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Effect of variation in active route timeout and my route timeout on the performance of AODV-ETX protocol in mobile adhoc network

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Abstract. Mobile adhoc network (MANET) consists of nodes that are independent. A node can communicate each other without the presence of network infrastructure. A node can act as a transmitter and receiver as well as a router. This research has been variation in active route timeout and my route timeout on the performance of AODV-ETX protocol in MANET. The AODV-ETX protocol is the AODV protocol that uses the ETX metric. Performance testing is done on the static node topology with 5 m x 5 m node grid model where the distance between nodes is 100 m and node topology that consists of 25 nodes moves randomly with a moving speed of 1.38 m/s in an area of 1500 m x 300 m. From the test result, on the static node, AODV protocol-ETX shows optimal performance at a value MRT and ART of 10 s and 15 s, but showed a stable performance in the value of MRT and ART ≥60 s, while in randomly moved node topology shows stable performance in the value of MRT and ART ≥80 s.

1. Introduction

Mobile adhoc network (MANET) consists of nodes that are independent. A node can communicate each other without the presence of network infrastructure. A node can act as a transmitter and receiver as well as a router. Wireless ad hoc network requires a routing protocol that is able to manage route reliably. AODV (Ad hoc On-Demand Distance Vector) is a routing protocol in an ad hoc network that uses hop count as a routing metric. AODV protocol has more minimal routing overhead compared to the proactive protocol type [1] and has a better energy efficiency compared to the proactive protocol type and other reactive protocol [2]. AODV combines the superior aspects of the two algorithms that is using the maintenance pattern of DSR and using hop per hop sequence number along with its update of DSDV [3]. AODV uses the routing table with one entry for every destination and will keep the timer-based state on each node. AODV has a type of unipath routing because it is only made with one path for one communication line [4]. AODV algorithm is inspired by Bellman-Ford algorithm such as DSDV. Performance evaluation of AODV protocol is needed to improve service quality (QoS) such as throughput , end to end delay, packet delivery ratio, overhead, drop packet etc. Performance of protocol is strongly influenced by the ability to maintain the route, the speed of route discovery, the choice of metric, the speed of route recovery. Several researchers

have done analyzed of AODV protocol on routing metric by using different simulators. They have result AODV-ETX protocol with ETX as metric [5]. From the throughput measurements that the AODV-ETX protocol has better performance compared to the AODV protocol because ETX is more concerned with paths of higher delivery ratios [6]. The AODV-ETX protocol has the same characteristics as the AODV protocol. The route is formed by the route discovery process. The packet delivery RREQ (Route Request) is performed in the route discovery process by the source node to the neighboring node to form a reverse path and packet delivery RREP (Route Reply) by the destination node to the neighboring node towards the source node to form a forward path. If there is a damage in the link, the RRER (route error) packet will be delivered by a broadcast to all forwarder [7]. In AODV protocol or AODV-ETX there is a table of the reverse and forward lines that have a life time. The life time is declared in My Route Timeout (MRT) and Active Route Timeout (ART). When the destination node replies the RREQ packet by sending a RREP packet through the reverse path then the forward path will be formed. Forward Pathway is used to transmit data packet from the source node to the destination node. Forward pathway has an active time in which the AODV protocol is specified in the ART parameters [3]. From the discovery route, the ability to maintain a route of the AODV or AODV-ETX protocol is depends by MRT and ART. MRT standard value given in AODV protocol is 10 seconds [8]. We are interested this does not apply to the AODV-ETX protocol. This study focused on the increasing of performance of AODV-ETX protocol to maintain a valid route using MRT's and ART's values. The expected results was to obtain MRT's and ART's values to improve AODV-ETX protocol performance.

2. Experimental

This research has been variation in active route timeout and my route timeout on the performance of AODV-ETX protocol in MANET. This research has used software tools here were follows: NS2 (Network simulator), Gedit, setdest, NS2 Scenarios Generator 2 (NSG2), cbrgen, NS2 Trace Analyzer and AWK script. Variation in active route timeout and my route timeout was conducted by changing the My Route Timeout (MRT) and Active Route Timeout (ART) values as indicated on the Figure 1.

```
class AODV;
#define MY_ROUTE_TIMEOUT              10   //seconds
#define ACTIVE_ROUTE_TIMEOUT          10   //seconds
#define REV_ROUTE_LIFE                6    //seconds
#define BCAST_ID_SAVE                 6    //seconds
```

Figure 1. A cut of aodv.h Script on NS2

Standard values of MRT and ART of the AODV protocol on NS2 was 10 seconds. In this study, MRT and ART values tuning would be conducted from 1second – 100 seconds. MRT value was made the same with ART value. Every time the ART and MRT values were changed, NS2 should be recompiled by using sudo make clean; sudo make all; sudo make install commands.

To determine the effect of variation values of ART and MRT dotesting of laboratory scale using NS2 simulator. There are 2 testing scenarios: test scenario 1 and scenario 2. In scenario 1, the topology of grid model with 25 nodes and the distance between nodes are 100 meters. Node-0 as the source node and node-24 act as the destination node. The source node sends a CBR packet with a size of 1000bytes /packet. Scenario 1 topology was shown in Figure 2. The simulation parameters in scenario 1 are shown in Table 1.

Table 1. Simulation Parameter set on NS2 of scenario 1

Parameter	Value
Channel type	Wireless channel
TX Power	0.28 Watt
TX dan RX Gain	1 dB
Antena position from the ground	1.5 m
Propagation model	shadowing
MAC layer	IEEE 802.11b
Routing protocol	AODV-ETX
Traffic type	UDP
Application type	CBR
Number of sender node and receiver node	1
Packet size	1000 byte
Packet delivery interval	0.005 seconds
Simulation time	0-300 seconds and 300 seconds
Number of nodes	25 (grid model)
Transmission range	250 m
Simulation location	Outdoor

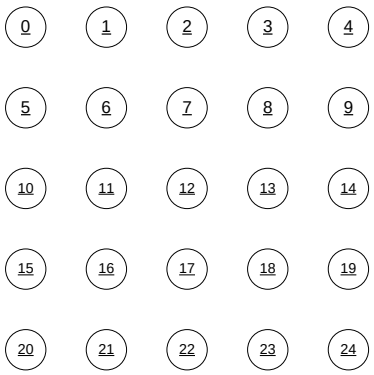

Figure 2. Topologi grid

The scenario 2 made on randomly moving node condition usingtechnique of Random Way Point. There are 25 nodes that move randomly of simulation times at 300 second with speed at every nodes is 1,38 m/sec thetotal area of 1500 m x 300 m. This 1500 m x 300 m wide area refers to research conducted by Sung-Ju Lee and Mario Gerla [9]. The source node and destination node are randomly selected. The source node sends CBR packet with size at 1000 bytes/packet. The simulation parameters in scenario 2 are shown in Table 2.

Table 2. Simulation Parameter set on NS2 of scenario 2

Parameter	Value
Channel type	Wireless channel
TX Power	0.28 Watt
TX dan RX Gain	1 dB
Antena position from the ground	1.5 m
Propagation model	shadowing
MAC layer	IEEE 802.11b
Routing protocol	AODV-ETX
Traffic type	UDP
Application type	CBR
Number of sender node and receiver node	1

Packet size	1000 byte
Packet delivery interval	0.005 seconds
Simulation time	0-300 seconds and 300 seconds
Number of nodes	25
Transmission range	250 m
Moving Model	Random Way Point
Node speed	1.38 m/second
Probe interval AODV	1 second
Probe window AODV	10 seconds
Area	1500 m x 300 m
Simulation location	Outdoor

The performance parameter measured here were throughput, end to end delay and routing overhead and packet delivery ratio (PDR). Throughput was the total packet of data received per second by a recipient calculated in kbps [10]. End to end delay was the time required for a packet to be sent until the packet was received and gives acknowledgment to the sender of the packet [9]. Routing Overhead was the total routing package in proportion to the number of packets received by the receiver. This routing overhead can be obtained by calculating the number of routing packets divided by the number of packets received by the receiver [10]. The PDR was the ratio between the packet successfully received by the destination and the packet sent by the source [10].

3. Results and Discussion

Test of scenario 1 intended to see the effect of changes in the value of MRT and ART of the AODV-ETX protocol on wireless mesh network with fixed node condition. The node was not move shown weak change in the link quality. The results of the test in scenario 2 were shown in Figure 3.

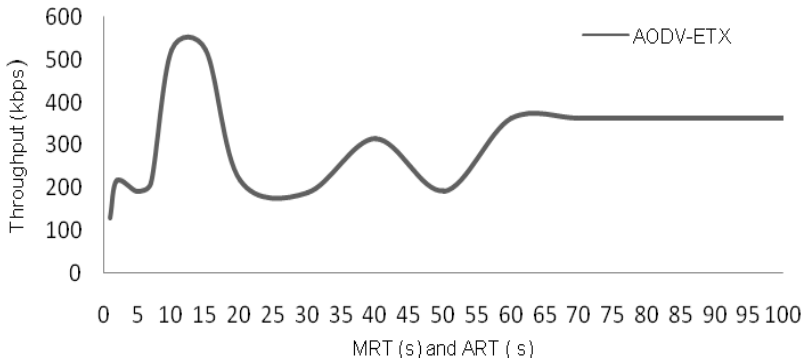

Figure 3. Association among MRT, ART and *throughput* on scenario 1

Based on the graph shown in Figure 3, the highest values of throughput AODV-ETX protocol was obtained the values of MRT and ART at 10 seconds and 15 seconds but the performance of AODV-ETX protocol was stable in the increase of MRT and ART at ≥60 seconds. The value MRT and ART at 10 seconds was the standard of a parameter value in the AODV-ETX protocol. This means that in the condition on the node does not move the protocol AODV-ETX will produce the most optimal throughput at the MRT and ART of 10 seconds.

The topology in scenario 2 was made with 25 nodes on moving randomly. To get different motion patterns then tested with different pause time. The small values of pause time reflected constant node motion and large of pause time reflected node motion to be silent. The change value of pause time will get different node motion pattern although use the same speed.

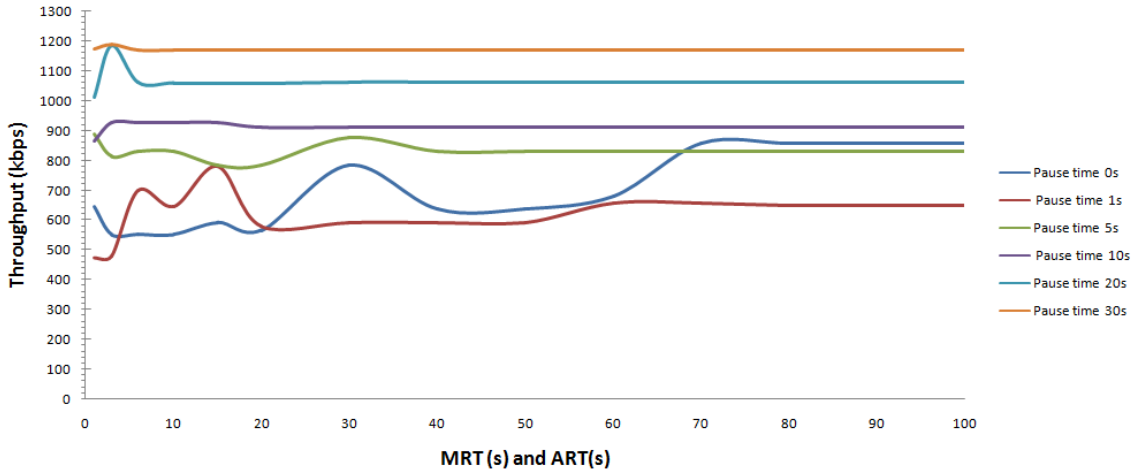

Figure 4. Association among MRT, ART and throughput on scenario 2

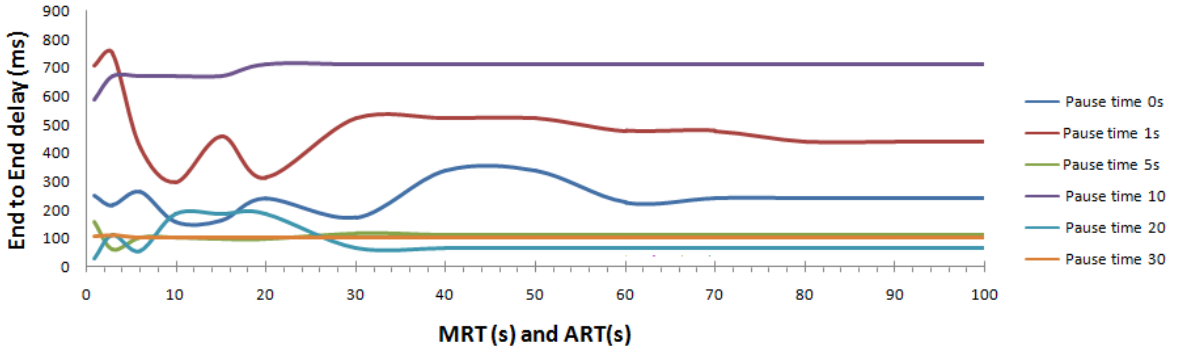

Figure 5. Association between MRT, ART and end to end delay on scenario 2

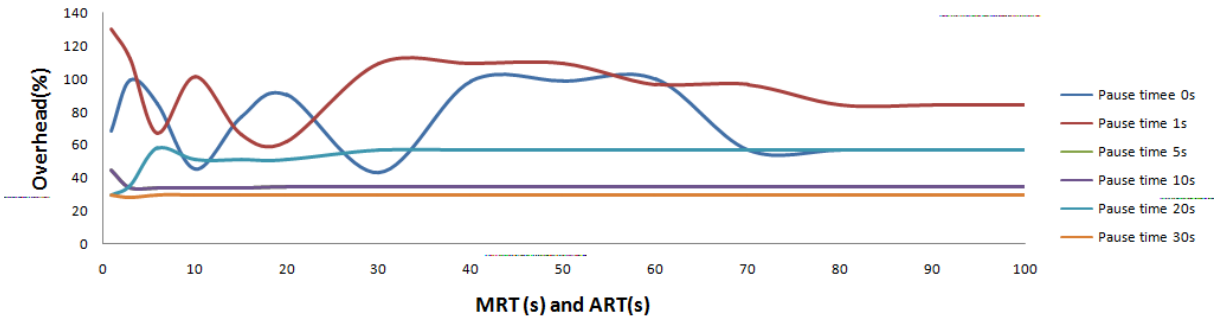

Figure 6. Association among MRT, ART and overhead on scenario 2

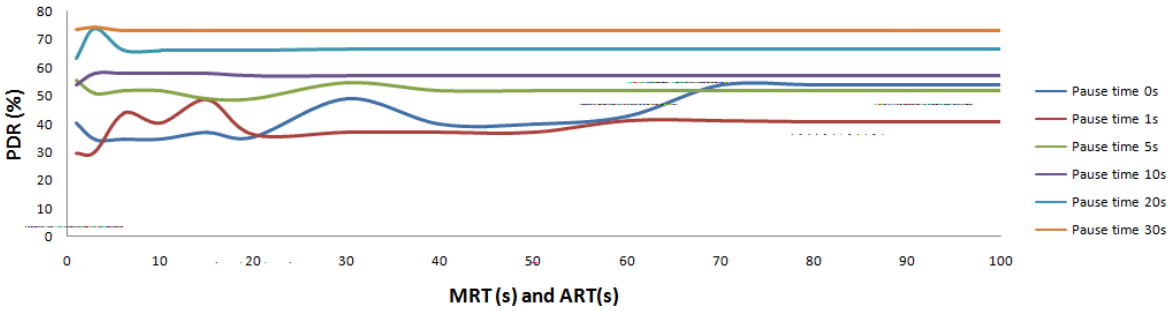

Figure 7. Association among MRT, ART and PDR on scenario 2

The data of scenario 2 shown that the variation of MRT and ART influences the AODV-ETX protocol. Figure 4 shows the value of throughput at pause time the 30s higher than at pause time 1s. This is because the pause time 30s mobility level of the node was lower than pause time 1s so the connection between nodes was much more stable. The large throughput was not necessarily smaller end to end delay, as shown in Figure 5 in pause time 10s has the largest end to end compared to the 1s and 5s pause time. The value of throughput, end to end delay, routing overhead, and PDR at different pause times in each change in MRT and ART values shows stable pattern when the value of MRT and ART was increased. The start values of MRT and ART showed stable pattern in each pause time are different but seen at MRT and ART of ≥80 seconds indicate a stable pattern.

4. Conclusion

This study have the following conclusions:

1. In the immobile node topology of AODV-ETX protocol showed optimal performance on the MRT and ART values of 10 seconds and 15 seconds, but showed a stable performance in the MRT and ART values of ≥60 seconds.
2. In the randomly mobile node topology showed stable performance on the MRT and ART values of ≥80 seconds.

As future work, we necessary to test the MRT tuning and ART protocols of AODV-ETX on the varied speed of the nodes, number of nodes, number of channels and the number of sender and receiver nodes to obtain the the most optimal MRT and ART values on any MANET network conditions.

References

[1] Richard C, Perkins C E, and Westphal C 2015 *Second Annual IEEE Communications Society Conf. on Sensor and Ad-Hoc Communications and Networks* (California:IEEE)

[2] Gouda B.S, Dass A.K, and Narayana 2013 K.L *IEEE Autom. Comput. Commun. Control Compress. Sens. Imac4s* (Kottayam: IEEE) 306 – 312.

[3] Nitnaware D. and Verma A. 2010 *IJCSC* **1** 67–71

[4] Mueller S, Tsang R P, Ghosal D 2004 *Springer* **2965** 209–234

[5] Hatti S, Kamakshi M.B 2013 *Springer* **131** 817-826

[6] Jonathan L J, Anne M P, Hilt B, and Boeglen H. 2012 *Int. Conf. On ICWCUCA* (Clermont Ferrand: IEEE) 1-5

[7] Patel D K, Shah S K, Thaker M P 2010 *Springer* **70** 276–280

[8] Dubey V and Dubey N 2014 *Proc. Int. Conf. On Computational Intelligence and Communication Network s* (Washington, DC : IEEE) 482 –485

[9] Lee S J and Gerla M. 2000 *WCNC* (Chicago:IEEE) 1311-1316

[10] Rohal P, Dahiya R, and Dahiya P 2013 *IJARET* **1** 54-58