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RELATIVE STUDY OF DSDVAND AODV ROUTING PROTOCOLS IN MANET

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Abstract- Mobile Ad hoc Network (MANET) is a collection of mobile nodes that are unsystematically located so that the interconnections between nodes are dynamically changing. Efficient routing protocols will make MANETs reliable. To establish correct and efficient route between a pair of mobile nodes, is the main aim of AdHoc network routing protocols. The AODV routing protocol is a reactive routing protocol that discovers the route only on demand. DSDV is a table-driven routing algorithm, wherein every node maintains a routing table which contains the shortest distance path to every other node in the network and the address of the first node on the shortest path. This paper presents performance evaluation of these two routing protocols i.e. Ad Hoc On-Demand Distance Vector Routing (AODV) and Destination-sequenced distance vector (DSDV). Performance of AODV and DSDV is evaluated based on Average end-to-end delay, Packet delivery ratio and Throughput using the NS2 simulator.

Keywords– MANET, AODV,DSDV, NS2, routing, Average end-to-end delay, Packet delivery ratio, Throughput.

1. INTRODUCTION

A Mobile Ad hoc network is a collection of independent mobile nodes that communicate with each other using radio waves in an infrastructure-less environment. In an ad hoc network, a node can communicate directly with another node in point-to-point mode when the two nodes are located in the same transmission zone, while communication with a node in another zone is carried out via several intermediary nodes in multi-hop mode [1]. Each node in the network acts as both host and router. It discovers and maintains routes to other nodes in the network. Such networks are useful in military, disaster recovery and in other environments calamities, where no infrastructure exists or existing infrastructure has been destroyed. The network topology may change rapidly and unpredictably and the connectivity among the terminals may vary over time, since the nodes are mobile. The time-varying nature of the ad hoc network topology renders the traditional fixed network routing techniques, such as the shortest-path and link-state protocols, obsolete for Ad hoc networks. An efficient routing protocol is required to cope with such dynamic network condition and must find the path quickly and efficiently.

2. TYPES OF ROUTING PROTOCOL IN AD HOC NETWORK

A number of routing protocols and algorithms have been projected and thoroughly studied in the last few years. Based on how routing information is acquired and maintained by mobile nodes, one of the most popular methods to distinguish mobile Ad hoc network routing protocols is introduced. The knowledge about recent connectivity of the network including the state of network links of a mobile node is used in this approach [2]. Routing protocol are classified into three categories based on the time at which the routes are discovered and updated.

2.1 Routing Protocols :

a. Table Driven (Proactive)
   - DSDV
   - WRP
b. On Demand (Reactive)
   - AODV
   - DSR
   - DYNO
c. Hybrid
   - ZRP

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2.2 Table Driven Routing Protocol

Since routing information is maintained in tables,proactive protocols also known as “table driven”approach. In this approach nodes in the network regularly discover path to all nodes which are reachable and tries to keep consistent and up-to-date routing information in the routing table. This makes it easier for a source node to get a routing path immediately when required[1]. Routing information is generally flooded in the whole network. These routing tables are periodically exchanged between nodes in network at set time interval. No matter whatever may be the mobility and traffic characteristics of network, the routing updates occur at specified time intervals.

2.3 Destination-sequenced distance vector (DSDV):

DSDV is a table-driven routing algorithm [2]. It is an enhancement of distributed Bellman-Ford algorithm, wherein every node maintains a routing table which containsthe shortest distance path to every other node in the network and the address of the first node on the shortest path. The routing table also contains vital information such as the number of hops toreach to the destination, sequence number of the destination originated by the destination node. DSDV uses both periodic and triggered routing updates to maintain table consistency. In periodic updates, tables are exchanged between neighbors at regular intervals. This will provide an up-to-date view of the network topology. Triggered routing occurs when node observes a significant change in local topology. The table updates either incremental updates or full dumps. Incremental updates are used when a node does not observe significant changes in the local topology. Incremental update carries only information changed since the last full dump and should fit in a single network data packet unit (NDPU). Full dump carries all available routing information and it is carried out when either the local topology changes significantly or when an incremental update requires more than a single NDPU. Tables are updated with increasing sequence number tags to prevent loops, to counter the count-to-infinity problem, and for faster convergence. Updates are introduced by a destination with a new sequence number which is always greater than the previous one. Upon receiving an updated table, a node either updates its tables based on the received information or holds it for some time to select the best metric (which may be the lowest number of hops) received from multiple versions of the same update table from different neighboring nodes. Based on the sequence number of the table update, it may forward or reject the table.

When a link to the next hop is broken, any route through that node is immediately assigned infinity metric and its sequence is increased. Upon receiving an update with weight infinity, each node quickly disseminates it to its neighbors in order to propagate the broken-link information to the whole network. Thus a single link break leads to the propagation of table update information to the whole network. This is the only situation when any mobile node other than the destination node assigns the sequence number. A node always assigns an odd sequence number to the link break update to differentiate it from the even sequence number generated by the destination.

2.4 On Demand Routing Protocol

In this approach a node does not continuously maintain a route between all pairs of network nodes. Here, routes are discovered only when they are actually needed. Whenever a node has data to send to some destination, first it checks its route table to know whether it has a route. If the route doesn’t exist in table, then it will find a path to the destination this procedure is called as route discovery procedure. Hence, route discovery becomes on-demand. This approach is therefore also called as on-demand routing.

2.5 Ad Hoc On-Demand Distance Vector Routing (AODV)

The AODV[3] routing protocol is a reactive routing protocol that discovers the route only on demand. Route discovery process begins by the source node broadcasting route request (RREQ) packet to the neighbors. The neighbors in turn re-broadcast the packet to their neighbors. This process is continued until either; it reaches an intermediate node that has recent route information about the destination or until it reaches the destination. Sequence numbers are used in route request packet to avoid the loop and to ensure that only most recent requests are replied by the intermediate nodes. Route table at each node contains the routing information for destination nodes along with an associated lifetime value. If a route is note utilized within the lifetime period, it gets expired. Premature expiry of route is prevented by updating its lifetime whenever it is used. Route request (RREQ) packet contains destination node’s IP address, the last known sequence number for that destination and the source’s IP address and current sequence number. The RREQ also contains a hop count, initialized to zero and RREQ ID.

Packet format of RREQ is shown in Figure 1

0										1										2										3	
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1
Type								J	R	G	D	U	Reserved											Hop Count							
RREQ ID																															
Destination IP Address																															
Destination Sequence Number																															
Originator IP Address																															
Originator Sequence Number																															

Figure 1. RREQ packet format in AODV

When a neighboring node receives a RREQ, it first creates a reverse route to the source node and increments the hop count in the RREQ by one to get the hop distance from the source. It checks for an unexpired route to the destination in its route table. If it does not have a valid route to the destination, it simply broadcasts the RREQ, with the incremented hop count value, to its neighbors. However, if a node has an unexpired route to the destination and route table entry for the destination, has a sequence number equal to or greater than the destination sequence number in the route request, it will return the route reply(RREP) message, containing the source node's IP address, the destination node's IP address and the destination's sequence number as given in the node's route table entry for the destination. In addition, the hop count field in the RREP is set equal to the node's distance from the destination. The hop count is set equal to Zero,if the destination itself is creating the RREP,. After creating the reply, message is unicasted to the next hop towards source node.
When the next hop receives the RREP, it first creates a forward route entry for the destination node. The hop count for that route is the hop count in the RREP, incremented by one. This forward route entry for the destination will be utilized if the source selects this path for data packet transmissions to the destination. The RREP is thus forwarded hop by hop to the source node. Once the source receives the RREP, it can utilize the path for the transmission of data packets. If the source receives more than one RREP, it selects the route with the greatest sequence number and smallest hop count.

2.6 Hybrid Routing Protocols

These protocols are the combination the proactive and reactive approaches that's why they known as hybrid routing protocol. Nodes within a certain distance from the node concerned, or within a particular geographical region, are said to be within the routing zone of the given node. A table-driven approach is used for routing within this zone. An on-demand approach is used for nodes that are located beyond this zone.

3. PERFORMANCE METRICS FOR ROUTING PROTOCOL IN AD HOC NETWORK

The routing algorithms were evaluated using following performance metrics[5].

3.1 Packet Delivery Ratio (PDR)

PDR is the ratio of difference between the total number of generated packets and total number of received packets divided by the total number of generated packets. The loss rate is measured as seen by transport protocols and as specific to both the correctness and efficiency of ad hoc routing protocols. When the packet delivery ratio is high the performance is improved. PDR is calculated as:
PDR = (Generated packets **-** Received Packets)/ Generated packets

3.2 End-to-end delay (EED)

The EED[6] is the total delay that a data packet experiences as it is traveling from the source node to the destination node. To find out the end-to-end delay the difference of packet sent and received time was stored and then gave the average end-to-end delay for the received packetsdividing the total time difference over the total number of packet received. The performance is better when packet end-to-end delay is low.
EED= (Received Packets Time **-** Time packet sent) / Total number of packets received
This delay is built up by several smaller delays in the network such as, time spent in packet queues, forwarding delays, propagation delay (the time it takes for the packet to travel through the medium) and time needed to make retransmissions if a packet got lost etc.

3.3 Throughput :

Throughput is defined as the average number of message successfully delivered per unit time i.e. average number of bits delivered per second. It is measured as, Total number of delivered data packets divided by the total duration of simulation time. We can analyze the throughput of the protocol in terms of number of messages delivered per one second. Throughput is calculated as the ratio of the total number of packets that reach their destination, to the total number of packets sent by the source
Throughput = Packets Received / Packets Sent

3.4 Control Overhead:

It is ratio of the control information sent to the actual data received at each node.

4. SIMULATION ENVIRONMENT

Network simulator (NS) is an open source, discrete event network simulator. It is used in the simulation of routing and multicast protocols, in particular for ad-hoc network research. NS supports an array of popular network protocols, offering simulation results for wired and wireless networks alike. It can be also used as limited functionality network emulator.

Network Simulator (NS2) version 2 is the second major iteration of a discrete-event network simulation platform. The core of ns-2 is written in C++, but the C++ simulation objects are also linked to shadow objects in OTcl. Simulation scripts are written in the OTcl language (Object-oriented Tool Command Language) which is an extension of the Tcl scripting language. This structure permits simulations to be written and modified in an interpreted environment without having to resort to recompiling the simulator each time a structural change is made.

4.1 Simulation Set-up :

The simulations were performed using Network Simulator2 (NS2). The source-destination pairs are spread randomly over the network. The detailed description of simulation environment is presented below in table1.

Parameter	**Value**
Simulator	NS-2.34
Radio-propagation model	Propagation/Two ray round wave
Channel type	Channel/Wireless channel
MAC Type	Mac /802.11
Network interface type	Phy/WirelessPhy
Interface queue Type	Queue/Drop Tail
Link Layer Type	LL
Antenna	Antenna/Omni Antenna
Maximum packet in ifq	50
Area (M*M)	1000*1000
Source Type	CBR(constant bit rate)
Simulation Time	150 s
Routing Protocols	DSDV and AODV
Number of connection	20
Data rate	20 packet/second
Pause time	30 second
Packet size	512 bytes
Mobility Model	Random Way point model
Transmission Range	250 m
Mobility speed	0-20 m/s

Table 1 Details of simulation environment.

5. SIMULATION RESULTS

5.1 Simulation Environment based on various Number of Nodes:

In this scenario, both the routing protocol are evaluated based on the four performance metric which are Packet Delivery Fraction, End-to-End Delay, Throughput and Control Overhead. The two routing protocols are compared to various numbers of nodes. The number of nodes is set to 10, 20,30,40 and 50.

2.1 Packet Delivery Ratio:

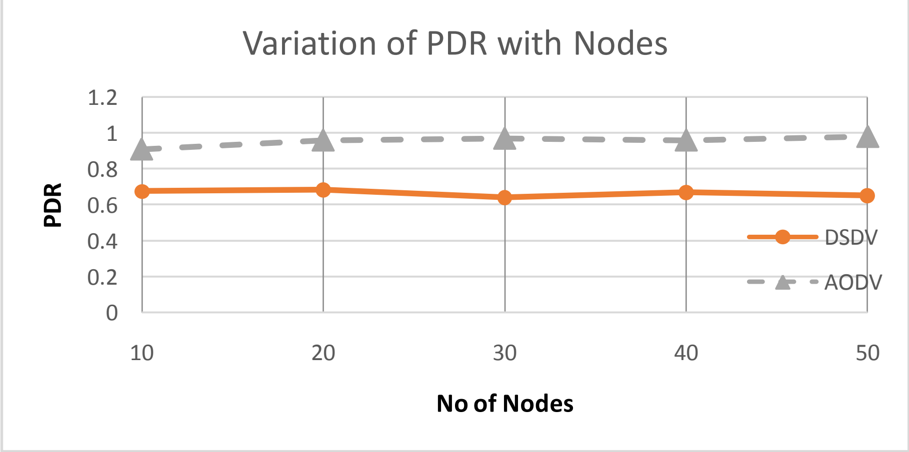

Figure 2.1 Packet Delivery Ratio

According to Figure 2.1,When the number of nodesincreases it is shown that AODV perform better because nodes become more stationary will lead to more stable path from source todestination. The performance of DSDV dropped as number of nodes increase because more packets were dropped due to link breaks.

2.2End-to-End Delay:

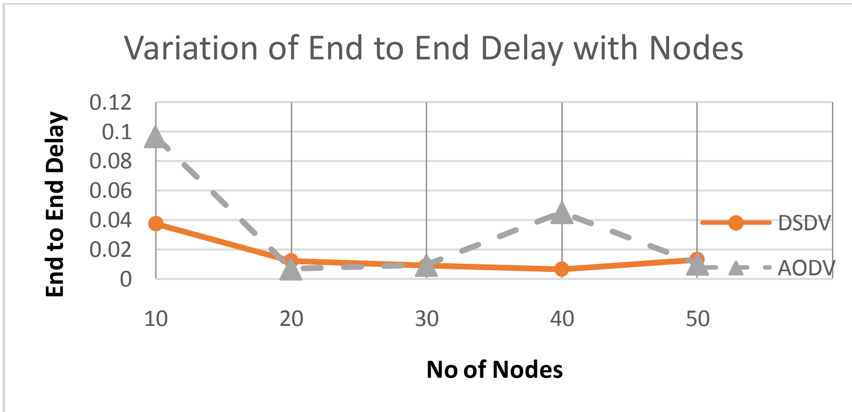

Figure 2.2 End to End Delay

The delay of AODV initially, is very high as compared to DSDV, it decreases at 20 – 30 nodes and has better delay performance than the other but then the performance degrades gradually. The performance of AODV is worse than DSDV, and has a much varying performance.

2.3 Throughput

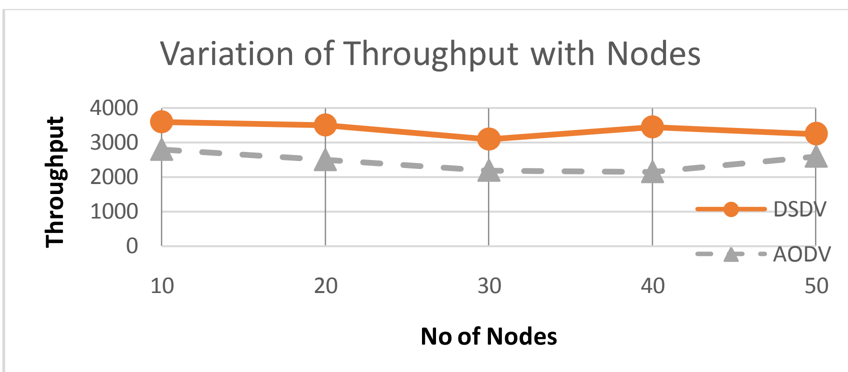

Figure 2.3 Throughput

Here in figure 2.3, we notice that as the number of nodes increases, value of throughput for AODV as well as DSDV varies. Since the throughput value for DSDV is higher than AODV even after variance the most preferred routing protocol for larger networks is DSDV in terms of throughput.The rate of packet received for AODV is better than the DSDV[2].

2.3 Control Overhead

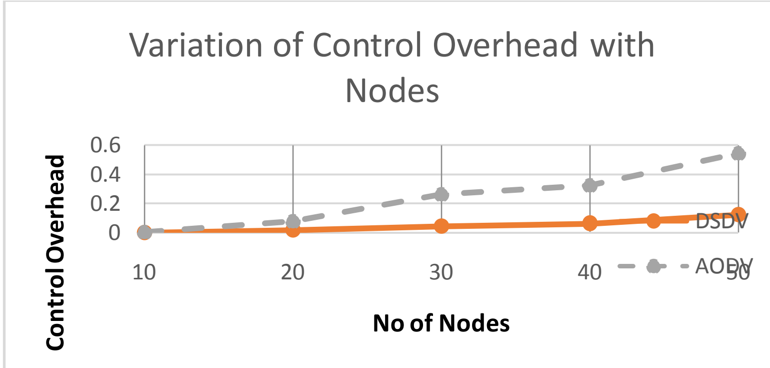

Figure 1.4 Control Overhead

From figure 1.4, DSDV less prone to route stability compared to AODV. For AODV, therouting overhead is not so affected as generated in DSDV.

6. CONCLUSION

In this paper the performance of two MANET routing protocols was compared, based on the performance metrics. Using NS2, and employing AODV and DSDV routing protocols the simulation results were obtained for comparison. DSDV packet delivery fraction is very low for high mobility scenarios and AODV has better performance when number of nodes increases. Delay is high initially in AODV but after some time it is very low. But in the case of DSDV, it is very low at starting and increased gradually.AODV throughput value increases as number of nodes increases than that of DSDV. Finally, it is concluded that theperformance of AODV is better than DSDV routing protocol for real time applications.

7. REFERENCES

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