Journal of Physics:
Conference Series

PAPER • OPEN ACCESS

Campus network Throughput improvement through metric modification of OSPF routing mechanism

To cite this article: L Sugiyanta and D Nurhidayat 2019 *J. Phys.: Conf. Ser.* **1402** 066047

Campus network Throughput improvement through metric modification of OSPF routing mechanism

L Sugiyanta* and D Nurhidayat

Informatics Education Program, Faculty of Engineering, State University of Jakarta, Jakarta, Indonesia

*lipurs@unj.ac.id

Abstract. OSPF (Open Shortest Path First) is routing protocol that are widely used in computer networks. Selection of routing protocols is very important in improving network performance. Calculation of OSPF metrics will determine the performance of data packet delivery. It based on Shortest Path Tree. To find the best route from source to destination, it must determine the shortest path between itself and each router in the network. The router creates this perspective by taking the information in the LSDB and transforming it into a shortest path first tree or SPF tree. It is an algorithmic calculation to construct logical network view performed by the computer within the router. To speed the construction of network tree, buffer on next hop, distance (RTT – round trip time), and direction of next hop (getting closer or away) variable is proposed to increase the speed of data packet communication among routers. This research was using OPNet modeler software, simulations were made on a campus network whose PDU variables were modified to obtain the optimum network tree with OSPF routing protocol. The weighted testing parameters in this study is time delay values. Hopefully, the value of redistribution delay is 1% better depending on traffic density. Main route retrieval and alternative package delivery are based on the smallest cost and metric values in the OSPF protocol.

1. Introduction

Campus Network means Wireless (Ad-Hoc) Mesh Networks in this research. One characteristic is topology of the network changes (all of the nodes move in time) [1-3].

Ideal mesh network is self-configuring network (the concept of no stable infrastructure takes a place). Each node should help relaying packets of neighboring nodes using multi-hop routing mechanism (in order to reach far destination nodes; to solve problem of dead communication) to form multiple traffic "hops ". It can extend the coverage area, but the repeatedly relayed traffic will exhaust the radio resource. In some scenarios, network become increasingly vulnerable to energy degradation and rapid increasing of overhead packets [4-7].

To increase the speed of data packet communication among routers, changing the packets is expected to minimize hop or relay as alternative solution. The weighted testing parameters in this Wireless (Ad-Hoc) Mesh Networks is time delay values, especially HELLO packet improvement.

The expected result is comparison between normal network (without routing packet improvement) and improved network (with routing packet improvement/HELLO improvement). Voice and live streaming packet considered to be covered in this simulation.

2. Simulation

The simulation image is presented below.

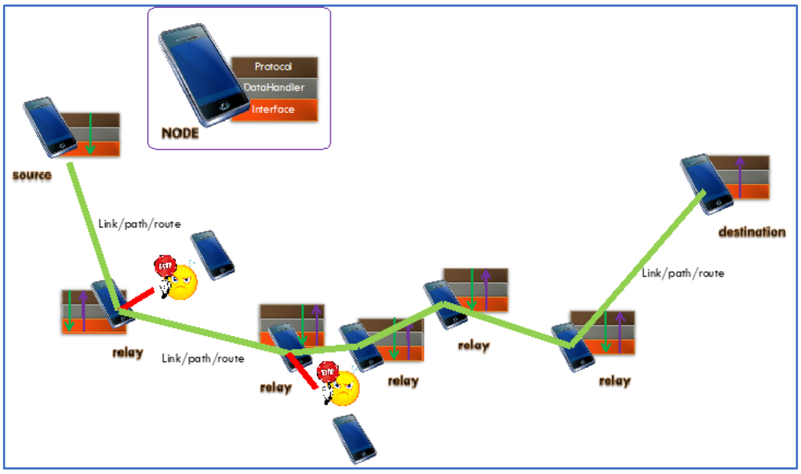


Figure 1. Simulation scenario.

Figure 1 can be viewed as follow: when nodes do communicate with others, they will use other node as relay (if destination located far away). Number of relays will determine hops. Transmission will follow sequential process (from node to node until destination). Each relay node will receive, examine, and then transmit/drop packet. Each relay node will also calculate the best route to next relay/node [8-10].

Packet is the object and subject of simulation. As object: packet contains information about "what", whereas as subject: packet is lead to proper node's actions [11]. Every packet's group type will responsible for topology creation and DATA transmission. Packet's structure illustration is given as follow:

```
static HEADER_SIZE: int= 20 [asumsi jumlah BYTE "pembungkus DATA"]
static FLAG_DO_NOT_FRAGMENT: int= 1
static FLAG_MORE_FRAGMENTS: int= 2
static OPTION_SECURITY: int= 2
static OPTION_LOOSE_SOURCE_ROUTING: int= 3
static OPTION_RECORD_ROUTE: int= 7
static OPTION_STRICT_SOURCE_ROUTING: int= 9
static OPTION_TIMESTAMP: int= 68
version: int= 4 [jenis IP, sudah FIX]
source: IPAddr= 192.168.0.1 [alamat Interface Node pengirim]
destination: IPAddr= 192.168.0.2 [alamat Interface Node penerima akhir]
precedence: int = 0 [Priority (0-7, 7 highest), diset FIX]
requested_service: int = 0
[requested_service represents the bits (D,T,R). It is 1 for 'low delay', 2 for
'high throughput' and 4 for 'reliability'. diset FIX]
length: int= 25 [Length of the complete packet. 25 didapat dari 5 BYTE
DATA ditambah 20 BYTE HEADER_SIZE]
id: int= 0 [Unique packet id]
flags: int= 0 [Flags (for fragmentation). 0 berarti tidak ada fragmentasi; 1
berarti DO NOT FRAGMENT; 2 berarti MORE FRAGMENT]
fragment_offset: int= 0
[urutan fragment dalam paket lengkapnya. juga menggambarkan urutan
pecahan DATA pada saat penggabungan]
ttl: int= 255 [ttl diset maksimum 255 dan akan decrement setiap kali
melewati relay]
protocol: int= 1 [menggunakan protocol TCP]
crc: boolean= TRUE [paket dilengkapi dengan CRC]
copy_options: boolean= FALSE [diset FIX]
option: int= 0 [diset FIX]
data: Object= {0,1,2,3,4} [DATA yg "sebenarnya" dikirimkan]
source_hop: IPAddr= 0.0.0.0 [berisi node relay pengirim]
destination_hop: IPAddr= 0.0.0.0 [berisi node relay penerima]
[source_hop dan destination_hop di"update" disepanjang path menuju node
tujuan akhir]
```

Figure 2. Packet container.

The scenario takes following sequences. When sending packet, process at Network Layer: if packet is larger than MTU, then it will be fragmented. When receiving packet, process at Network Layer is different for fragmented packets and single packet. Because of fragmentation scheme, without selective path mechanism, there will be packet flood from source to destination!

The modification of packets determines ‘control ‘of propagation. Only packet destined to “node” that will be proceed by this “node”. If there are several “destined nodes”, selection criteria must be used! This will be done by improved HELLO packet. The HELLO packet used 3 criteria: buffer on next hop, distance (*RTT), and direction of next hop (getting closer or away) [12,13].

As shown in the following Fig. 3, when packet reach RELAY, it will do tasks: either packets will be transmitted selectively (without re-transmit duplicate packets) or be transmitted “immediately” (with re-transmit duplicate packets).

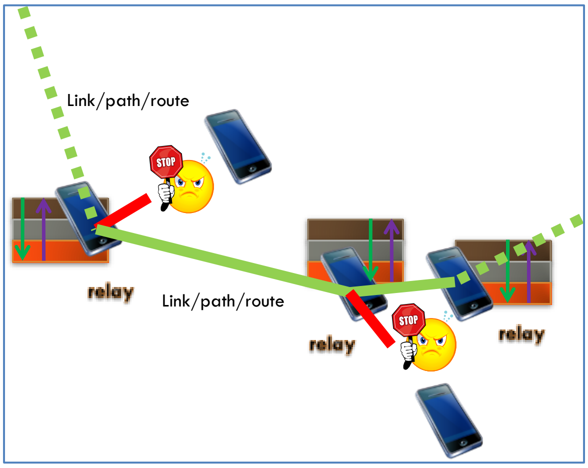


Figure 3. Packet route’s path.

Simulation view is shown in the Fig. 4 below.

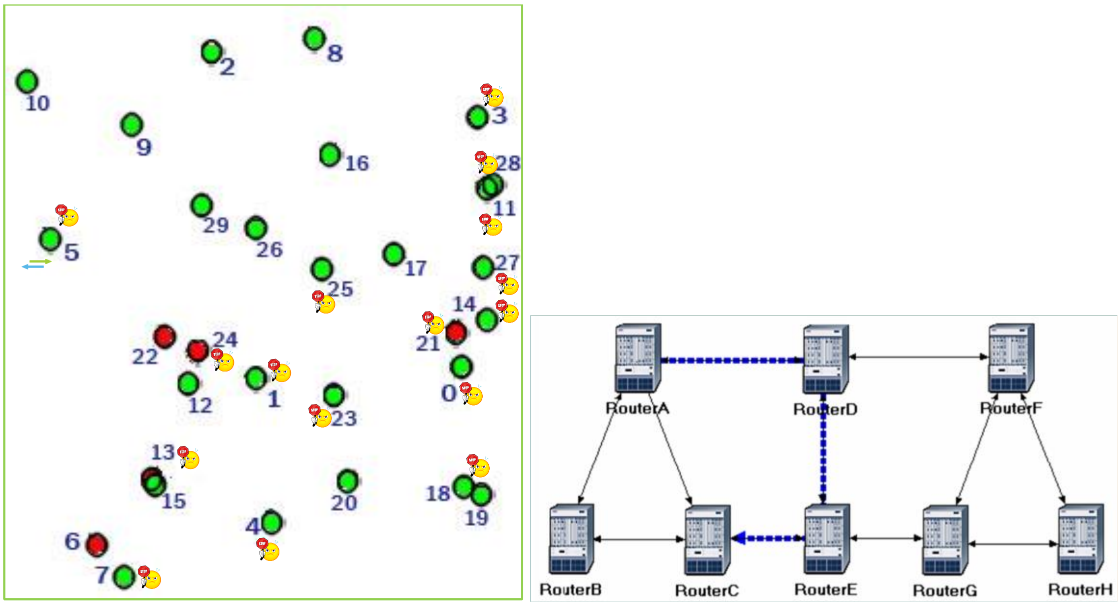


Figure 4. Proposed simulation (left), OPNet modeler simulation (right).

3. Results and discussion

The following result was from data transmission from node 13 (source) to node 0 (destination).

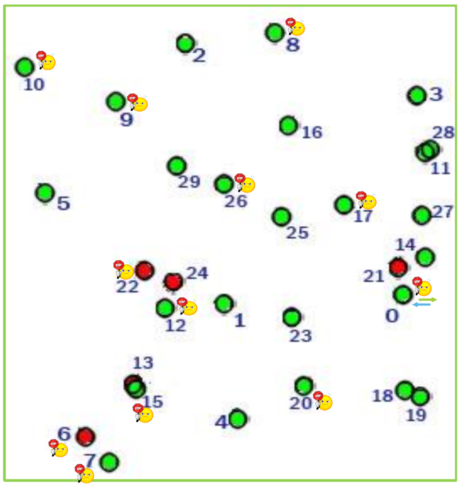
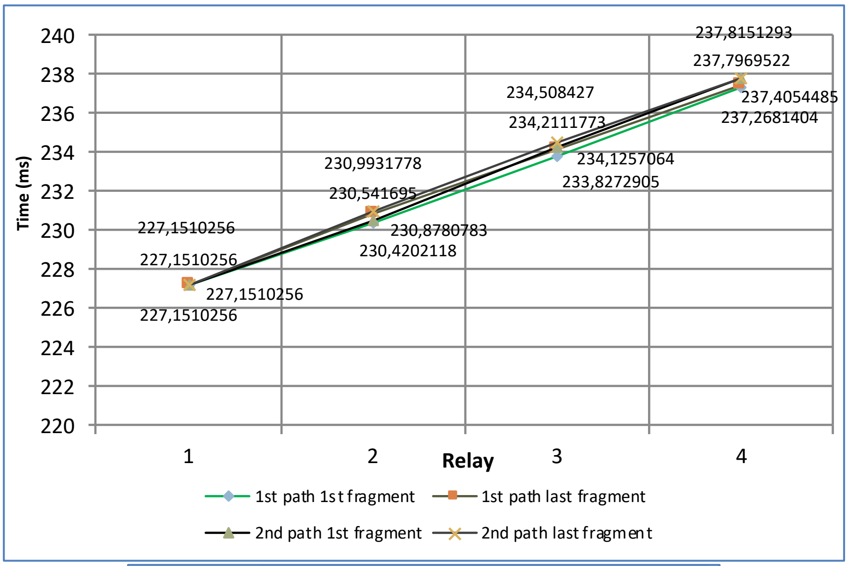


Figure 5. The simulation of data transmission in Wireless Mesh Network.

It can be analyzed from figure 5, there are two paths to reach destination. Path 1 is 13-4-23-0. Path 2 is 13-1-25-0. Time delay data is shown in figure 6.



Node path 1	1st path 1st fragment	1st path last fragment
13	227.1510256	227.1510256
4	230.4202118	230.8780783
23	233.8272905	234.1257064
0	237.2681404	237.4054485
Node path 2	**2nd path 1st fragment**	**2nd path last fragment**
13	227.1510256	227.1510256
1	230.541695	230.9931778
25	234.2111773	234.508427
0	237.7969522	237.8151293

Figure 6. Time delay as packets travel through relay node.

Path 1 is faster than path 2 with difference of almost 1%.

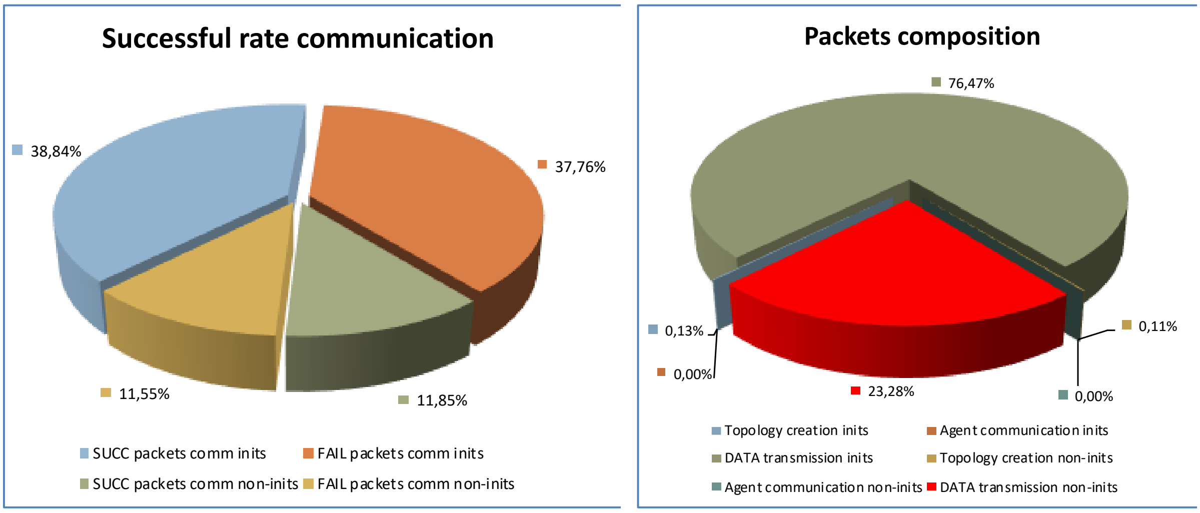


Figure 7. Throughput results, as part of (a) packets' sucessful rate, from (b) packets' flooded to the network.

During data transmission, some of overhead packets flood the network. Only 23,28% "true" packets transmitted to network from source (node 13) to destination (node 0), as shown in figure 7 (a). Only 11,85% "true" packets successfully delivered from source (node 13) to destination (node 0), as shown in figure 7 (b). The analysis data was done at Network Layer only.

4. Conclusion

Evaluation of wireless network routing packets (used existing results) shown that #packets in the network is dominant of non-DATA transmission. There will be Flood of packet without improvement of Routing and HELLO packets. Among the packets, there is 1% delay reduction using HELLO packet modification.

References

[1] Wang J, Xu F and Sun F 2006 Benchmarking of Routing Protocols for Layered Satellite Networks In *Proceedings of Multiconference on Computational Engineering in Systems Applications* **2** 1087-1094

[2] Arora V and Krishna C R 2010 Performance Evaluation of Routing Protocols for MANETs under Different Traffic Conditions *2010 2nd International Conference on Computer Engineering and Technology* **6**

[3] Bojković Z, Stojanović M and Milovanović B 2005 Current Developments towards the 4G Wireless System *Proceedings of International Conference TELSIKS* 229-232

[4] Arai K and Sugiyanta L 2011 Routing Approach with Immediate Awareness of Adaptive Path While Minimizing the Number of Hops and Maintaining Connectivity of Mobile Terminals Which Move from One to the Others *International Journal of Computer Science and Information Security (IJCSIS)* **9**(2) 94-101

[5] Arai K and Sugiyanta L 2011 Energy Consumption in Ad Hoc Network with Agents Minimizing the Number of Hops and Maintaining Connectivity of Mobile Terminals Which Move from One to the Others *International Journal of Computer Networks (IJCN)* **3**(2) 71–86

[6] Arai K and Sugiyanta L 2011 Energy Behavior in Ad Hoc Network Minimizing the Number of Hops and Maintaining Connectivity of Mobile Terminals Which Move from One to the Others *International Journal of Computer Networks (IJCN)* **2**(6) 190-204

[7] Arai K and Sugiyanta L 2010 Agent Based Approach of Routing Protocol Minimizing the

Number of Hops and Maintaining Connectivity of Mobile Terminals Which Move One Area to the Other *In the proceeding of ICCSA 2010* 305–320
[8] Rajan R and Shipra S 2012 WLAN Performance Improvisation by Fine Tuning IEEE 802.11 Parameters *International Journal of Computer Applications*
[9] Barakovićand S and Baraković j 2010 Comparative Performance Evaluation of Mobile Ad Hoc Routing Protocols *Proceedings of the 33rd International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO 2010)*
[10] Shah S 2008 Performance Evaluation of Ad Hoc Routing Protocols Using NS2 Simulation *Proceedings of the National Conference on Mobile and Pervasive Computing (CoMPC-2008)*
[11] Gorantala K 2006 *Routing Protocols in Mobile Ad Hoc Networks* (Sweden: Umeøa University, Sweden)
[12] Sarkar N I and Lol W G 2010 A Study of MANET Routing Protocols: Joint Node Density, Packet Length and Mobility 515-520
[13] Patel B and Srivastava S 2010 Performance analysis of zone routing protocols in Mobile Ad Hoc Networks *Communications (NCC), 2010 National Conference on* 1-5