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Energy Based Evaluation of Routing Protocol for MANETs

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***Abstract*—**A Mobile ad hoc network is a collection of mobile nodes connected through wireless links forming an temporary network without fixed topology, centralized access point, infrastructure. In such a network, each node can act as a router and host simultaneously, it can move out or join in the network freely as required. Various routing protocols have been discussed so far in this paper a brief comparison of two reactive protocols DSR and AODV along with proactive protocol DSDV will be done. Detail study of the network performance such as throughput, packet delivery ratio, energy consumption. The simulations are carried out using NS-2 simulator. The results presented specify the importance in careful evaluation and implementation of routing protocols in an ad hoc environment.**

Keywords- MANETs, Ad -Hoc Network, Energy consumptions, Analysis, AODV, DSR, DSDV

I. INTRODUCTION

A wireless network is a growing technology which allows users to access information electronically, irrespective of their geographic position. Energy based evaluation of Mobile ad-hoc networks is important as it allows determining the different types of applications that can be supported on such networks. In this work, attempt has been made to energy based evaluation of two prominent on demand reactive routing protocols AODV, DSR along with one proactive routing protocol DSDV for MANETs. DSR and AODV is a reactive gateway discovery algorithm where a mobile device of MANET connects by gateway only when it is needed. Evaluation variation can occur due to the differences in the protocol mechanism for DSR and AODV protocols. Effect of the link distance is investigated, specifically the geographic distance for a hop, on the throughput of the network. This work is a comprehensive simulation study on the influence of a number of nodes and fixed Simulation time on Manet's network. It can be also useful for guidelines for future protocol design and algorithm design. AODV performed better for parameters delivery ratio and energy consumption and throughputs while DSR performed better in less numbers of nodes and DSDV performed well providing a loop free path and removed the problem of count to infinity. Though DSR and AODV share similar on-demand behaviour as compared to DSDV, the differences in protocol mechanisms can cause difference in the performance.

II. MANETS

A Mobile Ad-hoc Network (MANET) is a temporary wireless network which consists of mobile nodes and does not require any base infrastructure. MANETS have the advantage of rapid deployment, low cost, flexibility, inherent support and robustness for mobility. With such features MANETS can find its applications in areas like military, Search and rescue, Vehicle-to-vehicle communication in intelligent transportation, temporary networks, Personal Area Networks. Ad hoc networks require no centralized administration or fixed network infrastructure such as base stations or access points, and can be quickly and inexpensively set up as needed.

The properties that are desirable in Ad-Hoc Routing protocols are as follows:

a) The protocol should be distributed and should not be dependent on a centralized controlling node.
b) Routes provided by routing protocol must be loop free as this will improve the overall performance,
c) avoidwastage of bandwidth and consumption of CPU.
d) Must have unidirectional link support.
e) For demand based operation the protocol must be reactive.
f) Power conservation.
g) Multiple routes can be used to reduce congestion.
h) Security.

III. ROUTING PROTOCOL

Numerous protocols have been developed for ad hoc mobile networks to deal with the typical limitations of these networks, which include high power consumption, low bandwidth, and high error rates. The reactive and proactive protocols described in this paper may be used as reference protocols when a new protocol evaluation has to be done. The routing protocol can be categorized as:

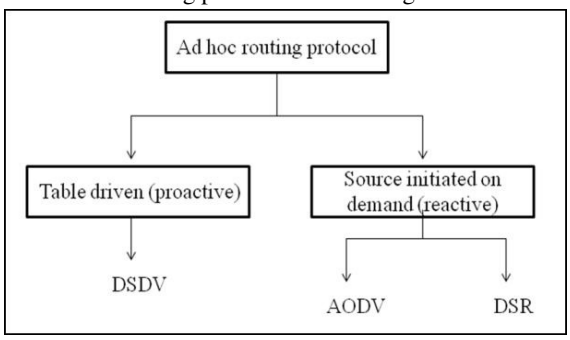

Fig 1: Routing Protocol Classification

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A.DSR

DSR [5][8][11] is a reactive source routing protocol designed for ad hoc networks up to two hundred mobile nodes. Unlike other unicast routing protocols, DSR does not maintain the routing table, because it utilizes the source routing option in data packets. It uses Route Cache instead, which store the complete list of IP addresses of the nodes along the path towards the destination. So as long as there is a route to the sink present in the cache, there is no need to perform route discovery, but if there is no route to the sink in the cache a route discovery has to be performed by broadcasting a route request message. When the route request reaches the desired target a route reply is returned to the source. If the links are bi-directional then the reply is sent back over the same route where the request travelled, otherwise it is returned via a route cached in the destination. When a used link is broken a route error message is sent back to the source and the path is invalidated.

B. AODV

The AODV [6, 7,9] [10-11] routing protocol is based on DSDV and DSR algorithm. It uses the periodic beaconing and sequence numbering procedure of DSDV and a similar route discovery procedure as in DSR. However, there are two major differences between DSR and AODV. The most distinguishing difference is that in DSR each packet carries full routing information, whereas in AODV the packets carry the destination address. This means that AODV has potentially less routing overheads than DSR. The other difference is that the route replies in DSR carry the address of every node along the route, whereas in AODV the route replies only carry the destination IP address and the sequence number.

The advantage of AODV is that it is adaptable to highly dynamic networks. However, node may experience large delays during route construction, and link failure may initiate another route discovery, which introduces extra delays and consumes more bandwidth as the size of the network increases.

C. DSDV

The DSDV algorithm [1-4] [11-14] is a modification of DBF which guarantees loop free routes. It provides a single path to a destination, which is selected using the distance vector shortest path routing algorithm. In order to reduce the amount of overhead transmitted through the network, two types of update packets are used. These are referred to as a ‘‘full dump’’ and ‘‘incremental’’ packets. The full dump packet carries all the available routing information and the incremental packet carries only the information changed since the last full dump. The incremental update messages are sent more frequently than the full dump packets. However, DSDV still introduces large amounts of overhead to the network due to the requirement of the periodic update messages. Therefore the protocol will not scale in large network since a large portion of the network bandwidth is used in the updating procedures.

Table 1: Simulation Parameters

S.NO	PARAMETERS	VALUE
1	Simulation Time	1000s
2	Numbers of Nodes	10,20,50,100,150,200
3	MAC type	MAC type 802.11
4	Radio Propagation Model	Two Ray Model
5	Routing Protocol	AODV,DSR,DSDV
6	Antenna Model	Omni-directional
7	Traffic type	CBR

IV. EVALUATION OF ROUTING PROTOCOL AND SIMULATION RESULT

A. Energy Consumption vs. Number of nodes

Energy consumption of these three routing protocols for MANETs. Here the simulation time is used as one of the parameter for simulation experiments for the MANET. By varying the number of nodes, the energy consumption for each routing protocol is noted.

From the results we have observed that the DSDV protocol consumes more energy in Mobiles ad hoc networks compare to DSR and AODV routing protocols. But as the number of nodes increases the energy consumption increases for all of the three protocols .We have also find out that DSR consumes more energy when compared to AODV routing protocol. Energy consumption for AODVis 1.33 times that of DSRand 1.59 times that of DSDV for simulation time of 1000sec.

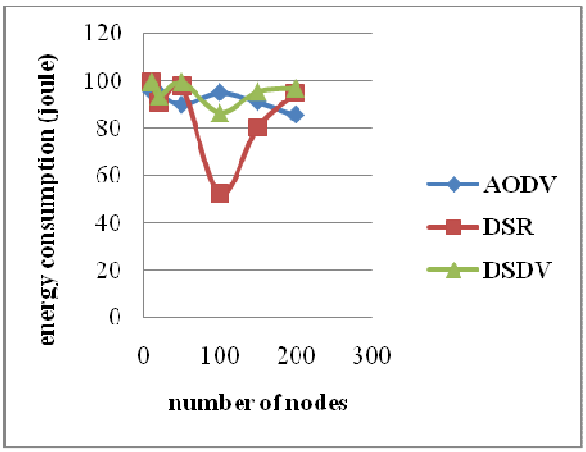

Fig 2: Energy consumption vs. no. of nodes

B. Throughput vs. Number of nodes

Throughput represents the number of packets received by the destination within a given time Interval. It is a measure of effectiveness of a routing protocol. From fig 3: it is observed that in low network size, all protocols give highest throughput; while throughput for DSDV is of smaller value. As the network size increases, throughput for AODV becomes highest among the three protocols, while the performance of DSR decreases and network size

increases. DSDV gives poor performance in low network size and gives best performance in high network size. Overall when comparing the routing throughput for each of the protocols, AODV has the highest throughput and DSR has the lowest throughput. From results it is clear that for 200 nodes AODV shows throughput which is 1.89 times than that of DSR and 1.05 times than that of DSDV. Hence, AODV shows better throughput performance with respect to throughput among these three protocols.

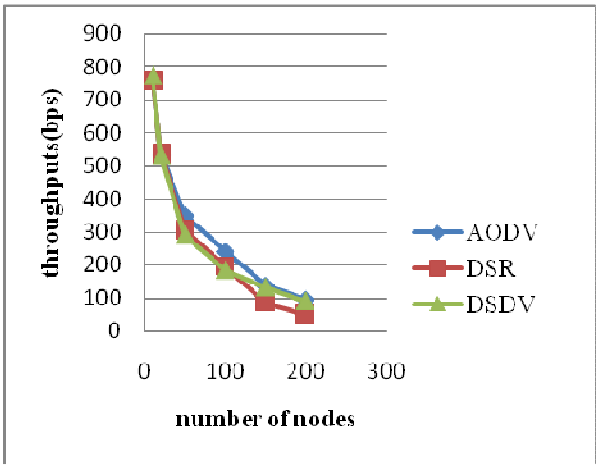

Fig 3:Throughput's vs. no. of nodes

C.PDR vs. Number of nodes

Packet Delivery Ratio is obtained by the ratio of number of packet transmitted by source node to number of packet received by receiving node in the presence of traffic node environment. Fig 4: depict that the PDR values of DSR and AODV are higher than DSDV for less numbers of node in the network but as the number of nodes increase in the network which is shown in fig.4, the PDR value of DSR is degrades. It is analysed from simulation results that for 200 nodes, PDR of AODV is 1.38 times higher than DSR and PDR of DSDV is 1.03 times higher than DSR. From the above study, in view of packet delivery ratio, reliability of DSDV and AODV protocols is greater than DSR protocol.

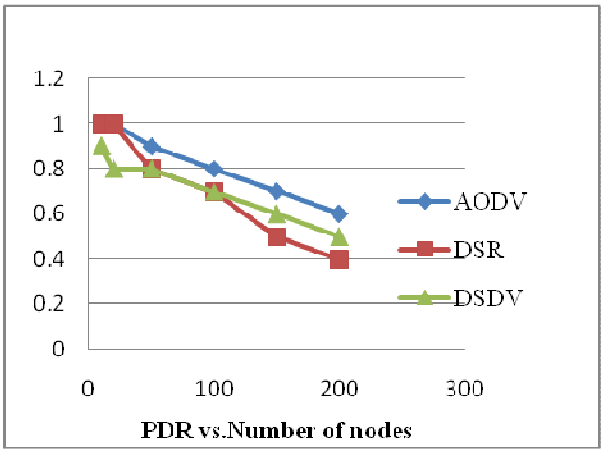

Fig 4: PDR vs. no. of nodes

V. CONCLUSIONS

It is however necessary to have some sort of feedback from the link-layer protocol like IEEE MAC 802.11 when links go up and down or for neighbour discovery. To only be dependent on periodic messages at the IP-level will result in a very high degree of packet losses even when mobility increases a little. The simulations have also shown that more conventional types of protocols like DSR have a drastic decrease in performance when number of node increases and are therefore not suitable for mobile ad-hoc networks. AODV and DSDV have overall exhibited a good performance also when number of node is high. A combination of AODV and DSR could therefore be a solution with even better performance than AODV and DSR. Another key aspect when evaluating these protocols is to test them in realistic scenarios. We have tested them in three types of scenarios. AODV had the best performance, but the large byte overhead caused by the source route in each packet makes DSDV a good alternate candidate. It has almost as good performance.

VI. FUTURE WORK

This paper gives the analytical study of change in network performance with varying number nodes and fixed simulation time for PDR, Throughput and Energy consumption. It can be observed from obtained results that overall AODV protocol outperforms DSR and DSDV protocol for chosen scenario specifications. In future we wish to study the effect of different path loss and propagation models on the performance of MANETs.

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