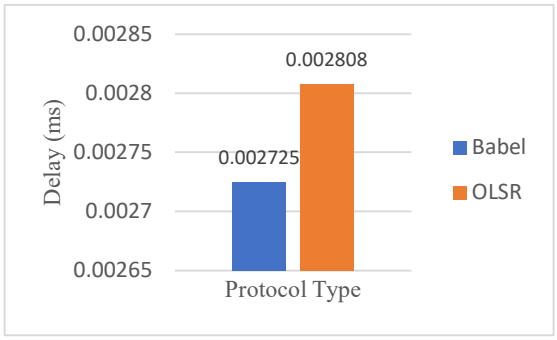

Figure 10. Average process delay scheme 2

Fig. 10 is a graphic result of the average process delay in testing the moving scheme, the results show that the process delay of the Babel protocol is 0.002725ms and the OLSR is 0.002808ms. The results show that the Babel protocol process delay is better than OLSR.

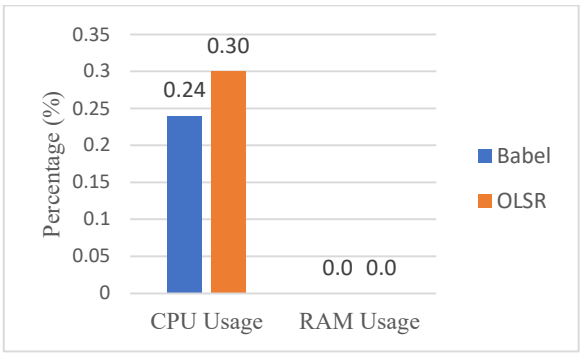

Figure 11. CPU usage and RAM usage scheme 2

In Fig. 11 is a graphic result of the average CPU and RAM usage in the mobile scheme, the results show that the average CPU usage from Babel is 0.24, from OLSR is 0.30 and RAM usage in both protocols does not increase.

C. Testing Results of Babel Protocol and OLSR Implementation in Scheme 3

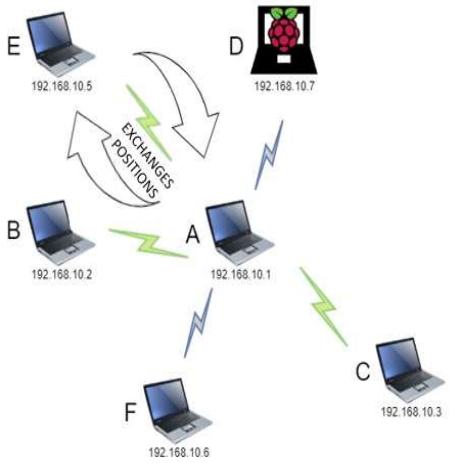

Figure 12. Implementation of test scheme 3

Fig. 12 is the result of the implementation of the swap scheme test, in this scheme there is an exchange of positions between Node A and Node E, so that the roles of the two nodes change to Node A as a router and Node E as a client. Therefore, the communication routes of all nodes will be updated.

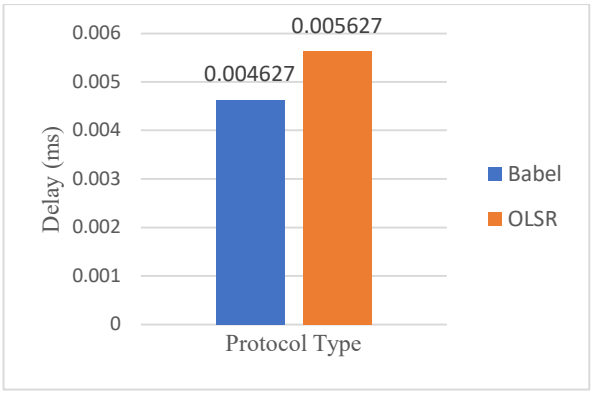

Figure 13. Average process delay scheme 3

Fig. 13 is a graphic result of the average process delay in the exchange scheme test, the results show that the average process delay of the Babel protocol is 0.004627ms and the OLSR is 0.005627ms, the results show that the Babel protocol process delay is better than OLSR.

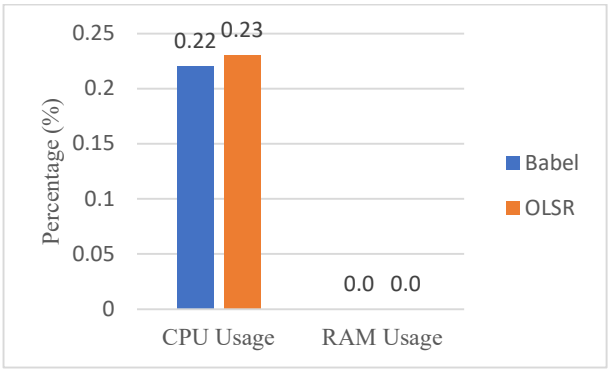

Figure 14. CPU usage and RAM usage scheme 3

In Fig. 14 is a graphic result of the average CPU and RAM usage in the swapping scheme, the results show that the average CPU usage from Babel is 0.22, from OLSR is 0.23 and RAM usage in both protocols does not increase.

V. CONCLUSION

From the data communication load that has been carried out during the test using the silent, moving, and swapping scheme, the following results are obtained : Based on the silent scheme test, the average process delay on the router node for Babel is 0.001729ms and OLSR 0.001949ms, then the average CPU usage on the router node is 0.21% Babel and 0.26% OLSR, while for RAM usage on the router node in both protocols did not increase. ; Based on the mobile scheme test, the average process delay on the router node for Babel is 0.002725ms and OLSR 0.002808ms, then the average CPU

usage on the router node is 0.24% Babel and 0.30% OLSR, while for RAM usage on the router node in both protocols did not increase. ; Based on testing the swapping scheme, the average process delay on the router node for Babel is 0.004627ms and OLSR 0.005627ms, then the average CPU usage on the router node is 0.22% Babel and 0.23% OLSR, while for RAM usage on the router node in both protocols did not increase.

From the results of the performance testing of the two protocols using the silent, moving and swapping test scheme, it was found that the Babel protocol was better than the OLSR protocol, in terms of process delay and CPU usage.

Some suggestions for future researchers are : Perform node performance testing using other protocols; Increase the number of nodes so that the coverage area is wider; Doing research with different testing schemes.

REFERENCES

[1] I. Sebuktekin, et al. "DiffServ QoS and OLSR MANET Outdoor Demonstration." Eighth International Symposium on Autonomous Decentralized Systems (ISADS'07). IEEE, 2007.

[2] M. Abolhasan, B. Hagelstein, J. C.-P. Wang, "Real-world performance of current proactive multi-hop mesh protocols." In: 2009 15th Asia-Pacific Conference on Communications. IEEE, 2009. p. 44-47.

[3] V. Ayu, "Pemodelan Proses Pemilihan Rute pada Protokol Babel dengan Activity Diagram dan Transition System." Media Teknika 12.1 (2018).

[4] M.I. Denatama, D. Perdana, dan R.M. Negara, "Analisis Perbandingan Kinerja Protokol Routing DSDV dan OLSR Untuk Perubahan Kecepatan Mobilitas pada Standar IEEE 802.11 ah." Jurnal Infotel 8.2 (2016): 100-106.

[5] H.C. Nisac, N. Suharto, dan M.D. Atmadja, "Perbandingan performansi protokol Batman dan AODV pada jaringan MANET (Mobile Ad-Hoc Network)." Jurnal Jartel: Jurnal Jaringan Telekomunikasi 6.1 (2018): 57.

[6] B. Taufan, R. Primananda, dan M. Data. "Analisis Perbandingan Kinerja Protokol Routing OLSR dan DSDV Pada MANET Berdasarkan Pergerakan Node." Jurnal Pengembangan Teknologi Informasi dan Ilmu Komputer e-ISSNN 2548 (2018): 964X.

[7] S. BUDIYANTO, A.S. PRASETYO, "Studi Analisis Performansi Protokol Routing IS-IS Dan OSPFv3 Pada IPv6 Untuk Layanan Video Streaming." Jurnal Teknologi Elektro, Universitas Mercu Buana, 2014, 5.1: 18-32.

[8] D. Edi, "Kajian Algoritma Routing dalam Jaringan Komputer." Jurnal Teknik Informatika dan Sistem Informasi, 2006, 2.1: 219206.

[9] J.Z. Sun, "Mobile ad hoc networking: an essential technology for pervasive computing." In: 2001 International Conferences on Info-Tech and Info-Net. Proceedings (Cat. No. 01EX479). IEEE, 2001. p. 316-321.

[10] P. K. Suri, M. K. Soni, P. Tomar, "Cluster based QoS routing protocol for MANET." International Journal of Computer Theory and Engineering, 2010, 2.5: 783.

[11] S. Corson, J. Macker, "Mobile ad hoc networking (MANET): Routing protocol performance issues and evaluation considerations." 1999.

[12] E.B. Harjono, "Analisa Dan Implementasi Dalam Membangun Sistem Operasi Linux Menggunakan Metode LSF Dan REMASTER." Sinkron: jurnal dan penelitian teknik informatika, 2016, 1.1.

[13] S. Wang, D. Xu, S.Yan, "Analysis and Application of Wireshark in TCP/IP Protocol Teaching." In: 2010 International Conference on E-Health Networking Digital Ecosystems and Technologies (EDT). IEEE, 2010. p. 269-272.

[14] D. Pazriyah, "Penggunaan Raspberry Pi Dalam Mendeteksi Warna Melalui Webcam." 2017. PhD Thesis. POLITEKNIK NEGERI SRIWIJAYA.

[15] Wartono, N. Sururi, "Menentukan Titik Pemasangan Radio Wireless untuk Link Point to Point Dengan memanfaatkan Bot Telegram." Jurnal DISPROTEK, 2018, 9.2: 74-85.