Implementation of improved (I_AODV) algorithm and comparison with traditional AODV routing protocol in MANETs

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Abstract: Today, person sitting at either end of the nation can speak with each other with the aid of wireless technology. Mobile ad hoc Network (MANETs) is a type of wireless ad hoc network which is a collection of mobile devices that creates random topology for communication. The fineness of MANETs is that it not required any central controller or base station. MANETs is only a network in which devices worked as a host as well as router. In this paper we proposed a new approach, named Improved ad hoc on demand distance vector (I_AODV) routing algorithm. It is a modified version of traditional AODV routing protocol. The objective of this thesis work is to improve the performance of AODV protocol with high throughput and less amount of end to end delay which are essential metric and Comparison of improved (I_AODV) algorithm with traditional AODV routing protocols in MANETs with following parameters: end to end delay, throughput and packet delivery ratio. In this work network simulator NS-2.34 tool is used for simulation. Implementation and performance analysis of (I_AODV) done by network simulator. Simulation result shows the improved ad hoc on demand distance vector (I_AODV) routing protocol perform better than traditional AODV routing protocol.

Keywords: MANETs, AODV, I_AODV, Network Simulator

I. INTRODUCTION

Mobile Ad-hoc Network (MANET) [3] consists of wireless mobile nodes that dynamically organize themselves in random network structures. There is no pre-installed infrastructure, which can facilitate the forwarding of packets from one host to another and MANETs is only a network in which devices worked as a host as well as router. [1] Nowadays we have latest several multimedia applications such as digital television, video conferencing and web games and real-time interactive audio and video streaming which needs high throughput and less amount of end to end delay which are main essential quality of service metrics. [2] MANETs have become quite popular due to its fundamental characteristics like fast and cost effective deployment, self-manageable, infrastructure-less etc. Ad hoc network are applicable in many application particularly where the establishment of fixed base station or access point is very difficult or impossible. [9] Mobile ad hoc networks (MANETs) are made out of an accumulation of nodes which can move freely and speak with each other utilizing a remote physical medium. Routing protocols are the set of rules that decide the movement of data between the wireless nodes [12]. Figure 1 shows a mobile Ad hoc network with 12 nodes.

In wireless communication [1], routing process plays an important responsibility for flow of data packets that to specially in mobile adhoc networks and it is a major subject for researchers, presently several concepts have been discussed and lots of changes are made and even many different routing protocols are developed. In this paper we proposed new routing protocol I_AODV which provides better performance and has different technique when compared to AODV types of reactive routing protocols in wireless ad-hoc networks. An improved (I_AODV) protocol using Manet Side Units (MSU) that contain more power for packet forwarding from one node to another nodes in network it reduce end to end delay. We particularly focused on three performance metrics such as throughput, end-to-end delay, and packet delivery ratio.

Figure 1: Mobile Ad-hoc Network

The flow of this paper is as follows: In section 2 we discuss literature review. In section 3, it tells about proposed method of I_AODV. In section 4, we discuss simulation results and analysis. Finally in section 5, we end with the conclusion and the future work of our research work.

A. AODV Routing Protocol

AODV is an on-demand routing protocol which consists of unicast and multicast method [1]. AODV is reactive / on-demand routing protocol that set up a link between pair of nodes only when it is necessary and only for those nodes that are currently being used to send data packets from
source to destination[7] AODV is a very simple, efficient, and effective routing protocol for Mobile Ad-hoc Networks which do not have fixed topology. This algorithm was motivated by the limited bandwidth that is available in the media that are used for wireless communications[10]. In this protocol, a node discovers a route on demand, i.e., only when it is needed, and caches it. Network wide flooding is used to discover the routes.

Working of AODV
Each mobile host in the network acts as a specialized router and routes are obtained as needed, thus making the network self-starting.

The AODV protocol is a reactive routing protocol based on the distance vector Principle, it supports unicast and multicast routing, it does not require nodes to maintain routes to destinations that are not in active communication and it allows mobile nodes to respond to link breakages and changes in network topology in a timely manner [4]. One distinguishing feature of AODV is its use of a destination sequence number for each route entry to ensure loop freedom [5]. Each node in the network maintains a routing table with the routing information entries to its neighboring nodes, and two separate counters: a node sequence number and a broadcast-id. When a node receives a HELLO Message in its routing table with that in the RREQ, it compares the destination sequence number in its routing table with that in the RREQ, if the same request destination sequence number of new RREP [10]. The intermediate node updates routing information and propagates new RREP only. Periodic hello messages can be used to ensure symmetric links, as well as to detect link failures.

II. RELATED WORK

This section gives the overview of related work done by various researchers for mobile ad hoc networks.

Ashraf Abu-Ein et al. (Jan 2014) [5] In this paper, a new routing protocol for Mobile Ad-Hoc networks (MANETs) has presented the proposed power-hop based Ad-hoc on demand Distance Vector (AODV) is named PH-AODV, it uses the node power and the hop count parameters to select the best routing path. It is compared with AODV in terms of throughput, end to end delay and number of drop packets. The proposed PH-AODV routing protocol is simulated using GlomoSim network simulator and compared to AODV routing algorithm. It is observed that the new protocol is much better than original AODV.

Vinay P.Viradia et al. (Jan 2014) [4] This paper proposed a new protocol Enhanced AODV (E-AODV) which is a modified version of AODV with enhanced packet delivery ratio and minimized end to end delay. The objective of this paper is to enhance the network performance of AODV, when frequent link failure in network due to mobility of the nodes in the network. After observing the simulation and analyzing the data, it is found that packets could get less end to end delay with a QoS based routing protocol when the traffic on the network is high.

Supriya Sawwashere et al. (April 2015) [6] In the paper, the conventional AODV is compared with proposed Improved Cost efficient AODV routing protocol using Euclidean distance. The route with shortest Euclidean distance is selected for communication. The proposed AODV routing protocol thus helps to overcome the factors like End to End Delay, Packet Loss and Network Routing Load which generally occurs in conventional AODV routing protocol due to changing topology of the network. The simulation is done using Network Simulator 2.35. It is observed even though if numbers of nodes are increased, still the improved cost efficient AODV protocol performs well and yields better throughput level with less delay and consumes less energy.

Ritu Parasher et al. (April 2015) [7] Researchers have proposed a modern routing algorithm (A-AODV) for MANET. The proposed approach enhancing the recitation of routing in MANET using the process shrink the active path whenever optimal pathway is available and switches the traffic on it. This approach reduces number of hops dynamically by continuously monitoring active routing paths and redirecting the path whenever a shortcut path is available, by excluding the redundant nodes from the active route. Since the traditional AODV does not consider this situation. It uses the active path for packet forwarding till
any link breakage does not occur. In this case packets traveling long distance while optimal shortest path is available and increases the chance of packet dropping. And simulation studies are conducted using NS2 to prove that proposed approach enhance network performance when network size, load or the mobility increases. The simulation results clearly indicate the efficiency and effectiveness of proposed approach over the traditional AODV routing protocol.

Siddharth Samal et al. (August 2016) [8] this paper proposed a new method by modifying the traditional AODV protocol called EPRAODV routing protocol which will introduce a power efficient plan in the MANETs. The existing protocol works properly if the network is very small but if the system is a complex one then the protocol does not work properly. But our proposed protocol that is EPRAODV can work efficiently in the complex scenarios. EPRAODV saves a lot of energy at the time of packet forwarding and packet receiving thus it increases the lifetime of the network. R.Mohan Kumar et al. [11] presented the modified version AODV in which the network performance is enhanced by balancing the load using queue length and link quality. This study focuses on introducing two metrics such as, Aggregate Interface Queue Length (AIQL) and link quality, in AODV to deal with load balancing issues. The modified protocol performs better than the conventional AODV in terms of the average throughput, average end to end delay and packet delivery ratio.

III. PROPOSED METHOD OF I_AODV ROUTING PROTOCOL

Various techniques have been proposed to minimization of end to end delay; improve the loss of packets in the network individually. There is need for considering a technique for reduced the delay in the network.

The proposed protocol I-AODV is similar to AODV with some additional constraint on route discovery process. Generally in AODV, during route discovery process AODV used flooding process to send RREQ message to all intermediate nodes to reach destination in networks. I_AODV also using same process for sending RREQ but used four Manets station unit for forwarding RREQ message which is deployed with high battery power integration provide faster communication and provides lesser end to end delay with higher packet delivery ratio, we know that mobile ad hoc network is mobility of nodes and quick link breakage because every node have no more energy power. Traditional AODV increase more end to end delay because every node wait for RREP in which intermediates node fell down and loss more data packets in transmission. In I_AODV source node sending the RREQ message to these units and then these units checked the status of all node those in range of units, if destination is available then send (reply message) RREP ,otherwise forward RREQ message to next unit in networks. The use of these units reduce end to end delay, more throughput, increase packets delivery ratio and main thing is reduce loss of data packets in networks during the transmission of data packets from source to destination.

IV. PERFORMANCE METRICS AND PARAMETERS

In order to calculate the performance of routing protocol such as Improved I_AODV and traditional AODV, we compare them with three performances metric such as Throughput, Packet Delivery Ratio (PDR) and end to end delay.

- Avg. Throughput: - It determines the speed of sending the data over a network. It tells about how many packets are delivered without any constraint. This is a very important parameter in evaluating the overall performance of a network [12]. It is calculated by sum of successful delivered packets divided by total simulation duration. It is given by:

\[ TP = PR \times SZ \div SE \]

Where, PR is Sum of packet received by destination node, SZ is Packet Size, SE is Simulation End Time. The unit of throughput is kbps [1].

- End to End Delay: - The average time from the beginning of a packet transmission at a source node until packet delivery to a destination [2]. This includes delays caused by buffering of data packets during route discovery, queuing at the interface queue, retransmission delays at the MAC, and propagation and transfer times. Delay is calculated by subtraction of time at which packet is sent from the time at which packet is received. Where PS is no of packet sent.

\[ E2E = End\ Time \ - \ Start\ Time \ \div PS \]

- Packets Delivery Ratio: - it is measured by actual number of packet received divided by actual number of packets sent by source node. The ratio of the number of data packets successfully delivered to the destinations to those generated by CBR sources.

\[ PDR = PR \times 100\% \div PS \]

Where, PR is Sum of packet received by destination node, is Sum of packet sent by source node [1]

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simulator</td>
<td>Ns-2.34</td>
</tr>
<tr>
<td>Simulation area</td>
<td>2000 x2000</td>
</tr>
<tr>
<td>No of nodes</td>
<td>26,37,50,65,82</td>
</tr>
<tr>
<td>MAC type</td>
<td>Mac/802_11</td>
</tr>
<tr>
<td>Link layer type</td>
<td>LL</td>
</tr>
<tr>
<td>Traffic</td>
<td>Constant bit rate(CBR)</td>
</tr>
<tr>
<td>Packet Size</td>
<td>512bytes</td>
</tr>
<tr>
<td>Queue type</td>
<td>Drop Tail/PriQueue</td>
</tr>
<tr>
<td>Propagation model</td>
<td>TwoRayGround</td>
</tr>
<tr>
<td>Routing Protocol</td>
<td>AODV, I_AODV</td>
</tr>
<tr>
<td>Antenna model</td>
<td>Omni Antenna</td>
</tr>
<tr>
<td>Agent Type</td>
<td>TCP</td>
</tr>
<tr>
<td>Channel type</td>
<td>Wireless Channel</td>
</tr>
</tbody>
</table>
V. SIMULATION RESULTS AND ANALYSIS
The performance analysis of AODV and I_AODV routing protocol in MANETs is performed in a simulated environment. NS 2.34 simulator is used under Linux Backtrack 5 and windows platform for simulation. The performance analyses are performed by following simulation parameters for both protocols.

Figure 2: Avg. Throughput (kbps)
Figure 2 shows average throughput with respect to different node values. It is seen that I_AODV has higher throughput value except 26 nodes than AODV routing protocol. Higher the throughput value more number of messages is delivered successfully.

Figure 3: End to End Delay (ms)
Figure 3 shows average end to end delay that exists at AODV and I_AODV routing protocol. It is observed that I_AODV has less end-to-end delay than AODV routing protocol.

Table 2: Overall Performance of Protocols in Tabular Form

<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>No. of nodes</th>
<th>Protocols</th>
<th>Avg. Throughput (kbps)</th>
<th>PDR</th>
<th>E2E Delay (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>26</td>
<td>AODV</td>
<td>1.29</td>
<td>25.85</td>
<td>537.12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I_AODV</td>
<td>1.86</td>
<td>33.59</td>
<td>306.12</td>
</tr>
<tr>
<td>2</td>
<td>37</td>
<td>AODV</td>
<td>1.18</td>
<td>24.79</td>
<td>285.52</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I_AODV</td>
<td>1.29</td>
<td>25.30</td>
<td>273.55</td>
</tr>
<tr>
<td>3</td>
<td>50</td>
<td>AODV</td>
<td>1.62</td>
<td>27.39</td>
<td>423.32</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I_AODV</td>
<td>1.87</td>
<td>28.74</td>
<td>270.57</td>
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<tr>
<td>4</td>
<td>65</td>
<td>AODV</td>
<td>2.85</td>
<td>38.86</td>
<td>466.25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I_AODV</td>
<td>3.13</td>
<td>41.95</td>
<td>429.1.</td>
</tr>
<tr>
<td>5</td>
<td>82</td>
<td>AODV</td>
<td>1.24</td>
<td>17.55</td>
<td>202.64</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I_AODV</td>
<td>1.25</td>
<td>17.78</td>
<td>204.14</td>
</tr>
</tbody>
</table>

VI. CONCLUSION
This research work compare the performance of AODV and I_AODV routing protocols with different performance metric such as end to end delay, packet delivery ratio and avg. throughput in the presence of different number of nodes in network. In this paper the new technique I_AODV
proposed which attempts four Manet station units (MSU) which is deployed with high battery power integration provide faster communication and provides lesser end to end delay with higher packet delivery ratio. I_AODV route discovery succeeds in fewer tries than AODV routing protocol. We have carried out an extensive simulation study to analyze the performance of proposed R-AODV and compared it with that of existing AODV routing protocol using NS-2 simulator NS-2.34 tool. The simulation results show that the performance of I_AODV routing protocol is better than traditional AODV routing protocol in most of the metrics, such as the average packet delivery ratio, average end to end delay and average throughput. Future work can be done on same protocol (I_AODV) with other parameters such as, normalized the route overloading, energy consumption and security.

REFERENCES