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Throughput Based Analysis of DSR Routing Protocol in MANET

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Abstract: *Mobile Ad hoc Networks (MANET) are wireless networks consisting of a collection of mobile nodes with no fixed infrastructure. Due to their decentralized, self-configuring and dynamic nature, MANETs offer many advantages and are easy to install. In the recent years, a lot of researches are going on in the area of Mobile Ad hoc Networks (MANETs). This network is an infrastructure -less network where nodes communicate with each other without any aid of centralized administration. In this paper, we are analyzing Throughput of DSR routing protocol.*

Keywords: *MANET, DSR,Throughput*

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I. Introduction

Recently, MANET has been more attractive in the research area. However, MANET is a temporary dynamic wireless network in which mobile nodes can move arbitrarily. Moreover, MANET is a self-organized network without centralized control. In such control, the nodes are freely and randomly moving. Therefore, it causes a change in the network topology and the event cannot be predictable. Each node in the network can act as both a host as well as a router [1]. Mobile Ad-hoc networking is an emerging technology that allows each node can connect by wireless communication links, without any base station [6]. The field of wireless communication is becoming more popular than ever before due to the rapid advancement of wireless technologies and the widespread of mobile devices. After a natural disaster,such as a fire, flood, or earthquake. Mobile Ad hoc Networks (MANET) are among the limited available options for wireless networks since such a network can be easily configured in a short period of time without the need for a fixed infrastructure network [2].

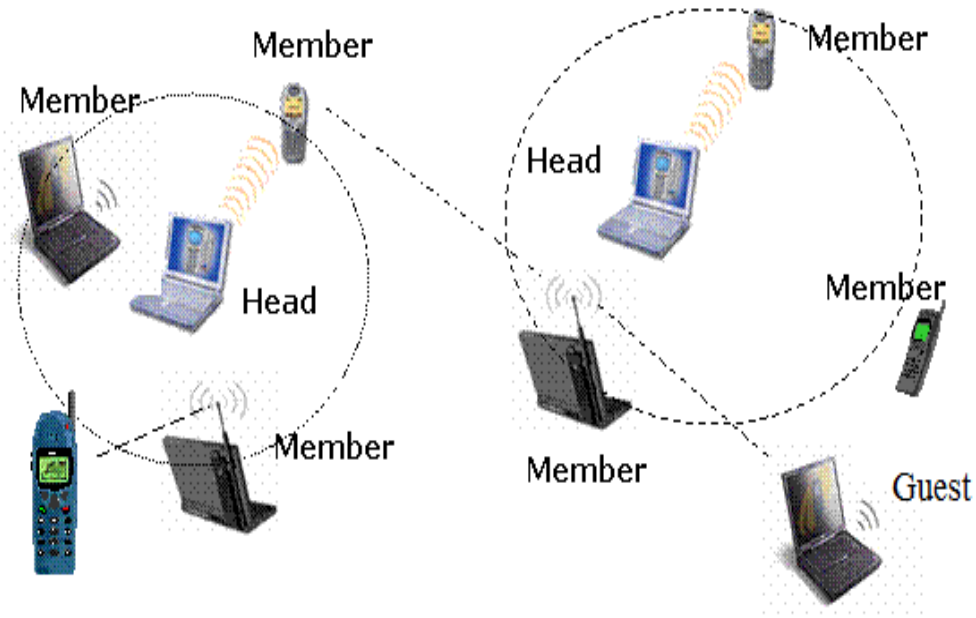

Fig1.A MANET Architecture

An Ad-hoc network is a decentralized type of Network. Decentralized means it doesn't rely on pre-existing infrastructure, each and every node in the network participate in forwarding data for other nodes. Each

node in a mobile Ad-hoc network is free to move independently and therefore will change its links to other devices frequently.The initial challenge in building a MANET is equipping each device to continuously maintain the information required to properly route the traffic. MANET can be connected to the larger Internet. There are thousands of nodes, how to get them connected from source to destination is seen by IP address.Each node maintains a routing table that contains the information about the destination node. DSR is routing protocol which provides the route to the destination node. We are using LEACH algorithm to determine the energy, cluster head, no of active nodes and dead nodes. After that, we can calculate the throughput of MANET network with the help of DSR protocol. The current paper intends to evaluate the DSR routing protocol while considering Throughput of Mobile Ad-Hoc Network.

II. MANET

Mobile Ad hoc Network (MANET) simply stated, is a collection of mobile nodes, with no necessary support from existing infrastructure of existing network or any other kind of fixed stations. A formal statement can be made defining an ad hoc network with a stand-alone or autonomous and infrastructure-less system of mobile hosts or routers wireless connection, collectively forming an arbitrary graph-like communication network. Communication between two mobile nodes in a cellular network model supporting wireless communications by base stations as access points rely completely on the fixed base stations and wired backbone. However, such infrastructures don't exist in a mobile ad hoc and might involve an unpredictable and dynamic change in network topology because nodes can move arbitrarily and freely.Basically, MANETs are multi-hop peer-to-peer mobile networks of wirelessly connected nodes where transmission of information packets takeplace in a keep and the forward way through intermediate nodes from a source to a destined node. As nodes start moving, topology change in the network that is incurred should be made aware of other nodes so that the out of date topology information of the network can be improved or removed.

2.1 Routing Protocols In MANET

A. Proactive Routing Protocols

In proactive routing protocol every node continuously maintains complete routing information of the network through the table. For this reason, the proactive routing protocol is also known as the Table-Driven routing protocol. In this, every node keeps up the network topology data as tables. These tables are periodically exchanged data for the current view of data or updating of data. Link State Routing protocol and Distance Vector Routing Protocols are not suitable for Mobile Network environment. DSDV, WAR, OLSR are the Proactive routing protocols in which DSDV eliminate count to infinity and looping problems of Distance Vector Routing Protocol [12].
Eg. OLSR, DSDV

(i)OLSR

Optimized Link State Routing (OLSR) Protocol is a table driven protocol and an optimization of classical link state protocol. OLSR routing protocol is isolated into three fundamental modules that are-neighbor detecting, advanced flooding, Link state informing and route count. In neighbor/connect detecting the connections and neighbors are distinguished by hello messages. Every one of the nodes transmits hello messages at a consistent interim. The upgraded flooding and multipoint handing-off are utilized to decrease the quantity of copy retransmission while sending a broadcast packet. In Link state informing all nodes surges the system with Link state data [11].

(ii)DSDV

Destination Sequence Distance Vector Routing (DSDV) Protocol is a hop-by-hop distance vector routing protocol. It is a proactive protocol in which each network node keeps up a directing table that contains the separation of next-node and the quantity of jumps to every reachable destination. A periodical broadcast of routing updates keeps the routing table completely updated at all times. To keep up the consistency of directing tables in an evolving topology, each station intermittently transmits refreshes, quickly when critical new data is accessible. DSDV uses a concept of sequence numbers to indicate the freshness of a route [3]. DSDV is inherited from the conventional Routing Information Protocol (RIP) to ad hoc network routing [8]. It adds a new attribute, sequence number, to each route table entry of the conventional RIP [13]. Using the newly added sequence number, the mobile nodes can distinguish old route information from the new one and thus prevent the formation of routing loops [1].

B. Reactive Routing Protocols–

Each node in this routing protocol keeps up data of just active routes to the destination node. A route scan is required for each new destination in this way the correspondence overhead is decreased at the expense of delay to search the route. Quickly changing wireless network topology may break active route and cause consequent route scan. Reactive Routing protocol based on demand so Reactive routing protocol also called the On-demand routing protocol [13]. In this routing protocol route is established based on Demand. AODV and DSR are the Reactive routing protocols [14].

Eg. AODV, DSR

(i)AODV

Ad-hoc On-Demand Distance Vector Routing (AODV) Protocol is a protocol which comes under the category of a reactive unicast routing protocol. It is a descendant of Destination Sequenced Distance Vector Protocol (DSDV) [9]. Ad-hoc On-demand Distance Vector Routing Protocol On request or Reactive routing protocols were intended to beat the overhead that was made by proactive routing protocol in the event of an expansive and exceptionally dynamic network. AODV depends on Bellman-Ford Distance algorithm [15]. It is on-request routing protocol. In this routing protocol, the route is finding from source to destination just on request premise. AODV has guided full routing protocol implies trading of hello message to make the association with the neighbors. AODV have the different stages of route discovery stage, route maintenance stage, route table management, and local connectivity management.

(ii)DSR

The Dynamic Source Routing (DSR) Protocol is a reactive unicast routing protocol that utilizes source routing algorithm. DSR allows the network to be completely self-organizing and self-configuring, without the need for any existing network infrastructure or administration [5]. Dynamic Source Routing is an on-demand routing protocol based on the concept of source routing where each routed packet carries in its header a complete and ordered list of nodes through which packet traverses[4]. In DSR, each node uses cache technology to maintain route information of all the nodes.

There are two major phases in DSR such as:

1. Route discovery
2. Route maintenance

When a source node wants to send a packet, it first consults its route cache [7]. If the required route is available, the source node sends the packet along the path. Otherwise, the source node initiates a route discovery process by broadcasting route request packets. Receiving a route request packet, a node checks its route cache. If the node doesn't have routing information to the requested destination, it appends its own address to the route record field of the route request packet. Then, the request packet is forwarded to its neighbors. If the route request packet reaches the destination or an intermediate node has to route information to the destination, a route reply packet is generated. When the route reply packet is generated by the destination, it comprises addresses of nodes that have been traversed by the route request packet. Otherwise, the route reply packet comprises the addresses of nodes the route request packet has traversed concatenated with the route in the intermediate node's route cache. Whenever the data link layer detects a link disconnection, a ROUTE_ERROR packet is sent backward to the source in order to maintain the route information. After receiving the ROUTE_ERROR packet, the source node initiates another route discovery operation. Additionally, all routes containing the broken link should be removed from the route caches of the immediate nodes when the ROUTE_ERROR packet is transmitted to the source. The advantage of this protocol is the reduction of route discovery control overheads with the use of route cache and the disadvantage is the increasing size of packet header with route length due to source routing.

III. Algorithm

We are using LEACH algorithm to determine the probability of a node to become cluster head.

$$T(n) = \frac{p}{1 - p \times (r \bmod p^{-1})} \qquad \forall n \in G$$

$$T(n) = 0 \qquad \forall n \notin G$$

Where n is a random number between 0 &1.

P is the cluster-head probability and G is the set of nodes that weren't cluster-heads the previous rounds.

If n <T (n) then that node becomes a cluster head, then T (n) = Threshold

For determining cluster head, we have to calculate the residual energy of each node in a cluster, the node whose residual energy is maximum , becomes cluster head.

$$T(n)_{new} = \frac{p \qquad E_{n\_current}}{1 - p \times (r \bmod p^{-1}) \;\; E_{n\_\max}}$$

Where$E_{n_current}$is the current amount of energy and E_{n_max} is the initial amount energy

$$T(n)_{new} = \frac{p}{1 - p \times (r \bmod p^{-1})} \left[\frac{E_{n\_current}}{E_{n\_\max}} + \left(r_s div P^{-1} \right) \left(1 - \frac{E_{n\_current}}{E_{n\_max)}} \right) \right]$$

Throughput (TP) can be defined as the total number of packets delivered tothe destination nodes per the total time that is required to complete the inventory or task. It illustrates the level of delivery to the destination nodes [10].

TH = I / T

TH is the throughput that we are determining or the average output of something over a given amount of time. The time is most commonly illustrated per second, minute, hour, or day.

*I*is the inventory or number of data received that is used over a period of time. .

T is the total time that is required to complete the inventory or task.

IV. Simulation And Results

4.1 Simulation

We are performing simulation of DSR routing protocol with the help of MATLAB simulation tool. The implementation of routing protocols such as OLSR, DSDV, AODV, and DSR can be done in MATLAB. The simulation scripts (.m files) are developed using the MATLAB simulation tool.

Table 1. Simulation Parameters for DSR Protocol

PARAMETERS	VALUES
Simulation Tool	MATLAB R2014a(32bit)
MAC type	802.11
Number of Nodes	100
Number of cluster heads	10
Simulation Area	100 x 100 m^2
Number of connections	2
Simulation time	100s
Pause Time	0s

4.2 Results

The simulation results are focused to analyze the performance of DSR routing protocol based on throughput. The results are calculated for DSR protocol on the basis of random waypoint mobility model.

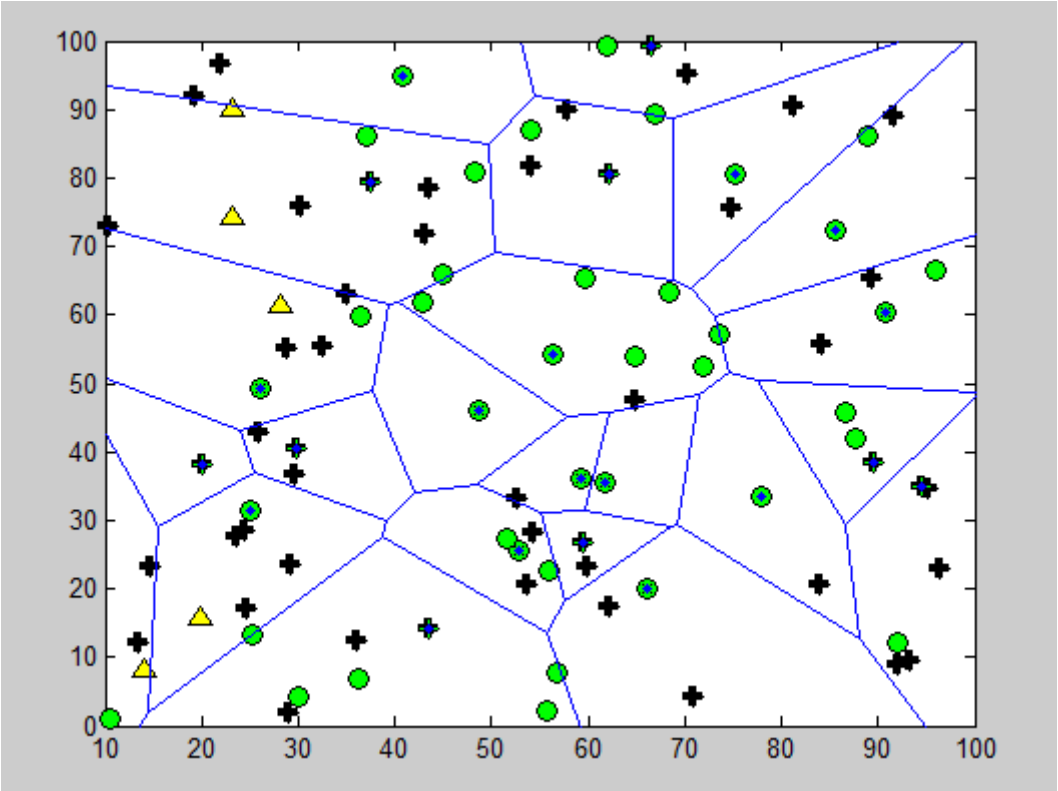

Fig. 2. The representation of a mobile ad hoc network

In starting all the nodes were alive, there was no dead node and packets were being transmitted easily,as the no of iterations increased from 1218 some nodes started becoming idle(dead).When all the packets transmitted (in 3215 iterations), the system became idle. At that time all the nodes became idle. (Fig. 3& Fig. 4)

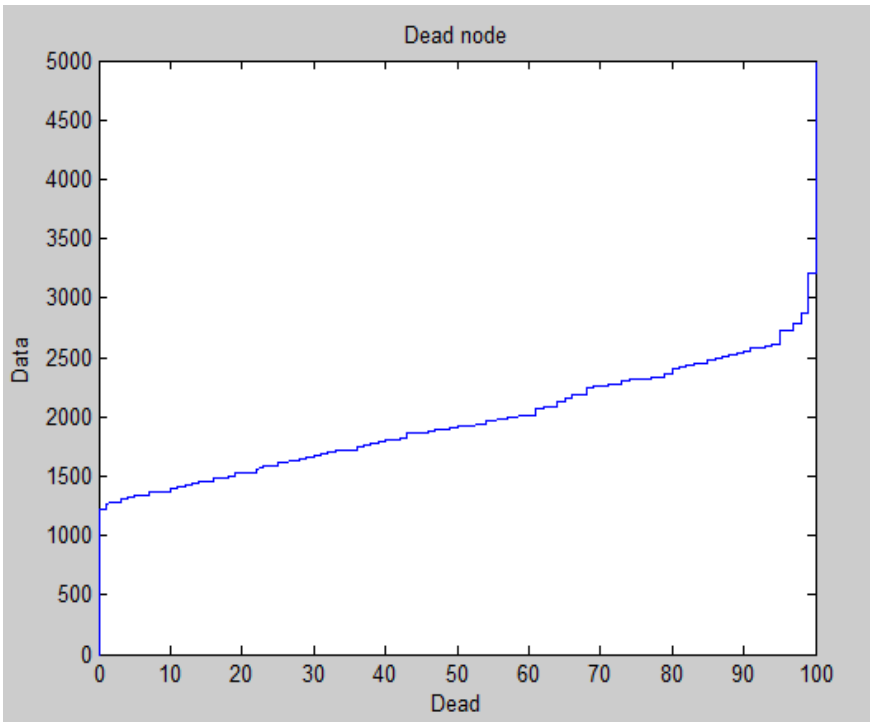

Fig. 3. Dead Nodes Representation

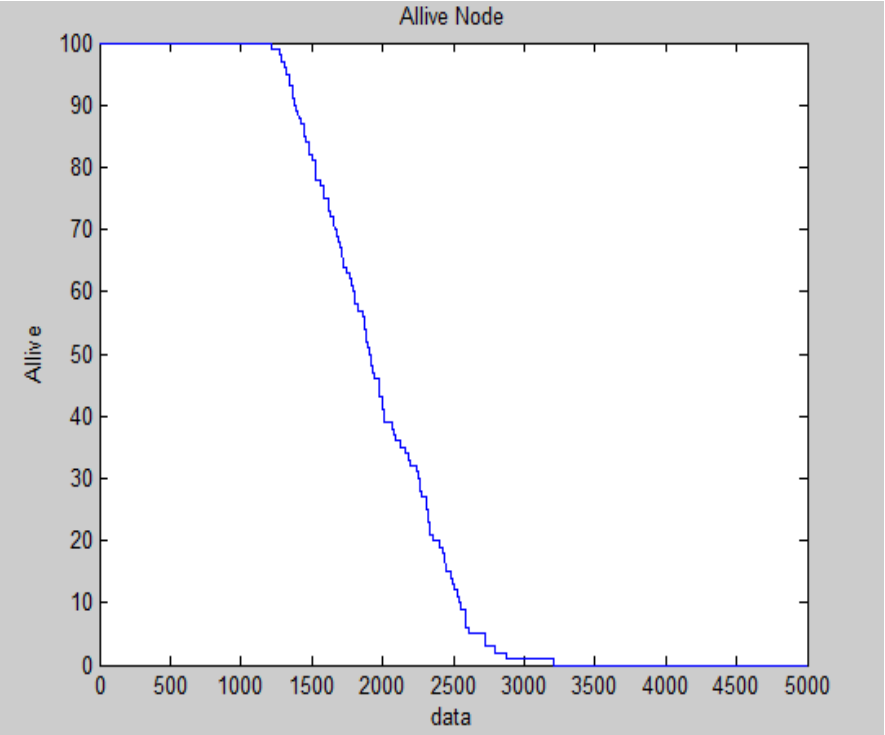

Fig. 4. Alive Nodes Representation

The packets delivered rapidly in a linear way but When all the packets (65765) delivered, there were no packets for transmission, so system became idle.(Fig. 4)

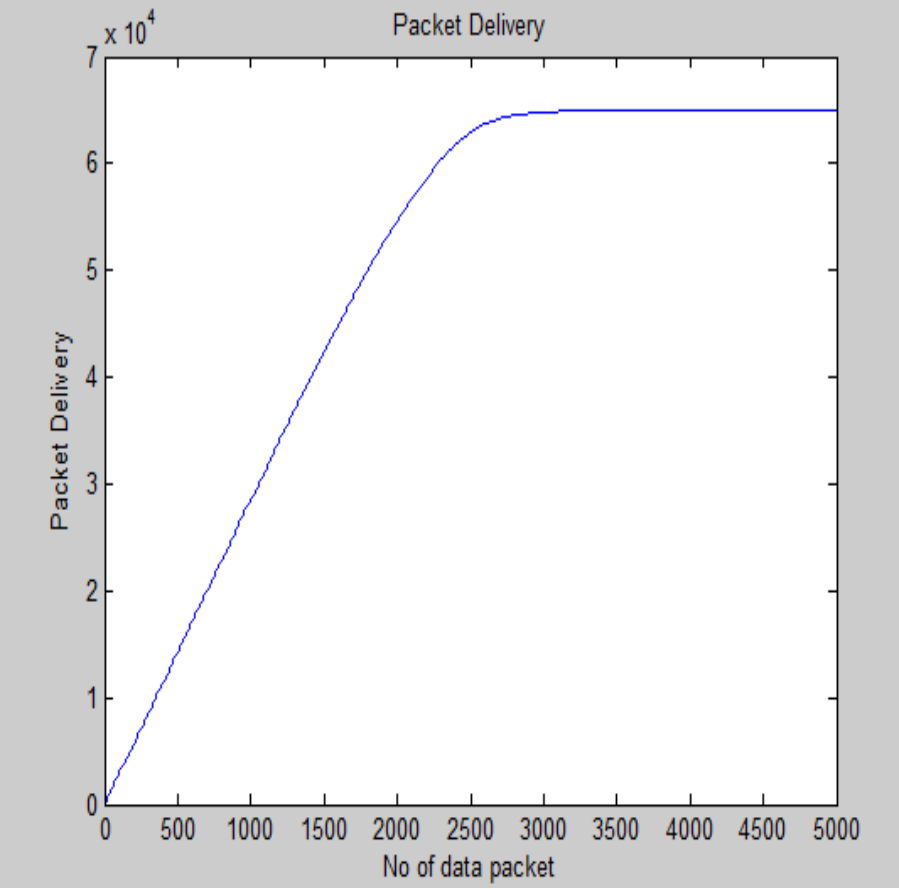

Fig. 5. Packet Delivery Ratio

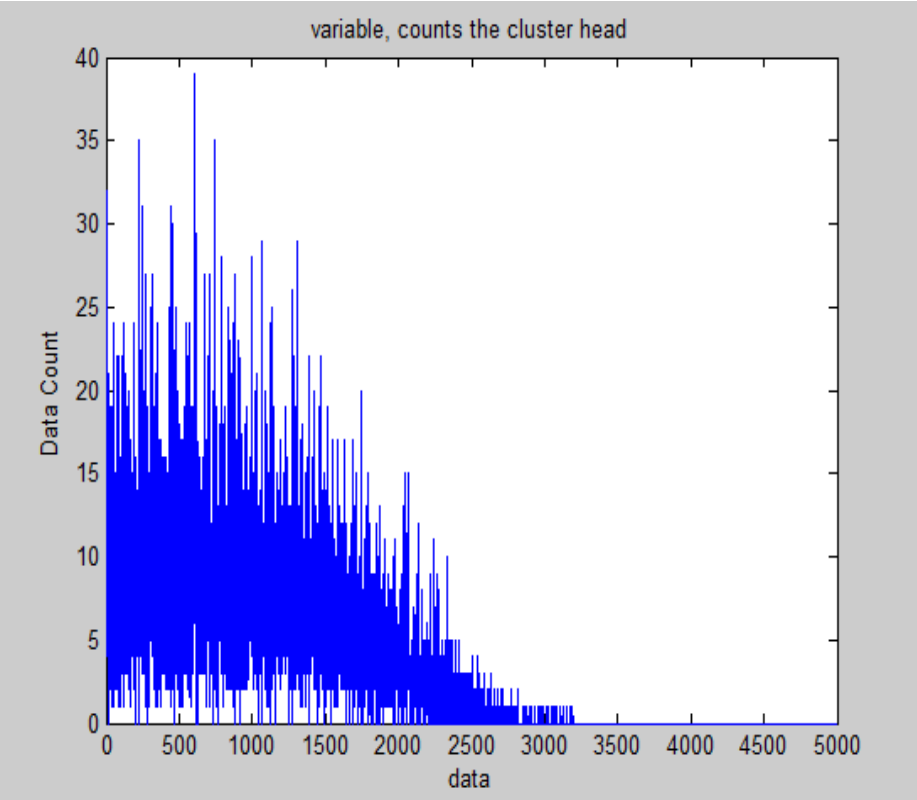

Fig. 6. Throughput

Table 2 shows the results obtained under different simulations performed for DSR protocol.

Table 2. Throughput Calculation

No. of Iterations	% of Alive Nodes	%of DeadNodes	Packet Delivery Ratio	Throughput
Till 1218	100	0	34659	793.18
1500	80.46	19.54	41267	687.78
2000	41.24	58.76	54954	785.05
2500	13.32	86.68	62543	781.78
3000	1.11	98.89	64321	714.67
After 3215	0	100	65765	657.65

V. Conclusion

In this paper, we evaluated the DSR routing algorithm used in MANET on the basis of Throughput, a QoSparameter.Wecan conclude that the DSR protocol dominates all other protocols like OLSR, AODV and DSDV. The positive aspect of DSR was that average energy consumption was quite low in contrast to OLSR, AODV, and DSDV.

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