International Journal of Advanced Scientific Research and Management, Volume 4 Issue 7, July 2019
www.ijasrm.com
ISSN 2455-6378

Minimized Routing delay and Energy consumption oriented routing in MANETs

R. Veeramani[1] and R. Madhanmohan[2]

[1] Department of Information Technology, SRM University,Ramapuram Chennai, Tamilnadu, India

[2] Department of Computer Science and Engineering, Annamalai University, Annamalainagar, Tamilnadu, India

Abstract

This work is intended with implementing energy efficient and load balanced routing protocol in MANETs. This paper describe the methodology of how this work is said to be implemented by using AODV routing protocol. The resultant of this work is analyzed with AODV routing protocol. The performance metrics are analyzed for both protocols and the results are evaluated..

Keywords: *Modified AODV, Energy efficient routing, load balanced routing, AODV.*

1. Introduction

The rapid deployment of independent mobile users is needed for the next generation of wireless network systems. These network scenarios can be conceived as applications of **Mobile Ad Hoc Networks**. A MANET[1] is an autonomous collection of mobile users that communicate over wireless links. With the mobile nodes the network topology changes rapidly. The network is decentralized, where all network activity including discovering the topology and delivering messages must be executed with the nodes themselves, i.e., routing functionality will be incorporated into mobile nodes. . MANETs need efficient distributed algorithms to determine network organization, link scheduling, and routing. The nodes prefer to radiate as little power as necessary and transmit as infrequently as possible, thus decreasing the probability of detection or interception. A lapse in any of these requirements may degrade the performance and dependability of the network. The aim of our work is to provide a characteristic comparison for the modified AODV protocol that balances the load on various routes and AODV routing protocol.

2. Modified AODV

In the modified AODV[7] routing protocol, the network traffic is evenly distributed by using the information available in the network. The basic idea is to select a routing path that consists of nodes with higher energy and hence longer life in order to reduce the routing overhead and end-to-end delay by distributing the packets over the path which is less utilized. The route determining parameters used in our modifications are defined as follows:

1. Route Energy (RE): The route energy is the sum of energy possessed by nodes falling on a route. Higher the route energy, lesser is the probability of route failure due to exhausted nodes.

2. Aggregate Interface Queue Length (AIQL): The sum of interface queue lengths of all the intermediate nodes from the source node to the current node.

3. Hop count (HC): The HC is the number of hops for a feasible path.

The routing process involved in any routing protocol can be classified into three main divisions: 1. Route Discovery, 2. Route Selection and 3. Route Maintenance. By implementing our load balancing features effectively in AODV, we have modified the Route Discovery and Route Selection process.

IJASRM
International Journal of Advanced Scientific Research and Management, Volume 4 Issue 7, July 2019
www.ijasrm.com
ISSN 2455-6378

2.1 Route Discovery

Source node NS [4] wants to find a path to destination node N_d. Suppose that z is the number of mobile nodes and N is the set of mobile nodes, i.e., $N = \{N_1, N_2, \ldots, N_z\}$, where $N_s, N_i, N_d \, \varepsilon \, N$, $1 \leq s, d, i \leq z$ and $s \neq d$, we assume that node N_i is an intermediate node that receives the RREQ packet.

If (node N_i is the destination node N_d) {

4. Destination node Nd adds its remaining energy (RE), aggregate interface queue length (AIQL), and hop count (HC) to the RREP packet.

5. Destination node Nd forwards the RREP packet towards the source node along the path in which the RREQ packet arrived the destination node.

6. A destination node sends a reply for each RREQ packet arriving at the destination node after travelling different route path.

7. The intermediate node forwards the route reply towards the source node NS.

}
Else Node Ni forwards the RREQ packet to the neighboring node.

2.2 Route Selection

After receiving all the route RREP packets the source node then computes the weight value for each route. Weight [16],[17]for a route i is calculated based on the following:

$$W_i = C1 * (RE_i/MaxRE) + C2 * (AIQL_i/MaxAIQL) + C3* (HC_i/ MaxHC)$$

Where |c1| + |C2| + \C3| = 1

Route energy is taken as a factor keeping in view that MANETs has scarce energy resources. Using a route frequently while other routes are idle or under load may result in network instability. The aggregate interface queue length gives us the idea about how busy our route is. Its highest value depicts a higher load on the route. Thus, this parameter helps in determining the heavily loaded route. If each intermediate host has a large roaming area and the MANET has many nodes (and hops), then a feasible path with a low hop count is preferred and hence the metric hop count has been considered for route selection. Our protocol effectively combines all the three parameters with weighing factors C1, C2 and C3. The values of these factors can be chosen as per the requirements, e.g. Energy is very critical for MANETs can have more weight than other factors. The adverse contribution to traffic distribution is built into negative coefficients. The path with the maximum weight value is selected as the primary routing path among all feasible paths.

2.2 Route Maintenance

The route maintenance process is carried whenever the route is active and data packets are transmitted .In MANET a link failure occurs when a mobile node moves out of its transmission range. Since the mobility of the node is high in MANET links breaks easily. Whenever an intermediate finds a link failure, it broadcasts a RERR (Route Error) packet to other mobile nodes. After receiving a RERR packet, the source node initiates a new route discovery or finds an alternative path.

3. Performance Evaluation

The simulations of the AODV and modified AODV routing protocols are carried out using NS-2.34 network simulator. We have used NS-2.34 for simulations. As mentioned earlier, we have performed a comparison study with AODV and the modified AODV. The AODV protocol in NS-2[7],[8],[9] maintains a send buffer of 64 packets used in route discovery. The maximum waiting time in the send buffer during route discovery is 30 seconds. If the packet is in the send buffer for more than 30 seconds, the packet is dropped. The size of the interface buffer of each node for simulation is taken as 50 packets. The simulation environment is constructed with 50 mobile nodes and the data transmission will happen between 3 pair of nodes at different periods of time. The data transmission between all the three pair of nodes are traced and all the required parameters are logged in the trace file. These trace files are later analyzed to evaluate the performance of the protocol.

We have used a constant bit rate (CBR) source as the data source for each node. We have considered 12 source nodes for simulation, each node transmitting packets at the rate of four packets per second, with a packet size of 512 bytes. A movement scenario arranges the movement and the position of the nodes according to the random waypoint model.

PARAMETER	VALAUE
NS Version	2.34
Channel Type	Wireless Channel
Network Interface Type	Wireless Physical
Propagation Model	Two Ray Ground
MAC	802.11
Interface Queue Type	Priority Queue
Antenna	Omni Antenna
Link Layer Type	LL
Interface Queue Length	50
Number of Nodes	50
Default Data Rate	512KBPS
Terrain Range (m^2)	1000 × 1000
Routing Algorithm	AODV (Extended)
Packet Size	512 bytes

Table.1 Simulation Parameters and Values

4. Results and Discussion

The results are plotted as graphs; each graph shows a comparison between the performance of the AODV and modified AODV on various parameters like throughput, routing delay, packet delivery ratio, packet loss , packet received and energy consumed.

The graphs show 6 curves (3 for AODV and 3 for modified AODV) . Each curve represents the values for a source and sink pair.

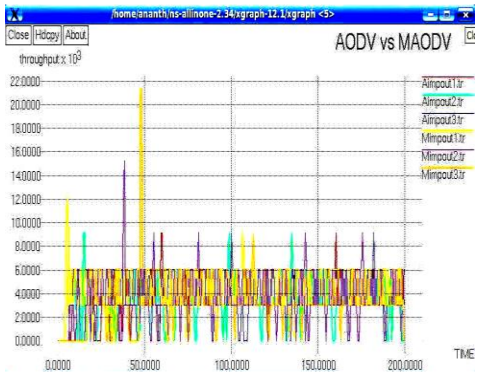

Fig 1 Throughput comparison between AODV and modified AODV

Graph details
X- axis – Time
Y-axis – Throughput.

Maximum Throughput for AODV – **9.00, 9.00, 9.00** respectively for each source sink pair. Maximum Throughput for modified AODV – **12.00, 15.00, 21.00** respectively for each source sink pair. From the above graph, it is very clear that the modified AODV is exhibiting higher throughput in all the cases.

Routing delay between AODV and modified AODV:

The following fig. 2 shows the comparison of AODV and modified AODV for Routing delay.

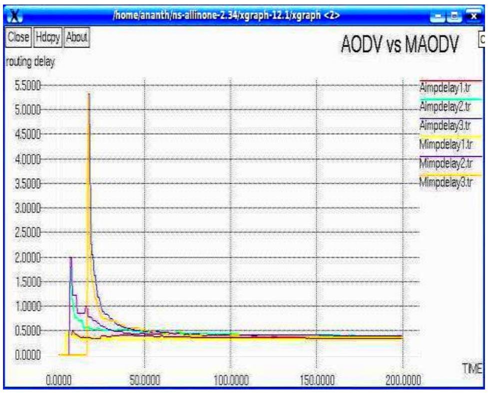

Fig. 2 Routing Delay between AODV and modified AODV

Graph details
X- axis – Time
Y-axis – Routing Delay

The above graph shows that routing delay in both the routing delay is almost equal to each other.

ISSN 2455-6378

Since the traffic scenario used in these experiments is normal loads, there is no much difference in the routing delay. If the number of nodes is increased, then surely the modified AODV will have less routing delay.

Packet Delivery Ratio:

The Packet delivery ratio of Aodv and modified AODV is compared, and the result is shown in the below diagram fig. 3.

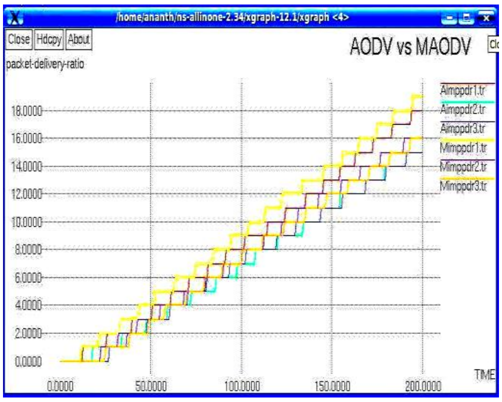

Fig 3 Packet Delivery Ratio between AODV and modified AODV

X-axis – Time
Y-axis – PDR

The modified AODV is showing high PDR ranging above 18.00 in the data transfer between source 1 and sink 1 pair. Since the AODV is having less PDR it shows the packet losses are quite high in AODV, which is the most important drawback in AODV.

Packet Loss :

The comparison of packet loss between AODV and modified AODV is represented by the following Figure Fig. 4.

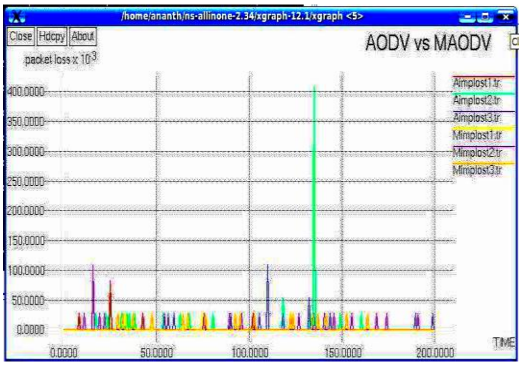

Fig 4. Packet Loss between AODV and modified AODV

X- axis - Time
Y –axis – Packet Loss

The above graph shows that the packet loss during the data transfer between source 2 and sink 2 pair is high. This high loss may be due to high traffic in the network. Since packet loss is high, it will lead to a throughput reduction in the network.

Packets Received

The Comparison of AODV and modified AODV for the packets received is shown by the fig. 5.

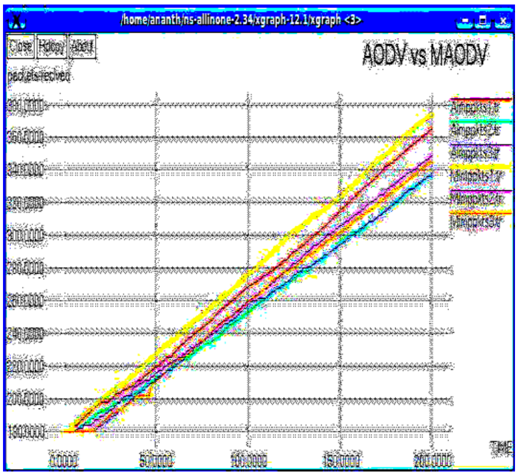

Fig.5 Packet received between AODV and modified AODV

X- axis – Time
Y- axis – Packets Received.

As inferred from the previous graph, the number of packets received for the source sink pair 2 is very low. This shows that the results are very accurate and calculations are done without any mistake.

Energy Consumption

The energy consumption of AODV and modified AODV is compared and the results are shown in the following Fig.6.

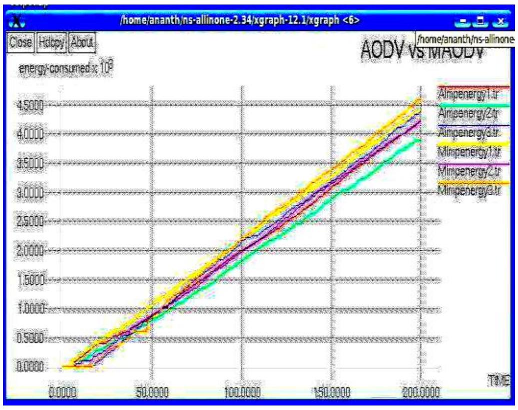

Fig 6. Energy Consumption between AODV and modified AODV

All the curves show that energy consumed during the data transfer between all the source and sink ranges around 4.00 x 10^3 units. But when looking at details, the modified AODV is consuming energy slightly higher than AODV. This is due to the fact that along with data packets, three other control parameters are also sent. This will be rectified in the future that modified AODV will consume less energy.

5. Conclusion

From the above results, it is very clear that modified AODV is out performing AODV in all the simulation scenarios. The modified ADOV selects a routing path by maximizing the weight among the feasible paths. The three routes selection parameters used in our modified AODV are the aggregate interface queue length, the route energy and the hop count. The main disadvantages of the AODV routing protocol have been overcome in the modified AODV. The routing delay and the energy consumption are low in modified AODV when compared to the original AODV.

References

[1] Kirousis LM, Kranakis E, and Krizanc DPelc A, Power consumption in packet radio networks. Theoretical Computer Science, 2000, 243 (1- 2): 289-305.

[2] Clementi A, Penna P, and Silvestri R, On the power assignment problem in radio networks. ACMIKluwer Mobile Networks and Applications (MONET), 2004, 9 (2): 125-140. http://www.cisco.com.2010.

[3] The Network Simulator-NS-2: http://www.isi.edulnsnarnlns.2010.

[4] Hossain M. Julius, Dewan M. Ali Akber,and Chae Oksam, Maximizing the effective lifetime of mobile ad hoc networks. lEICE Transactions on Communications, 2008, 91(9):2818-2827.

[5] Arvind Sankar, and Zhen Liu, Maximum Lifetime Routing in Wireless Ad-hoc Networks. INFOCOM 2004. Twenty-third AnnualJoint Conference of the lEEE Computer and Communications Societies, Hong Kong, China, March 2004, 2:1089-1097.

[6] C.Perkins, "(RFC) Request for Comments – 3561", Category: Experimental, Network, Working Group, July 2003.

[7] K Fall and K. Varadhan, The NS Manual, November 18, 2005, http://www.isi.edu/nsnam/ns/doc/ns_doc.pdf. 25 July 2005.

[8] Virtual InterNetwork Testbed, http://www.isi.edu/nsnam/vint, 14 May 2006. NS by Example, http://nile.wpi.edu/NS/overview.html, 14 May 2006.

[9] F. J. Ros and P. M. Ruiz, "Implementing a New Manet Unicast Routing Protocol in NS2", December, 2004, http://masimum.dif.um.es/nsrt-howto/pdf/nsrthowto. pdf, 25 July 2005.