

Performance Enhancement of AOMDV with Energy Efficient Routing Based On Random Way Point Mobility Model

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ABSTRACT: MANETs are extremely flexible and each node is free to move independently, in any random direction. Each node in MANET continuously maintains the information required for proper route traffic. To improve AOMDV's performance in selecting main path, introduced a new concept called Node state with mobility model (NS-AOMDV). In route discovery process, the routing update rule calculates the random node weight of each path and sorts the path weight by descending value in route list then chooses the path with largest path weight for data transmission. In this technology of route request packet delay forwarding and energy threshold to ease network congestion, limit the route request broadcast storm, and avoid low energy nodes to participate in the establishment of the path. The Proposed Protocol (NS-AOMDV) with mobility model investigation focuses three qualities of services to examine the protocol performance like Throughput, Average end-to-end delay and Packet drop ratio. This protocol can effectively improve the performance of AOMDV.

KEYWORDS: NS-AOMDV protocol, energy, Random way point, throughput

I. INTRODUCTION

The Mobile ad-hoc Network (MANET) is a collection of nodes, which have the possibility to connect on a wireless medium and form an arbitrary dynamic network with wireless links, which is made up of some mobile nodes by using distributed protocols, Since each node in ad hoc network has the function of the host and router, It has the characteristics of flexibility and convenience in deployment. In the situation of no fixed network infrastructure, mobile ad hoc network can communicate with each other by using multi-hop way and provide the convenience to some special occasions. Routing protocol plays an important role in the communication between nodes.[1].

On-demand multipath routing protocols discover multiple paths between a source and destination pair, in a single route discovery. So a new discovery is needed only when all these paths fail In contrast, a single path routing protocol has to invoke a new route discovery whenever the only path from source to destination fails.[2] . AOMDV has three novel aspects compared to other on demand multipath routing protocols. First it does not have inter-nodal coordination overheads like some other protocols. Second, it ensures disjointness of alternate routes via distributed computation without the use of source routing. Finally AOMDV computes alternate paths with minimal additional overhead, it does this exploiting already available alternate path routing information as much as possible.

The mobility model gives mobile users movement pattern, their location, speed and change in due course. Mobile nodes in random based mobility model move randomly and freely with no restriction. The destination is to consider based on the speed and direction for node choosen randomly and indecently of other nodes. Communication routes in MANETs are discovered either periodically or on demand that means the route discovery process has to start whenever route fails; each route discovery flood is associated with significant latency and overhead.

The rest of the paper is organized as follows. In Section 2 describes the related work. In section 3, to form a Structure of NS-AOMDV Protocol. In section 4, the design of NS-AOMDV with Random way Point Model and its performance

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is evaluated and compared with AOMDV and NS-AOMDV in Section 5. At last this paper makes a conclusion in section 6.

II. RELATED WORK

2.1 Routing Protocols

The basic idea behind multi-path routing is of finding multiple paths between sources to destination. As on demand routing protocols for MANET discovers a route when a source needs to communicate with destination. The multipath routing protocol discovers multiple paths during single route discovery process. In AOMDV multiple routes are discovered in single route discovery. AOMDV is designed for highly ad hoc network where link failures and route breaks occur frequently. [3]

The node broadcast a route request with a unique sequence number so that duplicate requests can be discarded. If an intermediate node receives the RREQ. It first checks if it has afresh enough route entry available in its routing table. If yes then sends a reply (RREP) back to the source else broadcast the RREQ. The nodes on reverse route towards source update their routing information. Duplicate RREP on reverse route is only forwarded if it contains either a larger destination sequence number or a shorter route found. AOMDV route update rules, applied locally at each node, play a key role in maintaining loop freedom and disjointness properties.

2.2 Mobility Model

A mobility Model should be attempted to emulate the movements of real mobile nodes. Mobility models can be classified into entity and group models. Entity models cover scenarios when mobile nodes move completely independently from each other, while in group models nodes are dependent on each other or on some predefined leader node. [4] [5] [6].

2.2.1. Reference Point Group Mobility Model (RPGM)

In reference Point Group Mobility Model, nodes are divided into groups. Every group has a group leader that determines the movements of all nodes in the group. At each instant, speed and direction of group number is calculated based on speed and direction of leader node at the instant. This model represents the movement of soldiers in a battalion, or tourist following the tourist guide.

In this model, initially each mobile node is assigned a current speed and direction at each fixed interval of time. Node Movement occurs by updating the speed and direction of each mobile node. Because of temporal dependency, the value of speed and direction at the particular time is calculated on the basis of the value of previous speed and direction. This model eliminates abrupt stops; quick turns and is close to be realistic.

2.2.3. Manhattan Mobility Model

In Manhattan model, movement pattern of mobile nodes were defined by map which composed of a number of horizontal and vertical streets. Node allows moving along the grid of horizontal and vertical streets on the map. Because of temporal dependency, velocity of mobile node at a particular time is dependent on the velocity of its previous time.

III. STRUCTURE OF NS-AOMDV PROTOCOL

3.1 NS-AOMDV Protocol

The main idea in AOMDV is to compute multiple paths during route discovery procedure for contending link failure [5]. When AOMDV builds multiple paths, it will select the main path for data transmission which is based on the time of routing establishment. The earliest one will be regarded the best one, and only when the main path is down other paths can be effective. In fact, a large number of studies indicate that the aforementioned scheme is not necessarily the best path. Mobile nodes, which usually due to residual energy are too low or under heavy load and other factors, seriously affect the performance of the network. In order to improve the performance, we propose the novel NS-

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AOMDV protocol based on existing AOMDV. First, we consider the rate of node residual energy and idle buffer queue as the weight of node. Second, in route discovery process, the routing update rules calculate the node weight of each path and sort the path weight by descending value of path weight in route list, and we choose the path which has the largest path weight to transmit data packets. At the same time, the protocol uses the technology of RREQ delay forwarding [6] and energy threshold to ease network congestion, limit the RREQ broadcast storm, and avoid low energy nodes to participate in the establishment of the path.

3.2 Mobility Model

A Mobility model should be attempted to emulate the movements of real mobile nodes. Mobility models are based on setting out different parameters related to the possible node movement. Basic parameters are the starting location of mobile nodes, their movement direction velocity range, and speed changes over time.

In this paper uses Random Waypoint Mobility Model to simulate mobile nodes movements. At the start each mobile node randomly selects one location in the simulation area as a destination and chooses a speed that is uniformly distributed between $[min-speed, max-speed]$. When the node reaches the chosen location, it stops for duration defined by wait time. After the wait time the node again chooses a random destination and repeats the whole process until the end of simulation.

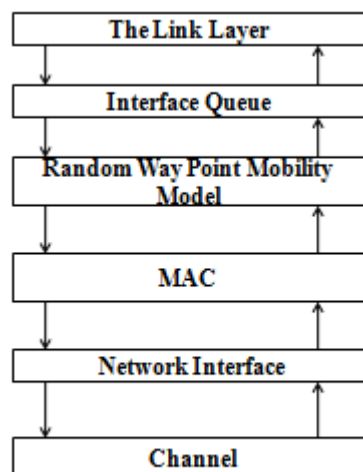


Fig 1: NS-AOMDV Mobile Node Structure

In ad hoc networks, a mobile node can be considered as a consist of the network interface, the MAC layer, Random way point mobility model, interface queue, and link layer. These modules are receiving and processing information. In this Fig1, shows the MAC layer and link layer are used to a node in the transmitted data packet, the data stream is usually required in the node interface queue filter delete processing. Mobile nodes in random based mobility model move randomly and freely with no restrictions. The destination, speed and direction for node are chosen randomly and independently of other nodes are based on random based mobility models. The interface queue utilizes the bottom of the interface queue information to reflect the network status.

IV. PROPOSED NS-AOMDV WITH RANDOM WAY POINT MODEL

4.1 Residual Energy Rate using NS-AOMDV

This paper first defines residual energy rate, which refers to the residual energy level of the node n_i at a certain time of t . The formula is shown as follows:

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$$e_i(t) = \frac{E_i(t)}{E_{initial}} \quad \text{----- (1)}$$

Where, $e_i(t)$ is the residual energy of the node at time t , $E_i(t)$ is used for estimate of energy at time t and $E_{initial}$ is the initial energy of it. We can easily find that $e_i(t)$ indicates one node's level of energy consumption. In this network, each node produces energy consumption due to sensing the signal of the neighbour nodes around. Excessive power consumption means large node density of one node in the case of common communication service. Finally it can be concluded that it's under heavy load in the process of communication.

4.2 The Calculation of Buffer Queue

The idle rate of buffer queue is expressed by the formula as given below

$$l_i(t) = \frac{L_{max} - L_i(t)}{L_{max}} \quad \text{----- (2)}$$

Where $L_i(t)$ is defined as the length of the buffer queue at time t . L_{max} means the maximum length of the buffer queue, it reflects the congestion status of the network. The smaller available buffer queue length means more data packets need to be processed and worse network congestion. In this paper get the idle rate of buffer queue by calculating the length of the interface queue, it utilizes the bottom of the interface queue information to reflect the network status.

4.3 Node Weight

The two state parameters above reflect the status of the network. In this paper, we will take both of them into consideration, and propose a new definition which is called Node Weight (NW). The formula is shown as follows

$$NW_i(t) = \alpha e_i(t) + \beta l_i(t) \quad \text{--- (3)}$$

Where $\alpha + \beta = 1$ ($0 \leq \alpha \leq 1, 0 \leq \beta \leq 1$), if $\alpha > \beta$ the residual energy rate is the main consideration. If $\alpha < \beta$, the idle rate of buffer queue as the main influencing factor.

4.4. Path Weight

First, we define Path Weight (PW) as the least NW of all nodes on a path. Its computation formula is as follows

$$PW_i(t) = \{\min(NW_i(t)) \mid i \in NODE\} \quad \text{--- (4)}$$

$PW_i(t)$ is the path weight at time t , and $NODE$ is the set of nodes on a path. Because we need to take the level of every path into consideration when we select the main path, it includes two important steps: updating path weight and selecting the main path. The Updating Path Weight means Updating node weight occurs in the time of routing updating. Meanwhile, we can get path weight of every path using random way point model. NS-AOMDV is similar to AOMDV, and its main difference is that NS-AOMDV needs to update node weight in the step of updating route. To Selecting the Main Path, the main idea in AOMDV is to compute multiple paths during route discovery procedure for contending link failure. When AOMDV creates multiple paths between source node and destination node, only the path based on some metric is chosen for data transmission.

In other words, the path which first reaches the destination node is chosen for the primary path and the other paths will become alternate ones. In this way, we can quickly create a path for data transmissions ignore the state of the node's own level and other factors. Nodes, which own the low level of residual energy and heavy load, may exist in the primary path. If so, this path is very likely to be disconnected because of energy depletion. Compared to AOMDV, NS-AOMDV firstly utilizes the forward path on which the first RREP packet arrives at source node earliest for data transmission. When multiple RREP packets arrive at the source node, it will utilize the path which owns the largest PW recorded in the routing table for data transmission. Because PW s are in descending order in route table, we can always select the path of largest PW every time.

The formula is as follows:

$$route_{list} = \max\{PW_p(t) \mid p \in PATH\} \quad (5)$$

Where, $route_{list}$ represents the path for data transmission and $PATH$ is the set of paths in routing table.

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4.5. Route Discovery the RREQ

In the route discovery procedure, we can also control those intermediate nodes with heavy load to delay forwarding RREQ packet, based on the level of NW. Its main goal is to allow a node with lighter load to be quickly involved in setting up the path using random way point mobility model. Its main purpose is to make a lighter load node to participate in the establishment of the path quickly. Also the node with heavy load can participate in the establishment of the path again when the network status improves. In this way, network traffic is balanced and network congestion is avoided efficiently. The paths will be relatively independent at the same time. We get RREQ delay forwarding time based on the formula as given below:

$$delay_i(t) = \begin{cases} T_c, & NW_i(t) > 0.5 \\ \frac{T_c}{NW_i(t)}, & NW_i(t) \leq 0.5 \end{cases} \text{----- (6)}$$

4.6 Route Maintenance

In the route maintenance procedure using the intermediate node owns low level of energy and it also needs to forward RREQ packet simultaneously. If you accidentally use it to establish one route, it will easily lead to the emergence of network segmentation. In order to avoid selecting this kind of nodes involved in the route setup, we set up an energy threshold $E_{threshold}$ to execute them. The energy threshold size setting refers to the setting method. The points out that one node's energy level is classified as a "discarded" level, and its survival time will be estimated less than 10% based of the initial. We propose to set the energy threshold 20% based on this. In the process of intermediate node processing RREQ packet, only when its own residual energy rate is larger than $E_{threshold}$, will it forwards the RREQ packet.

V. SIMULATION ENVIRONMENT

In order to study the performance of NS-AOMDV and to compare it with that of AOMDV routing protocol we have developed and implemented NS-AOMDV model based on NS-2 simulator [17]. We used the Distributed Coordination Function (DCF) of IEEE 802.11 for wireless LANs as the MAC layer protocol. We assumed that each node moves independently according to the random way point mobility model with specified average mobility speed and pause time. All nodes had the same transmission range of 1000 meters. The simulated traffic is a Constant Bit Rate (CBR). In the last two experiments the number of node varies from the mobile nodes. In the other set of the conducted experiments, a fixed number of mobile nodes have been assumed. Parameters that have been adopted in the simulated experiments are as shown in **Table 1**.

Table 1: Initial Parameters for node Configuration.

Parameter	Value
Dimensions	1000 m × 1000m
Number of Nodes	30
Source Type	CBR
Antenna Type	Omni directional
Spread Type	Two Ray Ground
Wireless channel capacity	2Mb/s
Communication Radius	250m
Packet size	512 bytes
Initial Energy	60J
Transmission Power	1.3 W
Reception Power	0.8 W
Buffer Size	50 bytes
SMAC Layer	IEEE 802.11b DCF
Transport Layer	UDP
Simulation time	300 s
Mobility Model	Random way point Model

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5.1. Packet delivery Ratio

To compare between the behavior of AOMDV and NS-AOMDV with different node speeds, we have conducted an experiment in which the throughput is evaluated as the number of path and the results are shown in **Figure 2**. We notice firstly, that in almost all results the throughput of both protocols increases as the number of path.. The reason behind this is the fact that as the number of more stable path increases the life time of the selected routes increases which allows the senders to send more data.

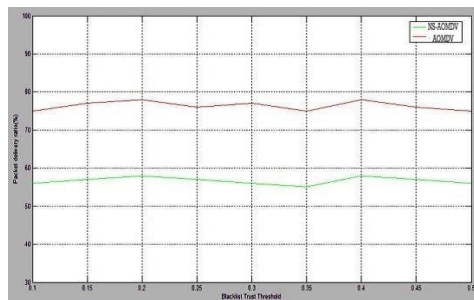


Figure 2. Packet Delivery Ratio

Figure 2 plots packet delivery rate against the maximum moving speed. The graph demonstrates packet delivery rate of the two protocols are significantly reduced with the increase of node maximum speed. To explain this behavior firstly we should note that generally, as the nodes speed increases the probability of link break gets higher and consequently the throughput would decrease. NS-AOMDV overcomes this drawback since it chooses shortest stable paths which have less opportunity to break compared with AOMDV which selects longer paths. This will lessen the effect of higher speeds on the throughput as the number of links that could break will be less than the case when using AOMDV. Furthermore NS-AOMDV distribute the burden of packet transmission on parallel overall the discovered paths and this in turn enhance the achieved throughput substantially, this is in contrast to AOMDV which transmit packets over one path until it gets invalid before trying to use the next one.

5.2. Average end-to-end delay

The result of the first experiment is shown in **Figure 3**. We compare the end-to-end delay of the AOMDV and the NS-AOMDV protocols, while changing the mobility of the nodes. The superiority of NS-AOMDV over AOMDV is clear almost regardless of the number of multiple paths. This is because in contrast with AOMDV, NS-AOMDV chooses the most stable paths with the minimum number of hops in the path. This increases the lifetime of the selected paths and so reduces the opportunity of future path breaks, which in turn reduces packet transmission delay. The second reason of the big difference between NS-AOMDV and AOMDV with regards to the end to end delay has to do with the way NS-AOMDV transmits packets. AOMDV transmits packets in parallel over all the discovered paths. It starts the transmission with the first discovered path and then distributes the transmission of the packet in an even way over the other path as they get discovered via receiving route replies from the destination. This parallel transmission of packets over all the path available greatly reduce the time needed to send the packets intended to be transmitted.

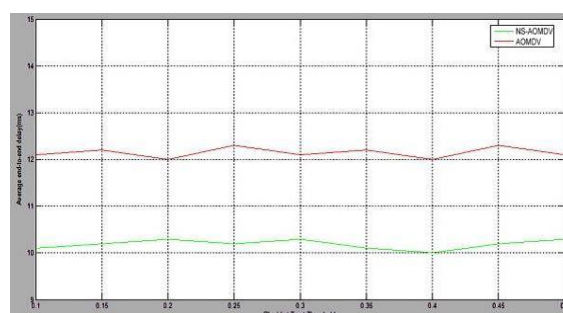


Figure 3: Average end-to-end delay

5.3. Routing Packet Overhead

In **Figure 4**, we show the average of packet overhead of NS-AOMDV and AOMDV protocols as we increasing number of paths. One can notice that for both protocols the discovery packet overhead drops down as the number of paths increases. This is true and especially for the NS-AOMDV protocol which drops more clearly until it converges with AOMDV protocol. Although the two protocols select the discovery of packet overhead of NS-AOMDV is higher than that of AOMDV. This NS-AOMDV uses multiple paths which pass through routes that are shorter than the primary path.

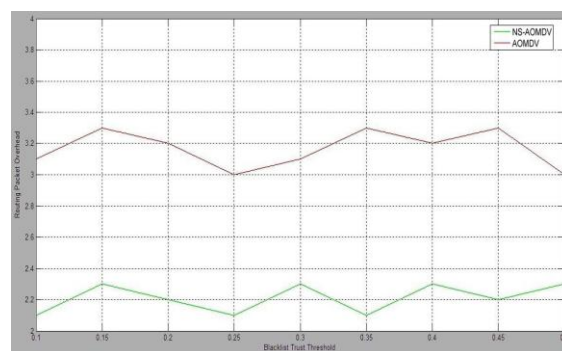


Figure 4: Routing Packet Overhead

VI. CONCLUSIONS

In this paper, a novel multipath distance vector routing protocol is NS-AOMDV with Random way point proposed to improve the performance of present AOMDV. In this process building of transmission path, we consider the residual energy rate and idle rate of buffer queue and also introduce the technology of RREQ delay forwarding and energy threshold in route discovery. Updating the information of the nodes on the path and also choose the shortest path with maximum node weight for data transmission. Further the extension of this work includes analysis of random way point to evaluate the effect of mobility model on routing protocol performance. The Random waypoint mobility model is used to simulate the real life mobility. The simulation results show that the proposed method has significant reliability improvement in comparison NS-AOMDV with AOMDV.

REFERENCES

1. Z. Chen, L.Guan, X.Wang and X. Fan, "Adhoc on-demand Multipath Distance Vector routing with Backup Route Update Mechanism" IEEE 14th International conference on High performance and Communications, 2012 pp 908-913.
2. Jieying Zhou, Heng Xu, Zhaodong Qin, Yanhao Peng, Chun Lei "Adhoc On-demand Multipath Distance Vector Routing Protocol Based on Node State", Communication and Network, 2013, vol 5, 408-413.
3. VB Kute et al, "Quality of Service assessment of AOMDV for Random waypoint and Random walk Mobility Models" International Journal of Computer Science and Mobile Computing" vol 3, issue 1 January 2014 pp 199-203.
4. C.Gomez et al., "Multilayer analysis of the influence of mobility models on TCP flows in AODV adhoc networks." FEDER and the Spanish Government through Project TIC2003-01748, Spain (2005).
5. C.P.Agarwal et al., "Evaluation of AODV Protocol for varying Mobility Models of MANET for Ubiquitous Computing", IEEE Thrid International Conference on Convergence and Hybrid information Technology, India., (2008).
6. Ejiro.E.Igbesoko et al., "Performance Analysis of MANET Routing Protocols over different Mobility Models London 2009.
7. M.Tekaya et al., "Multipath Routing Mechanism with load balancing in adhoc Network" International conference on computer engineering and systems 2010, pp 67-72.
8. S.Getsy et al., "Energy Efficient Ad hoc on demand Multipath Distance Vector routing Protocol" "International of Recent Trends in Engineering, 2009 pp 10-12.