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Comparing the Performance of Proactive and Reactive Routing Protocol in Mobile Ad-Hoc Network

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***Abstract*—Mobile Ad-Hoc network is infastructureless network where nodes are move randomly from one position to another. Routing protocol plays important role in Mobile Ad-Hoc Network. Number of different routing protocols have been proposed amongst them is DSR(Dynamic Source Routing) routing protocol and DSDV(Destination Sequence Distance Vector) routing protocol. In this paper we compare the performance of DSR and DSDV protocol using different network conditions as pause time, time interval using different parameters as end-to-end Delay, Packet delivery fraction, Throughput etc. using Network Simulator (NS2). By analyzing the performance we proposed that DSR protocol outperforms well as compare to DSDV.**

Mobile Ad-Hoc Network, Routing Protocol Dynamic Source Routing(DSR), Destination Sequence Distance Vector(DSDV)

I. Introduction

Rapid growth in networking and technologies introduces many handy wireless devices are introduce.Todays people is modern and use cellular phones, pagers and laptop. Mobile Ad-Hoc Network (MANET) is a continuously self-configuring, infrastructure-less network of mobile devices connected without wires. Individual device in MANET is free to move in omnidirection. Hence it's link is change independently [1]. Every node sends traffic next for network use and hence it is call as router. Main purpose of MANET to route traffic is it contineously contain the information for each device. This type of network may connect to network or may operated by themselves. MANET is having differrent types of application that are arise from very small static network to larger network. It is used in military type of application, collaborative and distributed computing, emergency operation, wireless mesh network, wireless sensor network, data or information fusion and traffic distribution [2]. The way from where the data is reach to destination, need path or route and medium through which this packet send is done using routing protocol. Due to mobilty of node , bandwith constraint routing plays important role in MANET [3]. To increase performance level Quality of Service(QOS) is consider for different parameter. Rendering QOS in ad hoc network is per flow, per link, or per node basis.

Huge number of protocol have been proposed for MANET the aim is to optimizing path to reach to the destination [4-7]. Each protocol have different algorithm proposing different approach to find new path or to change existing path to the destination when node moves. Based on routing information update mechanism ad-hoc network is divided into proactive or table driven, reactive or on-demand routing protocol. By observing several papers simulation result shows that on-demand protocol perform well as compared to table driven routing protocol[8-9]. In proactive routing protocol each node keeps network topology information. Routing information is distributed in the whole network. Information is require by path then it run path finding algorithm. Reactive routing protocol when routes are required they are created hence such type of network do not exchange routing information amongest the network [10]. Number of different issues such as Quality Of Service(QOS), mobilty of node and routing in MANET is present. By comparing the two type we analyse the the protcol and try to improve the performance of protocol.

This paper organised as, section 2 describes the overview and function of DSR and DSDV routing protocol. Section 3 gives network simulation model which gives all information about simulation. Section 4 gives simulation environment in which gives all condition where the simulations run. Section 5 describes the simulation parameters as number of packets receive, number of packet drop, packet delivery ratio, throughput, end-to-end delay and energy for DSR and DSDV protocol. Section 6 describes the result based on different parameters versus pause time.

II. PROTOCOL's

A. Dynamic Source Routing

Johnson et al [11]. propose one of the most widely known routing algorithms, called Dynamic Source Routing which is an on-demand algorithm and it has route discovery and route maintenance phases. DSR protocol is design specially for multihop wireless network. It is self organizing and self healing wireless ad-hoc network wihout the need for any infastructure base network. This protocol operate on on-demand basis. Routing overhead of DSR protocol is high and scale automatically when network is change rapidly. This protocol allows more than one route and allow each route to select and control the path to reach destination for routing its packet for improve robustness and inload balancing. The DSR protocol is not operated well over very large network up to 200 nodes.

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It work well even in very high rates of mobility. It is having loop free routing, containing unidirectional link, use soft state approach and recoved from network when route is change[12].

Following is the overview of DSR routing protocol.

1) Route discovery: In route discovery mechanism route is discover. A source routing protocol must solve two challenges, in which DSR have two phases as route discovery and route maintenance. In route discovery is the mechanism where by a node S want to deliver a packet to a destination D obtains a source route to D.

To perform route discovery, the source node S broadcasts a Route request packet with a catloged source route listing only itself. Each node that hears the route demand forwards the demand if appropriate, adding its own address to the recorded source route in this copy of the request and rebroadcasts the packet. The forwarding of demand is constructed so that copies of the demand or request propagate hop-by-hop outward from the node initiating the route discovery, until either the target of the demand is found or until another node is found that can supply a route to the target.

For example, suppose a node A is attempting to discover a route to node E. The route discovery initiated by node A in this example would proceed as follows:

$$\text{“}A\text{”} - -\rangle; \text{“}A, B\text{”} - - -\rangle \text{“}A, B, C\text{”} - - -\rangle \text{“}A, B, C, D\text{”}$$

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$$\mid A \mid - -\rangle \mid B \mid - -\rangle \mid C \mid - -\rangle \mid D \mid - -\rangle \mid E \mid$$

$$+ - - - - + + - - - - + + - - - - + + - - - - + + - - - - +$$

To start the route discovery, node A transmits a route request as a single local broadcast packet, which is captured by (approximately) all nodes currently within wireless transmission range of A, including node B in existing example. Each route request find out the initiator and target of the route discovery and also contains a request ID which is unique (2, in present example), determined by the initiator of the request. Every route request also contains a catlog listing the address of each middle node through which this particular copy of the route request has been send towards next. This route record is start to an empty list by the initiator of the route discovery. In this example, the route record initially lists only node A.

2) Route Maintenance: The process whereby S is able to find out, while using a source route to D, if the network structure has changed such that it can no longer use its route to D because a hop along the route no extended works. When route maintenance indicates a source route is collapsed, S can attempt to use any other route it happens to know to D, or can appeal route discovery again to find a new route.

Data structure in DSR protocol: Dynamic Source Routing Protocol can be co-ordinated conceptually into four data structures: 1. Route Cache 2. Send Buffer 3. Node Information Cache and 4. Retransmission Buffer, DSR route request packet is encoded in Type Length Value(TLV).

All nodes in the Ad-Hoc network should send packets for other nodes in the network. Diameter of the network is designed to be the number of hops necessary for a packet to reach from node located at one extreme edge of the network to node located at the opposite extreme. The speed of the node mobility is considered to be moderate with respect to the packet. In particular, DSR can support very rapid rates of arbitrary node mobility, but here assumption is that hosts do not continuously move so rapidly as to make the flooding of every packet the only possible routing protocol.

B. Destination Sequence Distance Vector

DSDV is a table-driven routing scheme for Ad-Hoc mobile networks based on the BellmanFord algorithm. It was developed by C. Perkins et al [13]. The main benefaction of the algorithm was to solve the routing loop problem. Each entry in the routing table contains a sequence number, the sequence numbers are generally even if a link is present and else an odd number is used. The number is generated by the destination, and the emitter needs to send out the next update with this number.

In DSDV protocol every node keeps the routing table. Sequence number which is produced by destination node is used to ensure the freshness of the route and to avoid loop for selection of the route. If link is live sequence number used are even otherwise odd number is used. Routing table is used to send packet at each node. If node is failure then sequence number is updated periodically [14].

Routing information is distributed between nodes by sending full dumps infrequently and smaller incremental updates more frequently. In this routing table is updated in two ways as full dump and incremental dump. In full dump it sends whole routing tables to neighbour and could spred many packets. In incremental dump there is space between packets hence whose sequence number are change such entries are removed. The route with higher sequence number is used on the basis of shortest route criteria [15].

Additional optimizations on the handling and forwarding of route requests are also used to further reduce the route discovery overhead. When the target of the request receives the route request, it copies the recorded source route into a route reply packet which it then sends this reply back to the initiator of the route request.

III. SIMULATION MODEL

We use detail simulation model based on NS2 in our evaluation. The monarch research group at Carnegie-Mellon University developed support for simulating multihop wireless networks complete with data link,physical, and Medium Access Control (MAC) layer models on ns2 [16].

The Distributed Coordination Function (DCF) of IEEE 802.11 for wireless LANs is used as the MAC layer protocol.The 802.11 DCF uses Request-To-Send (RTS) and Clear-To-Send Routing metrics are used by router to make routing decision whether one particular path should be chosen over another. Number of different metrics is present to analyse the protocols performance over MANET. Following are some parameters used to evaluate performance of protocol [17].

Send (CTS) control packets for unicast data transmission to a neighbouring node. The RTS/CTS exchange precedes

data packet implements and transmission a form of virtual channel reservation and carrier sensing to supress the impact of the well-known hidden terminal problem. Data packet transmission is replaced by an ACK. Broadcast data packets and the RTS control packets are sent using physical carrier sensing. An unslotted carrier sense multiple access (CSMA) technique with collision avoidance (CSMA/CA) is used to transmit these packets. The radio model uses characteristics similar to a commercial radio interface, Lucents WaveLAN. WaveLAN is modelled as a shared-media radio with a nominal bit rate of 2 Mb/s and a nominal radio range of 250 m. A indepth description of the simulation environment and the models is available in [18].

IV. SIMULATION ENVIRONMENT

Following is the simulation condition in which the network is simulated.

TABLE I
SIMULATION ENVIRONMENT

Parameters	Values
Radio Models	Two Ray Ground
Protocols	DSR,DSDV
Traffic Source	TCP
Packet Size	512
Max Speed	2 m/s
Area	800x800
No. Of Nodes	30
Application	FTP
MAC	802.11
Simulation Time	300
Pause Time	10,20,30,40,50

V. PERFORMANCE METRICS

Routing metrics are used by router to make routing decision whether one particular route should be chosen over another. Number of different metrics is present to analyse the protocols performance over MANET. Following are some parameters used to evaluate performance of protocol.

- Packet Delivery Ratio: It is the ratio in which number of packets received to the number of packets send with in specified time interval.
- End-to-End Delay: In this metrics total latency experienced by a packet to traverse the network from the source to the destination. At the network layer, the end-to-end packet latency is the sum of processing delay, packet, transmission delay, queuing delay and propagation delay. The end-to-end delay of a path is the sum of the node delay at each nod plus the link delay at each link on the path.
- Throughput: This parameter gives that in certain time the total size of useful packets that received at all the destination nodes. The unit of throughput is Kilobits per second (Kbps).
- Normalized Routing Load (NRL): In this metrics how many data packets transmitted to per data packets deliver to the destination. Each hop wise transmission of a routing packet is counted as one transmission. The first two metrics are the most important for best effort traffic. The routing load metric evaluates the efficiency of the routing protocol. Note, however, that these metrics are not completely independent. For example, lower packet delivery fraction means that the delay metric is evaluated with fewer samples. In the conventional wisdom, the longer the path lengths, the higher the probability of a packet drops. Thus, with a lower delivery fraction, samples are usually biased in favor of smaller path lengths.
- Number of packets received: This metric specify how many packets are received with in certain time period using different pause time.
- Number of packets generated: This metric gives information of how many packets are generated.
- Packet Dropped: When the simulation is done how many packets are dropped this is analysed by using this parameter.
- Energy: This gives how many power consumption is done using this metric in DSR and DSDV protocol at different pause time.

VI. RESULTS AND DISCUSSION

We are discuses two protocols as DSR and DSDV in this paper. By analysing there results we find out which one is best by taking different parameters as packet delivery ratio, end to end delay, throughput, energy, No. Of packets received, No. Of packets drop etc.

A. Packet Delivery Ratio:

From Fig 1. we find that as pause time increases packet delivery ratio of DSR protocol increases when we compare both the protocol then we find out that DSR has high Packet Delivery Ratio as compared to DSDV reactive protocol has high performance as compared to proactive routing protocol.

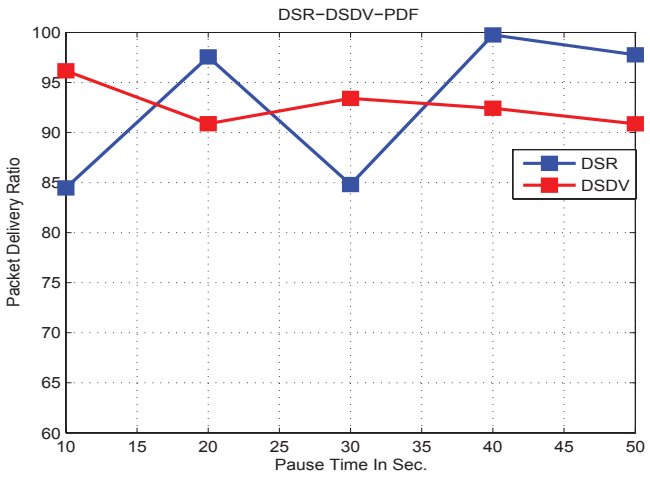

Fig. 1. Packet Delivery Ratio vs Pause Time for DSR and DSDV protocol

B. End To End Delay:

This parameter refers to the time taken for a packet to be transmitted across a network from source to destination. Fig 2. demonstrates the average end to end delay of considered routing protocol. It is noticed that DSDV has lower delay than DSR protocol. DSR protocol gives higher delay than DSDV because source node gives source path by searching its route cache previously stored. If path is not exist there then it floods rote request packet to find new route to the destination which causes delay to reach the packet to destination.

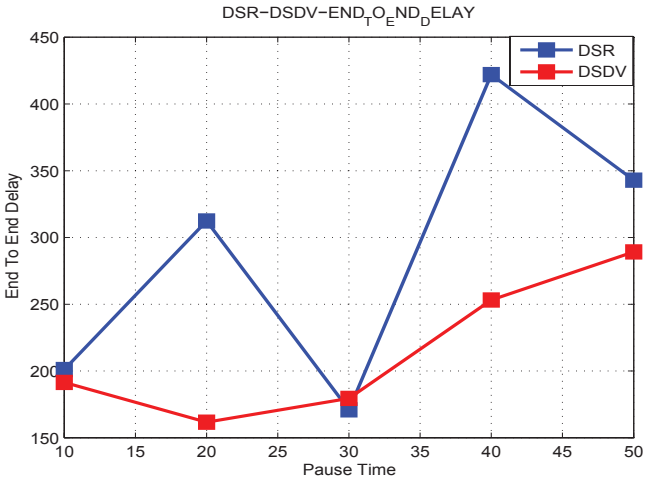

Fig. 2. End-to-End Delay vs Pause Time for DSR and DSDV protocol

C. Throughput

Fig 3. shows throughputs of protocol. DSDV noticed to be higher throughput then DSR protocol as pause time increases. DSDV protocol it is increases but in 40 and 50 pause time it gets lower because of packet dropped. Reason to higher throughput is less routing overhead of DSDV protocol. Agressive use of route cache cause certain problem in large network. Due to route cache overhead of protocol increases and throuhput of protocol degrades rapidly.

D. Normalized Routing Overhead

Normalized routing overhead getting from simulation is consider for protocol is in Fig 4. It could be find out that DSR protocol has lower routing overhead than DSDV protocol. Reason behind it is that instead of maintaining route table for keeping path information, DSR uses its route cache. Cache stores multiple route entries to keep per destination, thereby enabling multipath routing. When one link is break then source can find out other path from route cache, if it is present there, to aviod another route discovery process. On the other hand DSDV not mantain route cache. To discover route it periodically use the routing table information hence routing overhead of DSDV is high.

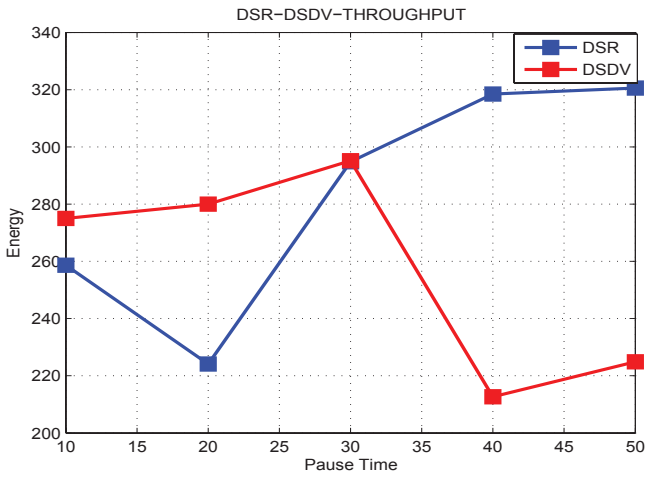

Fig. 3. Throughput vs Pause Time for DSR and DSD protocol

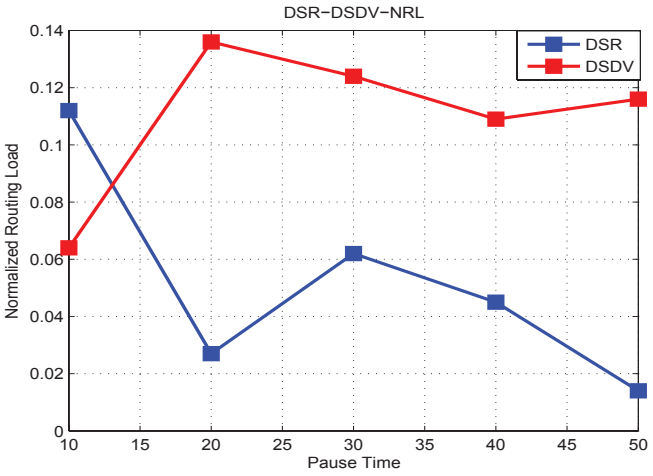

Fig. 4. Normalized Routing Load vs Pause Time for DSR and DSDV protocol

E. Number of packets received

Buffer used for protocol is 64 packets. If no replay are found packets are not reach destination and remaining packets are received by protocol. Fig 5. as pause time increasing number of packets received decreases for DSR protocol whereas pause time increases number of packets received also increases in DSDV protocol.

F. Number of packets generated

Fig 6. demonstrates for DSR number of packets generated decreases as pause time increases and DSDV as pause time increases generated packets decreases. By analysing both the protocol we find out that DSR has high packet generated as compare to DSDV.

G. Packet Drop

Fig 7. gives packet drop for given protocol. DSR protocol has lower packet drop as pause time increases but in DSDV

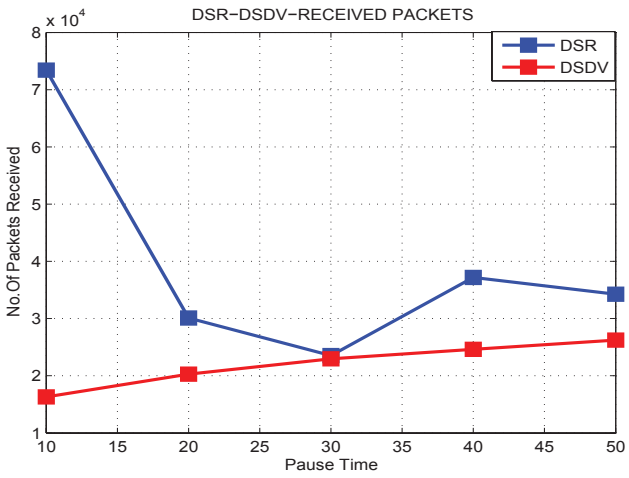

Fig. 5. No. of packets receivedvs Pause Time for DSR and DSDV protocol

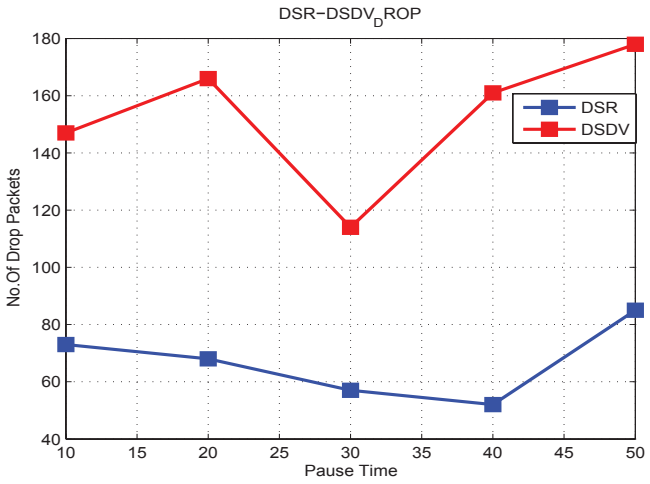

Fig. 7. Drop Packets vs Pause Time for DSR and DSDV protocol

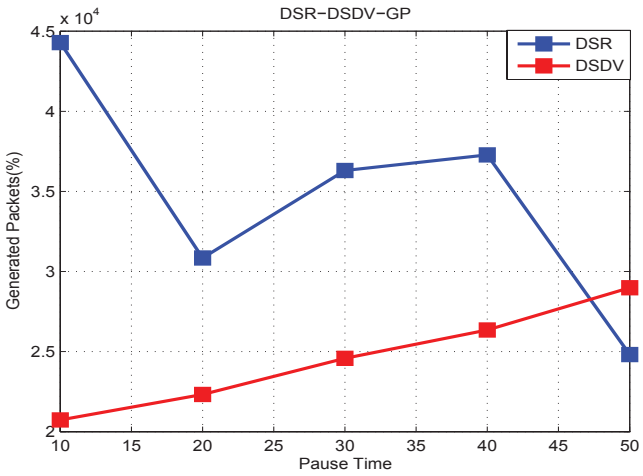

Fig. 6. No. of packets generated vs Pause Time for DSR and DSDV protocol

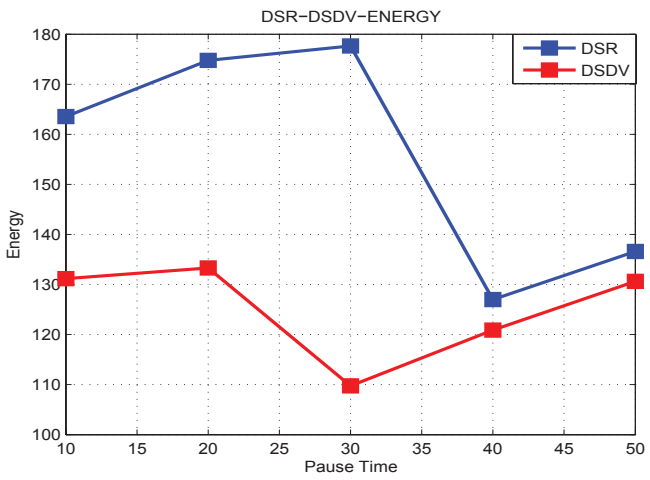

Fig. 8. Energy vs Pause Time for DSR and DSDV protocol

it changes randomly. DSR has lower number of packet drop then DSDV.

H. Energy

Fig 8. demonstrates energy required for given protocol. DSR has high energy consumption as compare to DSDV routing protocol. In both the protocol as pause time increases energy consumption changes randomly. Som packets in protocol lies Route Request (RREQ), Route Reply (RRPLY), control packets require long duration hence energy requred for DSR protocol is high.

VII. CONCLUSION

In this paper, we discuss two routing protocol as DSR and DSDV using network simulator (NS2). This is very critical issue to select efficient and reliable routing protocol. According to our simulation results and study we get different kinds of results. By analysing all parameters in proactive and reactive routing protocol we analyze that reactive(DSR) protocol outperforms well as compare to DSDV routing protocol in terms of packet delivery ratio, throughput, number of dropped packets, energy etc. End to end delay of DSR protocol is high as compared to DSDV protocol because of cache problem. In future work we will try to solve the cache problem in DSR protocol.

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