Performance Analysis Based On Energy Consumption Of Aodv And Dsdv Routing Protocol

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***Abstract*- Self organizing, wireless sensor networks are an emergent and challenging technology that is attracting large attention in sensing and monitoring community. A wireless mobile ad-hoc network is a temporary network which is jointly created by multiple wireless mobile terminals without the help of central entity A Routing in Ad-hoc network is one of the important factor. We have to design a routing protocol having maximum throughput. But the energy constraints nodes in sensor networks operate on limited battery power. Routing protocol design is based on two factors (a) throughput and (b) energy. It is important to choose one of the best routing protocol which utilizes minimum energy and gives maximum throughput. In this paper, we have focused on different routing protocol and tested the energy consumption of AODV and DSDV and routing protocol. To compare the result we have used well known Network Simulator NS2 as a core simulation software.**

***Key words*- Wireless Ad-hoc Network, AODV, DSDV, NS2, Packet Delivery Ratio, Energy.**

I.INTRODUCTION

Recently, Ad-hoc wireless network is one of the emerging field in wireless communication. Because of the limitation of cellular network, it is necessary to light up the wireless ad-hoc network. Ad-hoc network has large application in the field where it is difficult to deploy central administrative system. We can say that ad-hoc networks are distributed and self organized network [1]. It is adaptive according to the network scenario. Ad-hoc device or nodes are well design to detect the other communicating device and initiates handshaking process for sharing of information. The nodes are only responsible for all communication and complete end to end process for transfer of information. Ad-hoc wireless network are infrastructure less. All the nodes, which are nodes of wireless network, are operated on limited power.

To transform information, Nodes utilizes its battery power. Amount of power used by nodes depends on routing protocol design. More the data passed through nodes more energy is used by nodes. The sensor nodes perform desired measurements, process the measured data and transmit it to neighboring nodes. Nodes in a sensor networks have restricted storage, computational and energy resources. These restrictions place a limit on type of routing protocol used. They also use intermediate nodes to support end to end communication between arbitrary nodes in the network, thus resulting in extra usage of already limited node resources [2]. For efficient routing throughput should be as high as possible. Protocol which gives maximum throughput utilizes more energy and protocol which gives utilizes less energy gives less throughput. There are so many protocols available for routing in wireless ad-hoc network. But we have focused on AODV and DSDV routing protocol. Thus in this paper, we have shown comparison of AODV and DSDV with respect to both throughput and energy consumption.

Flow of paper is as follows: in depth discussion about AODV and DSDV routing protocol is done in section II. Section III contains two ray ground propagation model for our simulation. In section IV simulation scenario is generated in ns2 environment and followed by comparison of different simulation results are shown in section V. Finally concluding remarks are done in section VI.

II AD-HOC ROUTING PROTOCOL

In general, Ad-hoc routing protocol can be categorized in two part (i) Proactive (Table Driven). (ii) Reactive(On demand Driven). Table driven routing protocol are used to maintain consistent and up to date routing information from each node to every other nodes in the network. In this routing protocol, each node maintains one or more routing tables to store routing information. If any changes occur in the network topology then that information is also updated by propagating the route updates throughout the network to maintain the consistency in the network [2].

Reactive (On Demand Driven) routing protocol are completely different than the reactive (Table Driven) routing protocol. In this type, routing creates

the routes only when desired by source. When any node requires a route to a destination to exchange information, it first initiates the route discovery process with in the network. As this process is completed, all the possible routes are axamine and route is selected based on different matrices. Once the route is established, it is maintained the destination becomes inaccessible along the established path from the source [2].

A.DESTINATION SEQUENCED DISTANCE VECTOR ROUTING (DSDV)

Destination sequenced distance vector routing belongs to proactive (Table Driven) routing protocol [5]. It is based on distributed bellman-Ford routing algorithm. The improvement in it is the avoidance of routing loops in mobile network. In this routing protocol, each node in the mobile network maintains the routing table. This routing table consist the entry of all possible destination within the network and the entry of all possible destination. To distinguish the stale routes from new ones, a sequence numbering system is used. To maintain the consistency of routing table, a periodically routing table update is sent to the each node within the mobile network.

This is but-obvious that this periodically update process generate a lot of control traffic in the network which further implies an inefficient utilization of the network. To alleviate this problem, DSDV uses two types of route update packets.(i)Full Dump packet, which are transmitted infrequently during periods of occasional movement of the nodes. (ii) Incremental Packet, which are relay only information that has changed since the last full dump [6].

B.AD-HOC ON DEMAND DISTANCE VECTOR ROUTING (AODV)

Ad-hoc on demand distance vector routing protocol is the enhancement of DSDV routing protocol. As compared to DSDV, AODV minimizes the number of required broadcast by creating routes on an on-demand basis, which is completely differ to the maintaining the routes table as in DSDV

In the AODV routing if any node has a message to send to any node and if it does not know the valid path to that desired destination then it first initiate the path discovery process to locate the other node. In the path discovery process, it broadcasts the route request (RREQ) message to its neighbors. Which then forward the request to their neighbors, and so on, until the destination or intermediate node with a valid route to destination is located. Generally, this route request carries mainly the source ID (SrcID), the destination ID (DesID), the source sequence number (SrcSeqNum), the destination sequence number (DestSeqNum), the broadcast identifier (BcastID), and the time to live (TTL) field. DestSeqNum indicates the freshness of the route. On the reception of RREQ packet, if the intermediate node has a valid path to destination then initiates the route reply message to source node otherwise it forwards that RREQ packet to its neighbor nodes. Generally the multiple time reception of RREQ message at a single node is indicated by the BcastID and SrcID pair. In that case the duplicate copies are discarded. While forwarding a RREQ message to neighboring node every intermediate node enters the previous node ID and its broadcast ID [5].

III. TWO RAY GROUND PROPAGATION MODEL

In a wireless communication, a single line-of-sight path between two mobile node is seldom the only means of propagation, hence in most of cases, free space model becomes inaccurate when it is used alone [10]. In the two-ray ground reflection model, mainly two different paths exist: (i) Direct line-of sight path. (ii) Ground reflection path. Because of two ray ground reflection model provides the more accurate prediction for the large scale single strength over a long distance than the free space model, we have employed this propagation model in our simulation for packet transmission from one node to a another node.

For the free space propagation model, the received power at distance d is predicted by [10][11],

$$P_r(\mathrm{d}) = \frac{\mathrm{P_t G_t G_r \lambda^2}}{(4\pi)^2 d^2 L}$$

For the two ray propagation model, the received power at distance d is predicted by [9],

$$P_r(\mathrm{d}) = \frac{\mathrm{P_t G_t G_r h_t^{\,2} h_r^{\,2}}}{d^4 L}$$

Where, ht = transmitter antenna height.
hr = receiver antenna height.
Gt = transmitter antenna gain.
Gr = receiver antenna gain.
Pt = transmitted power.
Pr = received power.
d = distance between two node.
L = system loss. (Fixed at L=1 in NS2)

From equation 1, it is clear that as compared to free space propagation model, in two ray ground reflection model the power loss become faster as the distance increases. Also, the two ray ground reflection model does not give good result for short distance due to the oscillation caused by the constructive and destructive combination of two rays. Whereas free space model still provide good result when the distance d is small. Due to this

reason, calculation of crossover distance dc becomes necessary in two ray ground reflection model. Cross over distance dc can be calculated by [10],

$$P_r(\mathrm{d}) = \frac{4\pi \mathrm{h_t h_r}}{\lambda}$$

For the case when the d < dc, equation 1 is used for the calculation of received power. Whereas, when d > dc, equation 2 is used for calculating received power [10].

IV. SIMULATION IN NS2

To obtain a satisfactory result for comparison of different Ad-hoc routing protocols, we have used well known network simulator NS2 with program version 2.35 in linux platform. NS2 is the open source software and provides a good support to research scholars in networking field. One of the most important benefits of this software is that one can implement his/her own topology or one can check the performance of different routing protocols for different scenarios easily in NS2. It is one of the best programs in terms of implementing new topologies and new routing protocols. NS2 has been written in the two languages [12][13]: Object Oriented variant of Tool Command Language (OTCL) and Object Oriented Language C++.

To examine the impact of mobility over performance of DSDV and AODV routing protocol in wireless network, we have run the simulation for four different velocities of nodes. The complete simulation strategy is explained below.

A.SIMULATION SCENARIO

To compare a different routing protocol, we have generated 20 mobile sensor nodes in 500m × 500m area under NS2 environment. All nodes are having different velocities. For the simplicity we have assign the starting position of source and destination at (0, 0) and (500, 500) respectively. Also each node assigned with 100 watts of power. In the very first simulation analysis, we have assigned 0 m/s velocity to all nodes and compared energy consumption and packet delivery factor of AODV and DSDV routing protocol. We have used this result as a reference to next two simulation analysis. In the second analysis, we have assigned velocity of 5 m/s to all nodes and calculated the performance parameter. In the third simulation analysis, we have assigned the 10 m/s motion speed to all nodes to calculate the performance parameters. The complete simulation set up information is given in TABLE – 1.

TABLE – 1 simulation setup information.

PARAMETER	VALUES
Channel type	Wireless channel
Radio Propagation Model	Two ray ground
Network interface type	Wireless physical channel
MAC type	802.11
Interface queue type	DropTail/Priority Queue
Simulation area	500m × 500m
Total no of nodes	20
Initial position of source node	(0,0)
Initial position of sink node	(500,500)
Power Assigned	100watts
Velocity of nodes	0,5,10 m/sec
Simulation duration	100 sec

V. RESULT ANALYSIS

A. energy comparison of source node for AODV routing protocol

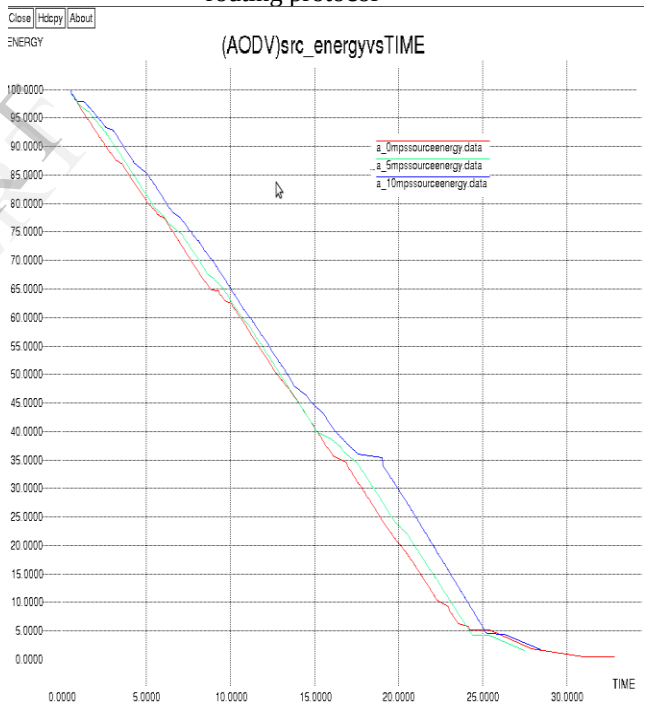

Figure.1. Energy Vs Time plot for AODV routing protocol with respect to source.

figure.1 represents energy vs time plot for AODV routing protocol with respect to source. From the graph we can observe that data transmission occurs only during 30 to 35 seconds out of 100 seconds simulation period, because all the energy given to the node is utilized within 35 seconds. Also moving node discharges quickly compare to fix node.

B. Energy comparison of source node for DSDV routing protocol.

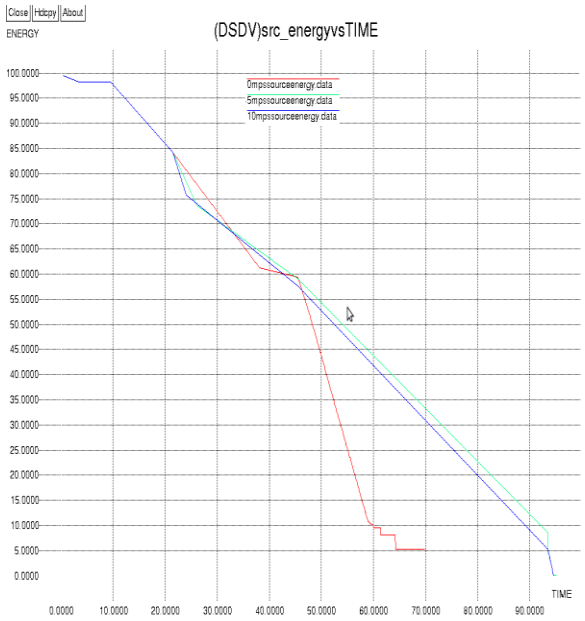

Figure.2 Energy Vs Time plot for DSDV routing protocol with respect to source.

Figure.2 represents energy vs time plot for DSDV routing protocol with respect to source. From the graph we can observe that for the fix node data transmission occurs up to 75 and for the moving node data transmission occurs up to 95 seconds from 100 seconds simulation period. Here, fix node discharges quickly compare to moving node. Also after 45 seconds fix node discharges suddenly, because all update process completes earlier compare to moving node and hence data transmission starts rapidly in fix node.

C. Energy comparison of destination node for AODV routing protocol.

Figure.3 represents energy vs time plot for AODV routing protocol with respect to destination. From the graph it can be observe that data transmission is done up to 25 seconds out of 100 seconds simulation period. Energy utilization is quite similar for both moving node as well as fix node. As we know that AODV is on demand routing protocol, it generates data traffic within zero time and hence simulation starts from 0 second.

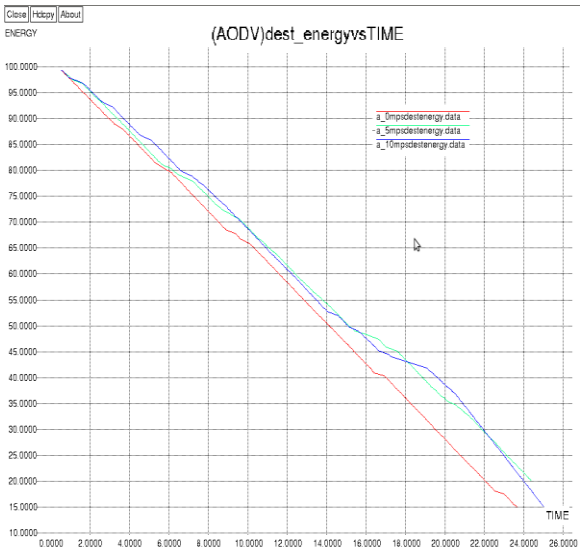

Figure.3 Energy Vs Time plot for AODV routing protocol with respect to destination.

D. Energy comparison of destination node for DSDV routing protocol

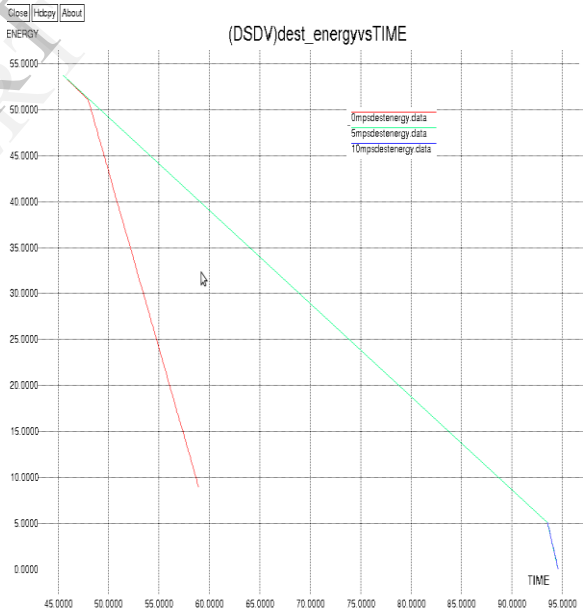

Figure.3 Energy Vs Time plot for DSDV routing protocol with respect to destination.

Figure.3 represents energy vs time plot for DSDV routing protocol with respect to destination. Two different end times we can see form graph, 58 seconds for fix node and 84 seconds for moving node. Also starting energy of node is around 54 watts. Rest of energy is lost during table update process.

E. Comparison of packet delivery ratio for AODV and DSDV routing protocol.

1) Packet Delivery Ratio of AODV routing protocol.

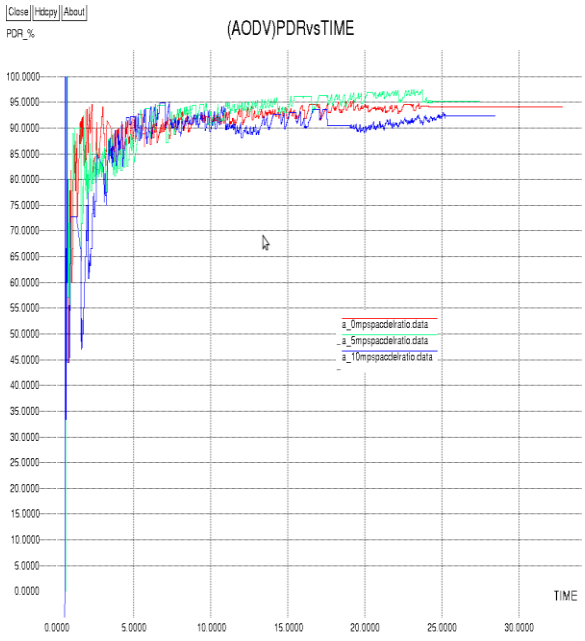

Figure.5 Packet Delivery Ratio Vs Time plot for AODV routing protocol.

Figure.5 represents packet delivery ratio vs time plot for AODV routing protocol. Data transmission stars at 0 second. Packet delivery ratio is almost 92%. Graph is more consistent for fix node compare to moving node. Actual traffic transmission occurs up to 25 second for mobile node and 35 second for fix node. Remaining time node can node send or receive traffic because all energy is utilized.

2) Packet Delivery Ratio of DSDV routing protocol.

Figure.6 represents packet delivery ratio vs time plot for DSDV routing protocol. Packet delivery ratio is different for fix as well as moving node. Data transmission starts at 48 second and 95 second for fix node and moving node respectively. Time span of packet transmission is very less. Most of energy is used for table update but not for traffic transmission.

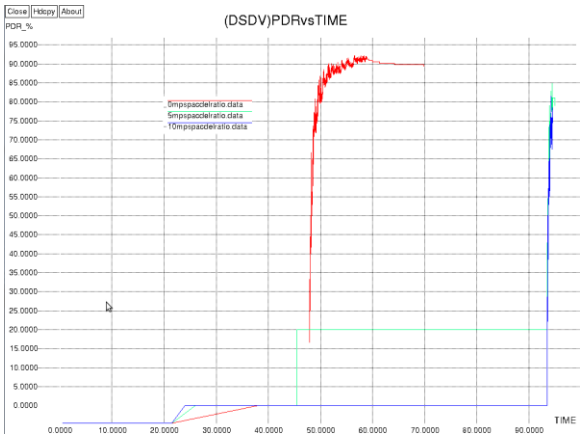

Figure.5 Packet Delivery Ratio Vs Time plot for AODV routing protocol.

V. CONCLUDING REMARKS.

After analyzing all simulation result we can conclude that, DSDV takes more energy to update its table and AODV utilizes its energy for traffic transmission. More than 50% energy is used in update process in DSDV routing protocol, hence packet delivery ratio is quite less compare to AODV routing protocol.

DSDV routing protocol is table driven protocol, so as mobility of nodes increases table update process becomes more frequent and hence more energy is needed for longevity of node. AODV routing protocol is on demand protocol, mobility of node does not affect much on routing in AODV routing protocol and hence longevity of node is good compare to DSDV routing protocol.

Overall AODV is more energy efficient compare to DSDV, but still both the above protocol can't be used directly for mobile as well as fix nodes. Some modification is required for more efficient routing based on our scenario.

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