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QoS Parameter Analysis on AODV and DSDV Protocols in a Wireless Network

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Abstract*—Wireless networks are characterized by a lack of infrastructure, and by a random and quickly changing network topology; thus the need for a robust dynamic routing protocol that can accommodate such an environment. To improve the packet delivery ratio of Destination-Sequenced Distance Vector (DSDV) routing protocol in mobile ad hoc networks with high mobility, a message exchange scheme for its invalid route reconstruction is being used. Two protocols AODV and DSDV simulated using NS-2 package and were compared in terms throughput, end to end delay and packet faction delivery varying number of nodes, speed and time. Simulation results show that DSDV compared with AODV, DSDV routing protocol consumes more bandwidth, because of the frequent broadcasting of routing updates. While the AODV is better than DSDV as it doesn't maintain any routing tables at nodes which results in less overhead and more bandwidth. AODV perform better under high mobility simulations than DSDV. High mobility results in frequent link failures and the overhead involved in updating all the nodes with the new routing information as in DSDV is much more than that involved AODV, where the routes are created as and when required. AODV use on -demand route discovery, but with different routing mechanics. AODV uses routing tables, one route per destination, and destination sequence numbers, a mechanism to prevent loops and to determine freshness of routes.

Keywords-AODV;DSDV;wireless;QoS;

I. Introduction

Wireless ad-hoc networks have gained a lot of importance in wireless communications. Wireless communication is established by nodes acting as routers and transferring packets from one to another in ad-hoc networks. Routing in these networks is highly complex due to moving nodes and hence many protocols have been developed. We selected two routing protocols (i.e. DSDV and AODV) for comparison using throughput and packet loss as parameters. A comparison of an Adhoc On-Demand Distance Vector (AODV) and the Destination Sequenced Distance Vector (DSDV) routing protocols with Few Performance metrics.

Routing protocols are classified either as reactive or proactive. Ad hoc routing protocols that are a combination of both reactive and proactive characteristics are referred to as hybrid. In this thesis, we considered two routing protocols. One of these is reactive: AODV and one is proactive: DSDV.

As briefly stated in the preceding section, in this work, we evaluate the behavior of how these protocols affect network performance when implemented in a wireless network. We do not address in depth the design of these algorithms.

II. Literture Survey

Since the 1970s wireless networks have grown in popularity. Ad hoc networks are networks of autonomous nodes that have wireless connections between each other. These connections can created and destroyed, changing the network topology as nodes change location, move out of range of other nodes or fail completely. Ad hoc networks pose an additional set of problems to those encountered in traditional fixed networks or wireless cellular networks. Dynamically forming the communications infrastructure from mobile devices is the source of these complications. One way of thinking about this is to imagine the problems caused by continually moving and changing the router you use to get from your local subnet to the rest of the world. How would packets get to or from you? This type of question has to be addressed along with requirements that affect traditional routing protocols such as loop free routing, completeness and stability. The proposed solutions to this problem have focused on developing ad hoc routing protocols such as DSDV [2], DSR [9] and AODV [3] to cite three.

Elizabeth Royer and Chai-Keong Toh wrote "A Review of Current Routing Protocols for ad hoc Mobile Wireless Networks" [1] in 1999, ad hoc networks have made significant progress. Many new classes of protocol have been developed, expanding the two main classes considered in [1], namely Source driven and Table driven protocols, to a whole collection of more specific classes. These classes are Hybrid Protocols, Geographically Aware Protocols, Clustering Protocols, Locally Repairing Protocol and Energy Efficient Protocols. The categorization of routing protocols in [1] placed a clear distinction between Source driven and Table driven protocols. With the additional classes mentioned above, the distinction between protocols is not so clear. Protocols have properties of one or more classes or ad hoc protocol. For example ZRP [7] is a Hybrid protocol and has features of both Source and Table driven protocols.

Destination Sequenced Distance Vector, DSDV, was described in [2] and [3] section 3.3.This is one of the first ad hoc routing protocols and is basically an adaptation of the Bellman Ford algorithm [8]. It was developed by Perkins et al. in 1994 and has been superseded by other ad hoc routing protocols, including AODV also by Perkins [5]. Each node maintains a list of all other nodes in the network along with a next hop to them, the number of hops to the destination and a sequence number. The sequence number is used to distinguish stale routes from fresh routes. Routing table updates are periodically broadcast throughout the network to ensure consistency. To minimize the effect of these broadcasts there are two different types of broadcast a full update and a partial update.

Ad hoc On Demand Distance Vector, AODV was initially set out in [3] and is defined in the IETF Draft, version 8, [4]. AODV is an on demand ad hoc routing protocol that provides both unicast and multicast routing. In contrast to DSR, AODV does not use source routing but rather dynamically creates routing entries in intermediate nodes between the source and destination. ADOV adopts a similar approach DSR in that the source wanting to send information initiates a Route Request, RREQ, which is broadcast throughout the ad hoc network until it reaches a node, that maybe the destination itself, which has a route to the destination. This node then propagates back a Route Reply, RREP to the source. The traversal of the network by the RREQ and RREP packets is the mechanism used to establish routing entries in the intermediate tables. Various mechanisms are used to ensure that routing loops do not occur and that only a single path through the ad hoc network is established. However no experimental comparison was made between ADOV and other ad hoc routing protocols, such as DSDV and DSR. The comparison of ad hoc routing protocols is examined in [5] and [6].

I. Classification of Routing Protocols

Classification of routing protocols in mobile ad hoc network can be done in many ways, but most of these are done depending on routing strategy and network structure. The routing protocols can be categorized as flat routing, hierarchical routing and geographic position assisted routing while depending on the network structure. According to the routing strategy routing protocols can be classified as Table-driven and source initiated. The classification of routing protocols is shown in the Figure 1.

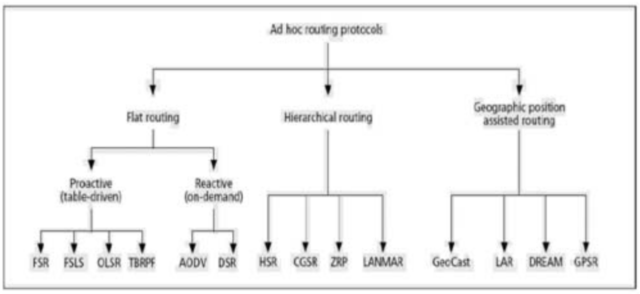

Figure 1. Classification of Routing Protocols in Mobile Ad-hoc Networks

I. Destination Sequenced Distance Vector (DSDV) Protocol

The destination sequenced distance vector (DSDV) routing protocol is a proactive routing protocol which is a modification of conventional Bellman-Ford routing algorithm. This protocol adds a new attribute, sequence number, to each route table entry at each node. Routing table is maintained at each node and with this table; node transmits the packets to other nodes in the network. This protocol was motivated for the use of data exchange along changing and arbitrary paths of interconnection which may not be close to any base station.

a) Protocol Overview and Activities:

Each node in the network maintains routing table for the transmission of the packets and also for the connectivity to different stations in the network. These stations list for all the available destinations, and the number of hops required to reach each destination in the routing table. The routing entry is tagged with a sequence number which is originated by the destination station. In order to maintain the consistency, each station transmits and updates its routing table periodically. The packets being broadcasted between stations indicate which stations are accessible and how many hops are required to reach that particular station. The packets may be transmitted containing the layer2 or layer 3 addresses.

Routing information is advertised by broadcasting or multicasting the packets which are transmitted periodically as when the nodes move within the network. The DSDV protocol requires that each mobile station in the network must constantly; advertise to each of its neighbors, its own routing table. Since, the entries in the table my change very quickly, the advertisement should be made frequently to ensure that every node can locate its neighbors in the network. This agreement is placed, to ensure the shortest number of hops for a route to a destination; in this way the node can exchange its data even if there is no direct communication link.

The data broadcast by each node will contain its new sequence number and the following information for each new route:

– The destination address

– The number of hops required to reach the destination and

– The new sequence number, originally stamped by the destination

The transmitted routing tables will also contain the hardware address, network address of the mobile host transmitting them. The routing tables will contain the sequence number created by the transmitter and hence the most new destination sequence number is preferred as the basis for making forwarding decisions. This new sequence number is also updated to all the hosts in the network which may decide on how to maintain the routing entry for that originating mobile host.

After receiving the route information, receiving node increments the metric and transmits information by broadcasting. Incrementing metric is done before transmission because, incoming packet will have to travel one more hop to reach its destination.

Time between broadcasting the routing information packets is the other important factor to be considered. When the new information is received by the mobile host it will be retransmitted soon effecting the most rapid possible dissemination of routing information among all the cooperating mobile hosts. The mobile host cause broken links as they move form place to place within the network. The broken link may be detected by the layer2 protocol, which may be described as infinity. When the route is broken in a network, then immediately that metric is assigned an infinity metric there by determining that there is no hop and the sequence number is updated. Sequence numbers originating from the mobile hosts are defined to be even number and the sequence numbers generated to indicate infinity metrics are odd numbers.

a) Advantages of DSDV

- DSDV protocol guarantees loop free paths.
- Count to infinity problem is reduced in DSDV.
- We can avoid extra traffic with incremental updates instead of full dump updates.
- Path Selection: DSDV maintains only the best path instead of maintaining multiple paths to every destination. With this, the amount of space in routing table is reduced.

b) Limitations of DSDV

- Wastage of bandwidth due to unnecessary advertising of routing information even if there is no change in the network topology.
- DSDV doesn't support Multi path Routing.
- It is difficult to determine a time delay for the advertisement of routes.
- It is difficult to maintain the routing table's advertisement for larger network. Each and every host in the network should maintain a routing table for advertising. But for larger network this would lead to overhead, which consumes more bandwidth.

II. Ad-hoc On-Demand Distance Vector (AODV) Protocol

AODV is a very simple, efficient, and effective routing protocol for Mobile Ad-hoc Networks which do not have fixed topology. This algorithm was motivated by the limited bandwidth that is available in the media that are used for wireless communications. It borrows most of the advantageous concepts from DSR and DSDV algorithms. The on demand route discovery and route maintenance from DSR and hop-by-hop routing, usage of node sequence numbers from DSDV make the algorithm cope up with topology and routing information. Obtaining the routes purely on-demand makes AODV a very useful and desired algorithm for MANETs.

a) Working of AODV

Each mobile host in the network acts as a specialized router and routes are obtained as needed, thus making the network self-starting. Each node in the network maintains a routing table with the routing information entries to its neighboring nodes, and two separate counters: a node sequence number and a broadcast-id. When a node (say, source node 'S') has to communicate with another (say, destination node 'D'), it increments its broadcast-id and initiates path discovery by broadcasting a route request packet RREQ to its neighbors. The (source-addr, broadcase-id) pair is used to identify the RREQ uniquely. Then the dynamic route table entry establishment begins at all the nodes in the network that are on the path from S to D.

As RREQ travels from node to node, it automatically sets up the reverse path from all these nodes back to the source. Each node that receives this packet records the address of the node from which it was received. This is called Reverse Path Setup. The nodes maintain this info for enough time for the RREQ to traverse the network and produce a reply to the sender and time depends on network size.

If an intermediate node has a route entry for the desired destination in its routing table, it compares the destination sequence number in its routing table with that in the RREQ. If the destination sequence number in its routing table is less than that in the RREQ, it rebroadcasts the RREQ to its neighbors. Otherwise, it unicasts a route reply packet to its neighbor from which it was received the RREQ if the same request was not processed previously (this is identified using the broadcast-id and source-addr).

Once the RREP is generated, it travels back to the source, based on the reverse path that it has set in it until traveled to this node. As the RREP travels back to source, each node along this path sets a forward pointer to the node from where it is receiving the RREP and records the latest destination sequence number to the request destination. This is called Forward Path Setup.

If an intermediate node receives another RREP after propagating the first RREP towards source it checks for destination sequence number of new RREP. The intermediate node updates routing information and propagates new RREP only,

If the Destination sequence number is greater, OR

If the new sequence number is same and hop count is small, OR

Otherwise, it just skips the new RREP. This ensures that algorithm is loop-free and only the most effective route is used.

b) Route Table Management

Each mobile node in the network maintains a route table entry for each destination of interest in its route table. Each entry contains the following info:

Destination, Next hop, Number of hops, Destination sequence number, Active neighbors for this route, Expiration time for the route table entry.

The other useful information contained in the entries along with source and destination sequence numbers is called soft-state information associated to the route entry. The info about the active neighbors for this route is maintained so that all active source nodes can be notified when a link along a path to the destination breaks. And the purpose of route request time expiration timer is to purge the reverse path routing entries from all the nodes that do not lie on the active route.

a) Interesting concepts of AODV

The concepts of AODV that make it desirable for MANETs with limited bandwidth include the following:

- Minimal space complexity: The algorithm makes sure that the nodes that are not in the active path do not maintain information about this route. After a node receives the RREQ and sets a reverse path in its routing table and propagates the RREQ to its neighbors, if it does not receive any RREP from its neighbors for this request, it deletes the routing info that it has recorded.
- Maximum utilization of the bandwidth: This can be considered the major achievement of the algorithm. As the protocol does not require periodic global advertisements, the demand on the available bandwidth is less. And a monotonically increased sequence number counter is maintained by each node in order to supersede any stale cached routes. All the intermediate nodes in an active path updating their routing tables also make sure of maximum utilization of the bandwidth. Since, these routing tables will be used repeatedly if that intermediate node receives any RREQ from another source for same destination. Also, any RREPs that are received by the nodes are compared with the RREP that was propagated last using the destination sequence numbers and are discarded if they are not better than the already propagated RREPs.
- Simple: It is simple with each node behaving as a router, maintaining a simple routing table, and the source node initiating path discovery request, making the network self-starting.
- Most effective routing info: After propagating an RREP, if a node finds receives an RREP with smaller hop-count, it updates its routing info with this better path and propagates it.
- Most current routing info: The route info is obtained on demand. Also, after propagating an RREP, if a node finds receives an RREP with greater destination sequence number, it updates its routing info with this latest path and propagates it.
- Loop-free routes: The algorithm maintains loop free routes by using the simple logic of nodes discarding non better packets for same broadcast-id.
- Coping up with dynamic topology and broken links: When the nodes in the network move from their places and the topology is changed or the links in the active path are broken, the intermediate node that discovers this link breakage propagates an RERR packet. And the source node re-initializes the path discovery if it still desires the route. This ensures quick response to broken links.
- Highly Scalable: The algorithm is highly scalable because of the minimum space complexity and broadcasts avoided when it compared with DSDV.

b) Characteristics of AODV

- Unicast, Broadcast, and Multicast communication.
- On-demand route establishment with small delay.
- Multicast trees connecting group members maintained for lifetime of multicast group.
- Link breakages in active routes efficiently repaired.
- All routes are loop-free through use of sequence numbers.
- Use of Sequence numbers to track accuracy of information.
- Only keeps track of next hop for a route instead of the entire route.
- Use of periodic HELLO messages to track neighbors.

c) Advanced uses of AODV

Because of its reactive nature, AODV can handle highly dynamic behavior of Vehicle Ad-hoc networks.

Used for both unicasts and multicasts using the ’J’ (Join multicast group) flag in the packets.

d) Limitations/Disadvantages of AODV

- Requirement on broadcast medium: The algorithm expects/ requires that the nodes in the broadcast medium can detect each others’ broadcasts.
- Overhead on the bandwidth: Overhead on bandwidth will be occurred compared to DSR, when an RREQ travels from node to node in the process of discovering the route info on demand, it sets up the reverse path in itself with the addresses of all the nodes through which it is passing and it carries all this info all its way.
- No reuse of routing info: AODV lacks an efficient route maintenance technique. The routing info is always obtained on demand, including for common case traffic.
- It is vulnerable to misuse: The messages can be misused for insider attacks including route disruption, route invasion, node isolation, and resource consumption.
- AODV lacks support for high throughput routing metrics: AODV is designed to support the shortest hop count metric. This metric favors long, low bandwidth links over short, high-bandwidth links.
- High route discovery latency: AODV is a reactive routing protocol. This means that

- AODV does not discover a route until a flow is initiated. This route discovery latency result can be high in large-scale mesh networks.

II. PERFORMANCE EVALUATION AND DESIGN

This section starts by giving a framework and overview of some techniques that are chosen for network performance evaluation. There are three techniques for performance evaluation which are analytical modeling, simulation and measurement. The reason for choosing simulation as a technique for performance evaluation in this thesis is explained as well in Section.

a) Selection Techniques for Network Performance Evaluation

Performance is a key criterion in the design, procurement, and use of computer systems. Computer systems professionals such as computer systems engineers, scientist, analysts and users need the basic knowledge of performance evaluation techniques as the goal to get the highest performance for a given cost. There are three techniques for performance evaluation, which are analytical modeling, simulation and measurement. Simulation had being chosen because it is the most suitable technique to get more details that can be incorporate and less assumption is required compared to analytical modeling. Accuracy, times available for evaluation and cost allocated for the thesis are also another reason why simulation is chose. By using simulation, researchers should be allowed to study a system in well-known conditions, repeatability if necessary in order to understand events.

a) Computer Network Simulator Tools

There are many simulators such as Network Simulator 2 (NS-2), OPNET Modeler, GloMoSim, OMNeT++ and etc. In this project we choices Network Simulation Tool (NS-2).

NS (version 2) is an object-oriented, discrete event driven network simulator developed at UC Berkely written in C++ and OTcl. NS-2 is primarily useful for simulating local and wide area networks. Although NS is fairly easy to use once you get to know the simulator, it is quite difficult for a first time user, because there are few user-friendly manuals. Even though there is a lot of documentation written by the developers which has in depth explanation of the simulator, it is written with the depth of a skilled NS user. The purpose of this project is to give a new user some basic idea of how the simulator works, how to setup simulation networks, where to look for further information about network components in simulator codes, how to create new network components, etc., mainly by giving simple examples and brief explanations based on our experiences. Although all the usage of the simulator or possible network simulation

setups may not be covered in this project, the project should help a new user to get started quickly.

NS-2 interprets the simulation scripts written in OTcl. A user has to set the different components (e.g. event scheduler objects, network components libraries and setup module libraries) up in the simulation environment. The user writes his simulation as an OTcl script, plumbs the network components together to the complete simulation.

b) Simulation Model

We run the simulation in Network Simulator (NS-2) accepts as input a *scenario file* that describes the exact motion of each node and the exact packets originated by each node, together with the exact time at which each change in motion or packet origination is to occur. The detailed trace file created by each run is stored to disk, and analyzed using a variety of scripts, particularly one called *file *.tr* that counts the number of packets successfully delivered and the length of the paths taken by the packets, as well as additional information about the internal functioning of each scripts executed. This data is further analyzed with AWK file and Microsoft Excel to produce the graphs.

The simulation models are built using the Network Simulator tool (NS-2) version 2.35.The experiments use a fixed number of packet sizes (512-bytes). The mobility model used is a radio propagation model. The field configurations used is 500m X 500m with 27 nodes and the stations are assumed to be evenly distributed in the area. Here, each packet starts its journey from a random location to a random destination with a randomly chosen speed.. Simulations are run for 500 simulated seconds. Identical mobility and traffic scenarios are used across protocols to gather fair results.

c) Performance Metrics

The project focuses on 3 performance metrics which are quantitatively measured. The performance metrics are important to measure the performance and activities that are running in NS-2 simulation. The performance metrics are:

Packet delivery fractions (PDF) — the ratio of the data packets delivered to the destinations to those generated by the CBR sources. The PDF shows how successful a protocol performs delivering packets from source to destination. The higher for the value give use the better results. This metric characterizes both the completeness and correctness of the routing protocol also reliability of routing protocol by giving its effectiveness.

$$PktDelivery\% = \frac{\sum_{1}^{n} CBRrecv}{\sum_{1}^{n} CBRrecv} \times 100 ......Equation1$$

Average end-to-end delay of data packets — there are possible delays caused by buffering during route discovery latency, queuing at the interface queue, retransmission delays at the MAC, and propagation and transfer times. The thesis use Average end-to-end delay. Average end-to-end delay is an average end-to-end delay of data packets. It also caused by queuing for transmission at the node and buffering data for detouring. Once the time difference between every CBR packet sent and received was recorded, dividing the total time difference over the total number of CBR packets received gave the average end-to-end delay for the received packets. This metric describes the packet delivery time: the lower the end-to-end delay the better the application performance.

$$Avg\_End-to-End\_Delay = \frac{\sum_{1}^{n}(CBRsentTime - CBRrecvTime)}{\sum_{1}^{n} CBRrec} \text{.....Equation2}$$

Data Packet Loss (Packet Loss) — Mobility-related packet loss may occur at both the network layer and the MAC layer. Here packet loss concentrates for network layer. When a packet arrives at the network layer. The routing protocol forwards the packet if a valid route to the destination is known. Otherwise, the packet is buffered until a route is available. A packet is dropped in two cases: the buffer is full when the packet needs to be buffered and the time that the packet has been buffered exceeds the limit.

$$PLose = DataAgtSent - DataAgtRec \text{.....Equation 3}$$

AGT– agent trace (use in new trace file format)

Throughput -The ratio of the total amount of data that reaches a receiver from a sender to the time it takes for the receiver to get the last packet is referred to as throughput. It is expressed in bits per second or packets per second. Factors that affect throughput include frequent topology changes, unreliable communication, limited bandwidth and limited energy. A high throughput network is desirable.

I. Simulation Result

This section described how to design and implement the comparison between the AODV and DSDV routing protocol using the average end to end delay, packet loss and packet delivery fraction performance metrics. The value of simulation in studies of protocols is that it allows near perfect experimental control: experiments can be designed at will and then rerun while varying an experimental variable and holding all other variables constant. With simulation, it is also possible to test the behavior of networks with more nodes than physical equipment is available for, or networks with equipment that does not even exist yet.

- The TCL Script

In the TCL script had defined the scene of communication in which ours agent of Density has operated. In the part it begins them come defined the parameters that define the characteristics of the topology and those of the communication model.

- Generating Traffic and Mobility Models

Continuous bit rate (CBR) traffic sources are used. The source-destination pairs are spread randomly over the network. Only 512-byte data packets are used. The mobility model uses the random waypoint model in a rectangular field. The field configurations used is: 500 m x 500 m field with 27 nodes. Here, each packet starts its journey from a random location to a random destination with a randomly chosen speed (uniformly distributed in 20m/s). Once the destination is reached, another random destination is targeted after a pause. Simulations run for 500 simulated seconds. Identical mobility and traffic models generated only once to gather fair results for this thesis. Its related the scenario that relevant to this thesis.

As already outlined we have taken two routing protocols, namely Ad hoc On-Demand Distance Vector Routing (AODV) and destination sequenced distance vector (DSDV). The mobility model used is Random waypoint mobility model because it models the random movement of the mobile nodes. For all the simulations, the same movement models were used, simulation time is kept same, and the pause time is varied as 2ms and 4ms.

A. SCENARIO – 1:

In this scenario some parameters with a specific value are considered. Those are as shown in table 8.1

Parameter	Value
Number of nodes	27
Simulation Time	160 sec
Pause Time	2ms
Environment Size	500X500
Traffic Size	CBR
Packet Size	512bytes
Queue Length	50
Simulator	ns 2.35
Antenna Type	Omni directional

TABLE I. Scenario 1 for implementation of AODV and DSDV

*a) **Throughput***

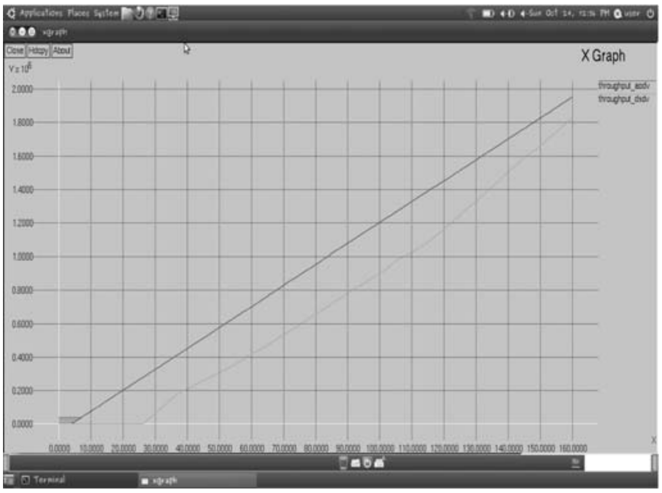

Figure 2. Throughput for AODV and DSDV with pause time 2ms

The above figure shows the xgraph for AODV and DSDV with a pause time set to 2ms. The X-axis of the graph indicates the time and the Y-axis shows the throughput. As we can clearly observe from the graph, the throughput of AODV is better than DSDV. There is a steady increase of throughput in case of AODV whereas in case of DSDV it is not the same. Thus in case of Throughput, AODV performs well when compared to DSDV.

*a) **End to End Delay***

Figure 3. Screen shot of End to end delay

In this End to end delay metric, we can observe that AODV and DSDV generate same no. of packets. The received packets are more in number in case of AODV than DSDV. The packets dropped in AODV are less when compared with DSDV. Thus, the Average end to end delay is m more in AODV when compared to DSDV.

a) Packet Delivery Fraction

In case of Packet delivery fraction (PDF), the ratio of received packets to sent packets is greater in AODV (i.e. r/s = 0.4827) than in DSDV (i.e. r/s=0.4519).

Figure 4. Screen shot of Packet delivery Fraction

B. SCENARIO – 2:

In this scenario some parameters with a specific value are considered. Those are as shown in table 8.2.

TABLE II. Scenario 2 for implementation of AODV and DSDV

Parameter	Value
Number of nodes	27
Simulation Time	160 sec
Pause Time	4ms
Environment Size	500X500
Traffic Size	CBR
Packet Size	512bytes
Queue Length	50
Simulator	ns 2.35
Antenna Type	Omni directional

a) Throughput

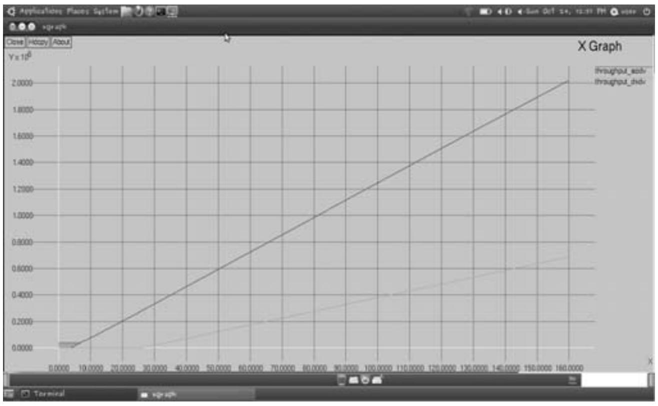

Figure 1. Throughput Xgraph of AODV and DSDV with Pause time set to 4ms

The above figure shows the xgraph for AODV and DSDV with a pause time set to 4ms. The X-axis of the graph indicates the time and the Y-axis shows the throughput. As we can clearly observe from the graph, the throughput of AODV is very much better when compared with DSDV. There is a steady increase of throughput in case of AODV whereas in case of DSDV it is not the same. Thus in case of Throughput, AODV performs significantly well when compared to DSDV.

b) End to End Delay

Figure 6. Screen shot of End to End Delay

In this End to end delay metric, we can observe that AODV and DSDV generate same no. of packets. The received packets are much more in case of AODV than DSDV. The packets dropped in AODV are very less (i.e. can be neglected) when compared with DSDV. Thus, the Average end to end delay is more in AODV when compared to DSDV.

a) Packet delivery Fraction (PDF)

Figure7. Screen shot of Packet delivery Fraction

In case of packet delivery fraction, the ratio of received to sent packets is high in AODV (i.e. r/s = 0.999) whereas in DSDV, it is less (i.e. r/s=0.8476). Thus, AODV works better than DSDV.

I. CONCLUSION

DSDV routing protocol consumes more bandwidth, because of the frequent broadcasting of routing updates. While the AODV is better than DSDV as it doesn't maintain any routing tables at nodes which results in less overhead and more bandwidth. From the above, chapters, it can be assumed that DSDV routing protocols works better for smaller networks but not for larger networks. So, my conclusion is that, AODV routing protocol is best suited for general mobile ad-hoc networks as it consumes less bandwidth and lower overhead when compared with DSDV routing protocol.

AODV perform better under high mobility simulations than DSDV. High mobility results in frequent link failures and the overhead involved in updating all the nodes with the new routing information as in DSDV is much more than that involved AODV, where the routes are created as and when required. AODV use on -demand route discovery, but with different routing mechanics. AODV uses routing tables, one route per destination, and destination sequence numbers, a mechanism to prevent loops and to determine freshness of routes.

References

[1] Elizabeth M. Royer, University of California, Santa Barbara Chai-Keong Toh, Georgia Institute of Technology, "A Review of Current Routing Protocols for Ad Hoc Mobile Wireless Networks".

[2] Charles E. Perkins and Pravin Bhagwat. Highly dynamic destination-sequenced distance-vector routing (dsdv) for mobile computers. 1994.

[3] Charles E. Perkins and Elizabeth M. Royer. Ad hoc on-demand distance vector routing. In *Proceedings of the 2nd IEEE Workshop on Mobile Computing* Systems and Applications, pages 80–100.IEEE, February 1999.

[4] AODV, internet-draft. World Wide Web, http://www.ietf.org/internet-drafts/draft-ietf-manet-aodv-08.txt.

[5] Josh Broch, David A. Maltz, David B. Johnson, Yih-Chun Hu, and Jorjeta Jetcheva. A performance comparison of multi-hop wireless ad hoc network routing protocols. In Mobicom 1998, pages 85–97.ACM, 1998.

[6] B. Das, E. Sivakumar, and V. Bhargavan. Routing in ad-hoc networks using a spine, 1997.

[7] Haas. ZRP, internet-draft. World Wide Web, http://www.ee.cornell.edu/˜haas/Publications/draft-ietf-manet-zone-zrp-%02.txt.

[8] L.R. Ford Jr. and D. R. Fulkerson. Flows in Networks. Princeton Univ. Press, 1962.

[9] David B. Johnson and David A. Maltz. Dynamic Source Routing in Ad Hoc Wireless Networks, chapter 5, pages 153–181. Kluwer Academic Publishers, 1996.

[10] http://www.isi.edu/nsnam/ns/ns-tutorial/index.html

[11] Samyak Shah, Amit Khandre, Mahesh Shirole and Girish Bhole, “Performance Evaluation of Ad Hoc Routing Protocols Using NS2 Simulation”.

[12] Krishna Gorantala, “Routing Protocols in Mobile Ad-hoc Networks”, June 15,

[13] Md. Anisur Rahman, Md. Shohidul Islam, Alex Talevski, “Performance Measurement of Various Routing Protocols in Ad-hoc Network”.

[14] V.Ramesh, Dr.P.Subbaiah, N. Koteswar Rao, M.Janardhana Raju, “Performance Comparison and Analysis of DSDV and AODV for MANET”.

[15] S. A. Ade & P.A.Tijare, “Performance Comparison of AODV, DSDV, OLSR and DSR Routing Protocols in Mobile Ad Hoc Networks”.