Simulation Comparison and Analysis of Quality of Service in DSDV and AODV Mobile Adhoc Networks

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Abstract—**Mobile Ad hoc Networks (MANETs) is a collection of wireless mobile nodes that communicate with each other without centralized control or pre-established infrastructure. Mobile Ad hoc Networks due to their characteristics put some extra requirements on the routing protocols such as, distributed control management, on demand operation, energy efficient approach and limited packet size. Numerous routing protocols have been proposed to make the communication possible within the MANET. However, with the development of real-time applications, incorporating Quality of Service (QoS) into the network architecture becomes essential. In this paper, we analyze and compare DSDV (proactive or Table Driven) and AODV (reactive or On Demand) routing protocols for MANETs using Network Simulator NS2. Performance evaluation of AODV and DSDV is evaluated based on three parameters of quality of service (QoS), throughput, packet loss ratio and delay. Our simulations show that AODV outperforms DSDV in terms of throughput and packet loss ratio.**

Keywords: MANET, Quality of Servive, AODV, DSDV, NS2

I. Introduction

In recent years mobile computing has enjoyed a tremendous rise in popularity. The continued miniaturization of mobile devices and the extraordinary rise of processing power available in mobile laptop computers combine to put more and better computer based applications in the hand of growing segment of population. Mobile Ad Hoc Networks (MANET) represent complex distributed system that comprise wireless mobile nodes that can freely and dynamically self organized into arbitrary and temporary ad hoc network topologies, allowing people and devices to seamlessly internet work in area with no pre-existing communication infrastructure. Each of the nodes has a wireless interface and communicates with each other over either radio or infrared. Numerous MANET routing protocols have been proposed to address the challenges of mobile ad hoc networks. These routing protocols are divided into the following categories: Table driven, on demand, and hybrid models.

The rest of the paper is organized as follows. In Section 2, a general description of the MANET protocols is presented. A description of the AODV and the DSDV routing protocols is given in Section 3. We present our simulations and experiments in Section 4 along with some results and analysis. The conclusion of this work is given at Section 5.

II. Mobile Adhoc Networks

A wireless network in general consists of a set of mobile hosts which communicate to other mobile hosts either directly or via an access point (base station) [1].

Wireless networks have many advantages:

- Mobile users are provided with access to real-time information even when they are away from their home or office.
- Setting up a wireless system is easy and fast and it eliminates the need for pulling out the cables through walls and ceilings.
- Network can be extended to places which can’t be wired.
- Wireless networks offer more flexibility and adapt easily to changes in the configuration of the network [2].
- Yet, on the other hand, its main disadvantages are:
- Interference due to weather, other radio frequency devices, or obstructions like walls.
- The total throughput is affected when multiple connections exists [2].

Wireless networks can be either infrastructure where wireless hosts can be connected with the wireless system by the base stations, or infrastructureless where each mobile node communicate each other without need of any base station.

A. Mobile Ad hoc NETworks (MANETs)

The idea of ad hoc networking goes back to the U.S. Defense Advanced Research Projects Agency (DARPA) packet radio network, which was used in the 1970s. An ad-hoc network is a collection of wireless mobile hosts forming a temporary network without the aid of any stand-alone infrastructure or centralized administration [3][4]. Mobile Ad-hoc networks are self-organizing and self-configuring multihop wireless networks, where the structure of the network changes dynamically [5]. This is mainly due to the mobility of nodes. Nodes in these networks cooperate in a friendly manner to engaging themselves in multihop forwarding. The absence of centralized administration obliges nodes to act as hosts and router in the same time in order to route data to/from nodes in network.

1) *MANETs Architecture*

The architecture of an Ad Hoc network can be divided into two types: peer-to-peer structure and hierarchical structure [3][4].

a) *Peer-to-peer*

In this structure, each mobile node has the same status. Each node can move randomly and establish point-to-point wireless connection with each other, automatically. Information can be exchanged among the nodes, directly [6][7].

b) *Hierarchical*

In this type, the whole network is organized into different clusters. Each cluster is a subnet and includes one cluster head with multiple cluster members. The cluster head and cluster members move randomly and are self-organized, and use the same radio frequency to connect with each other. However the cluster head use another radio frequency to communicate with the other cluster heads. In the hierarchical structure, the status of the cluster head is more important than the cluster members. This cluster heads link among themselves to provide the backbone of an Ad Hoc network. The traffic flow is higher in the backbone than on the other links. Thus, some cluster members that are located far away from the backbone, do not need to participate in some of the routing processes [8].

2) *MANETs routing protocols*

a) *Proactive*

- Maintain routing information independently of need for communication
- Update messages send throughout the network periodically or when network topology changes.
- Low latency, suitable for real-time traffic
- Bandwidth might get wasted due to periodic updates [9].

b) *Reactive*

- Discover route only when you need it
- Saves energy and bandwidth during inactivity
- Can be bursty -> congestion during high activity
- Significant delay might occur as a result of route discovery
- Good for light loads, collapse in large loads [9].
- Hybrid
- Proactive for neighborhood, Reactive for far away (Zone Routing Protocol, Haas group)
- Proactive for long distance, Reactive for neighborhood (Safari)
- Attempts to strike balance between the two [9].

3) *MANET challenges*

a) *Quality of Service (QoS)*

Providing different quality of service levels in a constantly changing environment will be challenge [9]. The inherent stochastic feature of communications quality in a MANET makes it difficult to offer fixed guarantees on the services offered to a device. An adaptive QoS must be implemented over the traditional resource reservation to support the multimedia services.

b) *Routing*

Since the topology of the network is constantly changing, the issue of routing packets between any pair of nodes becomes a challenging task, because routes between nodes may potentially contain multiple hops, which is more complex than the single hop communication [9].

c) *Security and reliability*

An ad hoc network has its particular security problems due to nasty neighbor relaying packets [9]. The feature of distributed operation requires different schemes of authentification and key management. Further, wireless link characteristics introduce also reliability problems, because of the limited wireless transmission range, the broadcast nature of the wireless medium, mobility induced packet losses, and data transmission errors.

d) *Internetworking*

Addition to the communication within an ad hoc network, inter-networking between MANET and fixed networks is often expected in many cases [9]. The coexistence of routing protocols in such a mobile device is a challenge for the harmonious mobility management.

e) *Power consumption*

For most of the mobile terminals, the communication-related functions should be optimized for lean power consumption [9]. Conservation of power and power-aware routing must be taken into consideration.

B. *Quality of Service in MANET*

Quality of Service (QoS) support in MANETs has become an important requirement, However, is unlike that of the wired network or the cellular network because wireless bandwidth is shared among neighboring nodes and the network topology continuously changes with node mobility. This condition requires extensive collaboration between the nodes, both to establish the route and to secure the resources necessary to provide the QoS [10].

a) *Definition of QoS*

QoS is defined as a set of service requirements to be met by the network while transporting a packet stream from source to destination. Intrinsic to the notion of QoS is an agreement or a guarantee by the network to provide a set of measurable pre-specified service attributes to the user in terms of delay, jitter, available bandwidth, packet loss, and so on. As in the Internet, mobile ad hoc networks are designed to support the best-effort service with no guarantees of associated QoS. Therefore, when a packet is lost in a mobile ad hoc network, the sender simply retransmits the lost packet. This is an efficient method for applications requiring no QoS, but simple end-to-end retransmission is inadequate for real-time applications that are sensitive to packet loss, delay, bandwidth availability, etc [10].

b) QoS parameters

QoS metrics could be defined in terms of one or a set of parameters:

- delay,
- bandwidth,
- packet loss,
- Throughput,
- delay-jitter, etc.

c) QoS Models for MANETs

IntServ (Integrated Services)

The IntServ model merges the advantages of two different paradigms: datagram networks and circuit switched networks. It can provide a circuit-switched service in packet switched networks. The Resource Reservation Protocol (RSVP) was designed as the primary signaling protocol to setup and maintain the virtual connection. RSVP is also used to propagate the attributes of the data flow and to request resources along the path. Routers finally apply corresponding resource management schemes to support QoS specifications of the connection. Based on these mechanisms, IntServ provides quantitative QoS for everyflow [11].

DiffServ (Differentiated Services)

DiffServ was designed to overcome the difficulty of implementing and deploying IntServ and RSVP in the Internet backbone and differs in the kind of service it provides. While IntServ provides per-flow guarantees, Differentiated Services (DiffServ) follows the philosophy of mapping multiple flows into a few service levels. At the boundary of the network, traffic entering a network is classified, conditioned and assigned to different behaviour aggregates by marking a special DS (Differentiated Services) field in the IP packet header (TOS field in IPv4 or CLASS field in IPv6). Within the core of the network, packets are forwarded according to the per-hop behaviour (PHB) associated with the DSCP (Differentiated Service Code Point). This eliminates the need to keep any flow state information elsewhere in the network [11].

2) The need of QoS in MANETs

Applications have special service requirements [12]:

a) VoIP: delay, jitter, minimum bandwidth

- Needs intelligent buffer handling and queueing
- High mobility of users and network nodes

b) Routing traffic is important

- No retransmission of lost broadcast messages
- Routing contol messages must be prioritized
- For use in emergency and military operations

c) User traffic prioritization is needed

- user, role, situation etc
- Wireless bandwidth and battery capacity are scarce resources
- Need efficient resource usage.
- E.g. only route high priority traffic through terminals that are low on power.
- Need QoS aware routing.

3) Why QoS is hard in MANETs

Quality of Service in MANETs is different than regular networks due to [12]:

a) Dynamic network topology

- Flow stop receiving QoS provisions due to path disconnections
- New paths Must be established, causing data loss and delays

b) Imprecise state information

- Link state changes continuously
- Flow states change over time

c) No central control for coordination

d) Error-prone shared medium

e) Hidden terminal problem

f) Limited resources availability

- Bandwidth, battery life, storage, processing capabilities.

g) Insecure medium.

III. AODV AND DSDV ROUTING PROTOCOLS

Proactive protocols are based on periodic exchange of control messages and maintaining routing tables. In reactive protocols, a route is discovered only when it is necessary. For comparison purpose, we present two different protocols: the DSDV protocol (Destination-Sequenced Distance-Vector) and AODV protocol(Ad hoc On demand Distance Vector).

A. The difference between proactive and reactive protocols

1) Proactive protocols

These protocols based on periodic exchange of control messages and maintaining routing tables, each node maintains complete information about the network topology locally, This information is collected through proactive exchange of partial routing tables stored at each node. Since each node knows the complete topology, a node can immediately find the best route to a destination, however, a proactive protocol generates large volume of control messages and this may take up a large part of the available bandwidth, The control messages may consume almost the entire bandwidth with a large number of nodes and increased mobility.

2) Reactive protocols

A route is discovered only when it is necessary, the protocol tries to discover a route only on-demand, when it is necessary, These protocols generate much less control traffic at the cost of latency, i.e., it usually takes more time to find a route compared to a proactive protocol.

B. DSDV protocol

In distance vector each node only monitors the cost of its outgoing links, but instead of broadcasting this information to all nodes, it periodically broadcasts to each of its neighbors an estimate of the shortest distance to every other node in the network. The receiving nodes then use this information to recalculate the routing tables, by using a shortest path algorithm.

1) Definition

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 [2].

2) Properties

Because DSDV is dependent on periodic broadcasts it needs some time to converge before a route can be used. This converge time can probably be considered negligible in a static wired network, where the topology is not changing so frequently. In an ad hoc network on the other hand, where the topology is expected to be very dynamic, this converge time will probably mean a lot of dropped packets before a valid route is detected. The periodic broadcasts also add a large amount of overhead into the network [8].

3) Basic Mechanism

- DSDV is a hop-by-hop distance vector routing protocol requiring each node to periodically broadcast routing updates. It guarantees loop-freedom.
- Each DSDV node maintains a routing table listing the “next hop” for each reachable destination.
- DSDV tags each route with a sequence number and considers a route more favorable than other if R has a greater sequence number or if the two routes have equal sequence numbers but R has a lower metric.
- If a route is broken then a message with infinite metric and sequence number one greater than the sequence number of the route is advertised [9].

4) Implementation Decisions

- Link layer breakage detection from the 802.11 MAC was not used because of severe performance problem.
- Many packets can be lost due to this mechanism as infinite metric is broadcasted to each node about link break.
- DSDV-SQ (sequence number): receipt of a new sequence number causes triggered update.
- This enables to detect the broken link and creation of alternative route because new sequence number is being propagated.
- DSDV: only the receipt of a new metric should cause a triggered update, and that the receipt of a new sequence number is not sufficiently important to incur the overhead of propagating a triggered update.
- DSDV-SQ is much more expensive in terms of overhead; it provides a much better packet delivery ratio in most cases.
- DSDV is more prone to packet drops [9].

5) DSDV (Route Advertisements)

a) Advertise to each neighbor own routing information

- Destination Address
- Metric = Number of Hops to Destination
- Destination Sequence Number

b) Rules to set sequence number information

- On each advertisement increase own destination sequence number (use only even numbers)
- If a node is no more reachable (timeout) increase sequence number of this node by 1 (odd sequence number) and set metric = ∞ [13].

6) DSDV (Route Selection)

a) Update information is compared to own routing table

- Select route with higher destination sequence number (This ensure to use always newest information from destination)
- Select the route with better metric when sequence numbers are equal[13].
- Assign the metric of this link to ∞ and increases the sequence number of this link by 1; Then it increases its own sequence number by 2 and immediately broadcasts an incremental update

7) 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.

8) Limitations of DSDV

– Waste 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.

C. AODV protocol

The Ad hoc On-Demand Distance Vector (AODV) routing protocol is designed for mobile ad hoc networks (MANETs) and other wireless ad-hoc networks with large numbers of mobile nodes. The protocol's algorithm creates routes between nodes only when the routes are requested by the source nodes, giving the network the flexibility to allow nodes to enter and leave the network as will. Routes remain active only as long as data packets are traveling along the paths from the source to the destination. If the source stops sending packets, the path will time out and close. AODV was developed at the Nokia Research Center of University of California, Santa Barbara and University of Cincinnati by C. Perkins and S. Das [10].

1) How AODV works

AODV utilizes routing tables to store routing information; one routing table for uncast routes as well as one for multicast routes. These tables hold information like: destination address, next-hop address, hop count, destination sequence number, and life time.

AODV discovers routes as needed and when it is necessary, which means no need to maintain routes from every node to all other nodes. And routes should be maintained as long as it’s necessary. AODV nodes have four types of messages to communicate between each other:

– Route Request (RREQ)

– Route Reply (RREP)

– Route Error (RERR)

– HELLO messages

– RREQ and RREP messages are used for route discovery, whereas RERR and HELLO messages are used for route maintenance [10].

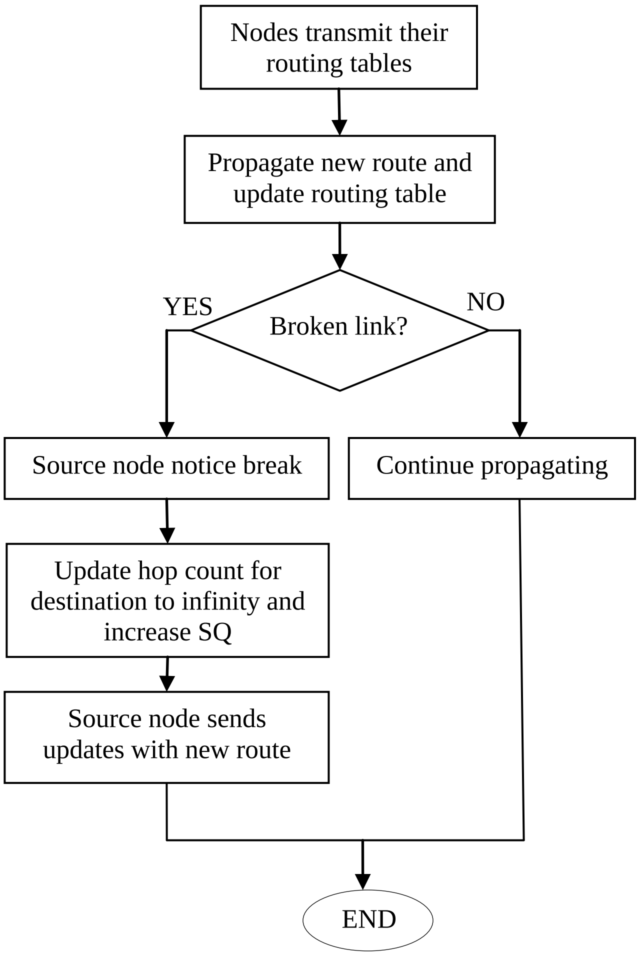


Figure 1: DSDV Flowchart

2) Properties

– AODV discovers routes as and when necessary. It does not maintain routes from every node to every other [11].

– Routes are maintained just as long as necessary.

– Every node maintains its monotonically increasing sequence number which increases every time the node notices change in the neighborhood topology.

– AODV utilizes routing tables to store routing information

– A Routing table for unicast routes

– A Routing table for multicast routes

– The route table stores: <destination addr, next-hop addr, destination sequence number, life_time>

– For each destination, a node maintains a list of precursor nodes, to route through them. Precursor nodes help in route maintenance (more later) Life-time updated every time the route is used. If route not used within its life time, it expires [11].

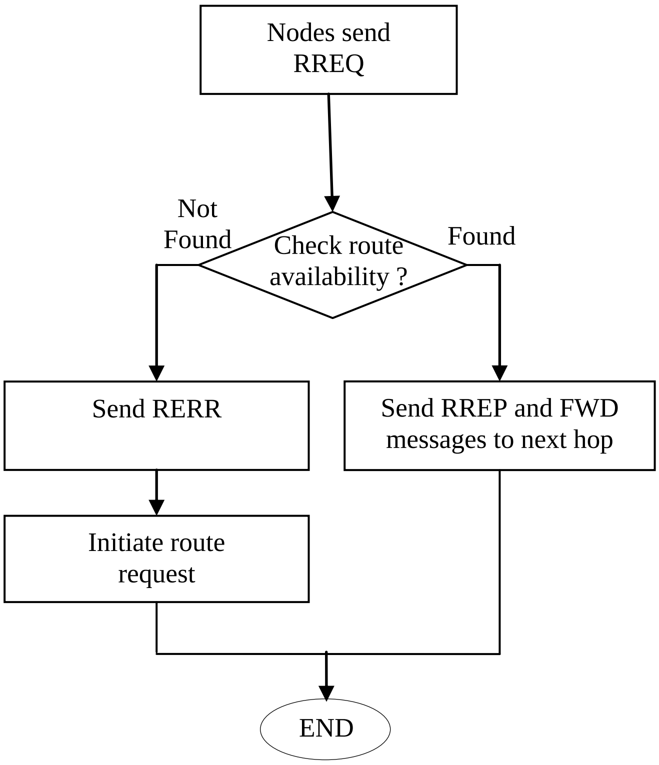


Figure 2. AODV Flowchart

IV. SIMULATIONS, RESULTS, COMPARISON AND ANALYSIS

This section described the simulation tool, Simulation parameters and simulation results. The QoS of proactive and reactive routing protocols is evaluated on the basis of three metrics: Throughput, Packet lossratio, and delay. This simulation of proactive and reactive routing protocols is done by using network simulator2 (NS2) software due to its simplicity and availability. NS is a discrete event Simulator targeted at networking research. NS provides substantial support for simulation of TCP, routing, and multicast protocols over wired and wireless (local and satellite) networks.

A. Simulation Tools

The Network Simulator 2 (NS-2) is a free computer program with a large pool of libraries, written both in Tcl/OTcl and C/C++, for the purpose of simulating networks. Those libraries include variety of protocols such as TCP, routing, multicast, MAC protocols, and architectures.

AWK programming is like any other high level programming. Since we have to only deal with reading text files and extracting relevant results, we can limit ourselves with learning simple features of the language like defining variables, reading files and displaying results. Since there are different trace formats, the same AWK code will not work for all trace files, however the basic concept is the same. AWK identifies the strings separated by tabs and spaces on a single line in the text as a single unit and accordingly designates those numbers.

B. Simulation environment

The overall goal of this simulation study is to analyze and compare the QoS of DSDV and AODV routing protocols for mobile ad hoc networks. The simulation has been performed using the NS-2 simulator. Simulation with NS-2 basically consist two types of files as an input to simulator, A scenario file that describe the movement of mobile nodes and a communication file that describe the traffic in the network. Simulation is performed to measure the performance of DSDV and AODV routing protocols over

- Changing the number of nodes,
- Changing time of simulation and
- Changing speeds.

CBR, Pareto and Exponential traffic models are used, and 1000-byte data packet.

1) Traffic Generators

A traffic generator models user behavior which follows a predefined schedule. In particular, it sends a demand to transmit one burst of user payload to an attached agent at a time specified in the schedule, regardless of the state of the agent. In NS2, there are four main traffic generators:

a) Constant Bit Rate (CBR)

Send a fixed size payload to the attached agent. By default, the interval between two payloads (i.e., the sending rate) is fixed, but it can be optionally randomized.

b) Exponential On/Off

Send fixed size payloads for every randomized intervalto an attached agent during an ON period. Stop sending during an OFF period. ON and OFF periods are exponentially distributed, and area alternated when one period terminates.

c) Pareto On/Off

Similar to the Exponential On/Off traffic generator. However, the durations of ON and OFF periods follow a Pareto distribution.

2) Simulation scenarios

TABLE I. SIMULATION SCENARIO 1 – VARYING NUMBER OF NODES

Simulation Environment	
Simulation Time	200sec
Area Size	1000 x 1000
Queue Length	5
Speed	10
Traffic Parameters	
Type	CBR
Packet Size	1000 bytes
Interval	0.002
Number of Nodes	
10, 15, 20, 25, 30,	35, 40, 45, 50

TABLE II. SIMULATION SCENARIO 2 – VARYING NODES SPEED

Simulation Environment	
Simulation Time	200sec
Area Size	1000 x1000
Queue Length	5
Number of Nodes	50
Traffic Parameters	
Type	CBR
Packet Size	1000 bytes
Interval	0.002
Speeds	
10, 20, 30, 40, 50,	60, 70, 80, 90, 100

TABLE III. TABLE 3: SIMULATION SCENARIO 3 – VARYING SIMULATION TIME

Simulation Environment	
Simulation Time	200sec
Area Size	1000x1000
Queue Length	5
Number of Nodes	50
Traffic Parameters	
Type	CBR
Packet Size	1000 bytes
Interval	0.002
Time of Simulation	
200, 400, 600,	800, 1000

C. Performance Metrics

The following metrics are used in this paper for the performance analysis of AODV, DSDV Routing protocols:

1) Throughput

Throughput can be defined as how many data packets received by receiver with in data transmission time or successful data transmission performed within a time period. In any network throughput is average rate of successfully data packet delivered from source node to destination node.

Throughput is represented in bits/bytes per second. In any network higher throughput is most essential factor.

Throughput = Total Received Bytes / Elapsed Time

2) Packet loss radio

In the transmission, some of the packets may be lost due to the overflow of the queue.

Loss Packets= ∑ bytes lost in each node / ∑number of connection

3) Delay

End to End delay of data packet is time taken by the packet from source node to destination node. End to end delay time include all the delay taken by router to seek the path in network consumption, propagation delay, processing delay and End to end delay for packet p which was sent by the node n.

Delay= ∑delay occur between each pair of nodes / ∑number of connection

D. Results and Discussion

Using Awk, we analyze the simulation trace files then the results are represented graphically using histograms of MATLAB.

1) Static case

The next figure shows the packet delay versus number of nodes over three traffic type: CBR, Pareto and Exponential.

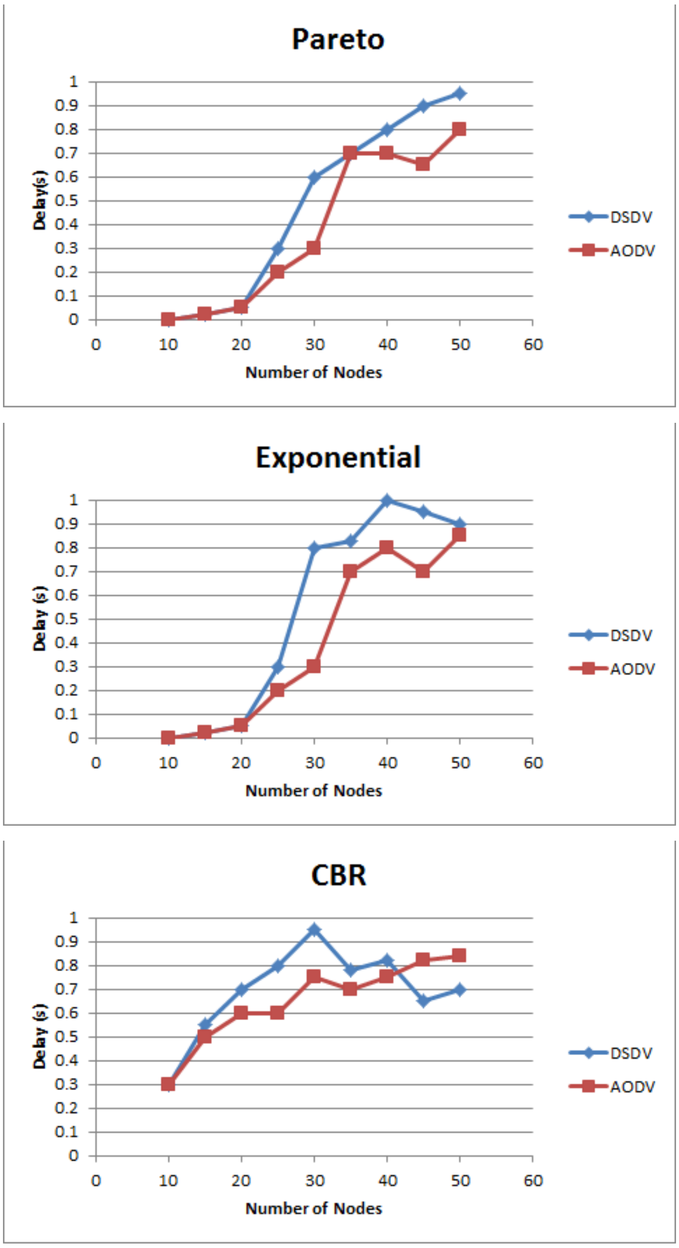


Figure 3. Delay vs. number of nodes

The previous figure shows that for both protocols AODV and DSDV the delay increases when the number of nodes is increases in the three traffic types. Yet, the delay in DSDV was less than AODV.

The next figure represents the histogram of average delay in the three traffic types.

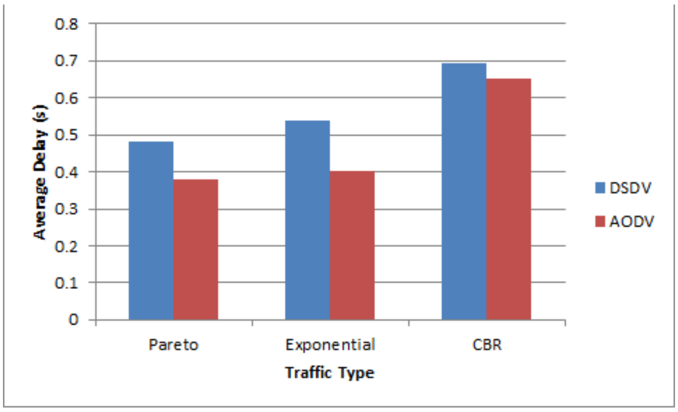
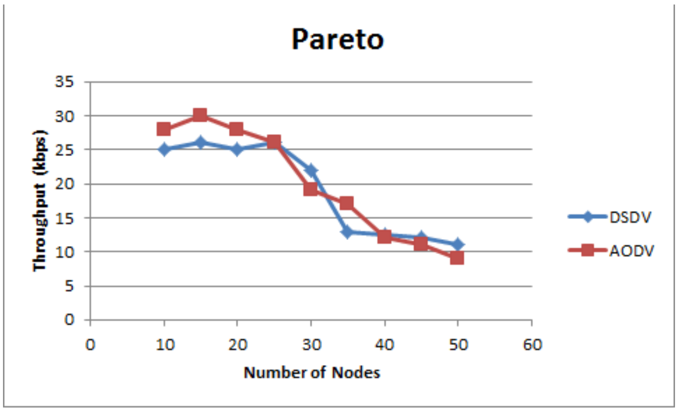
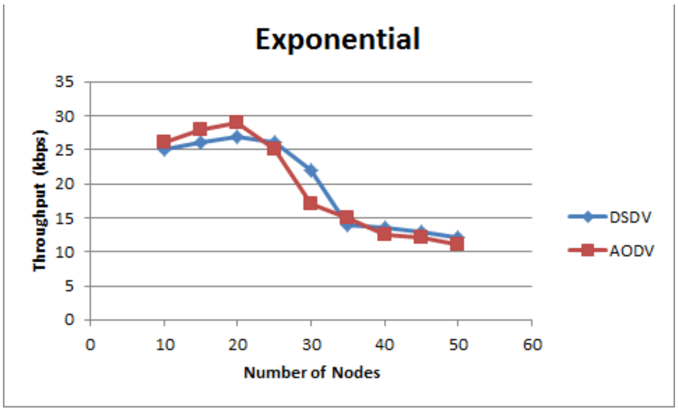


Figure 4. Average delay vs. traffic types

The next figure shows the throughput versus number of nodes over different traffic types:





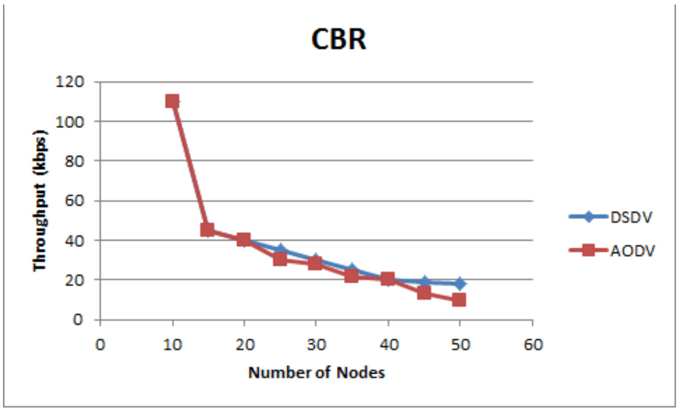


Figure 5. Throughput vs. number of nodes

The above figure shows that the number of nodes increases when the throughput decreases for both protocols AODV and DSDV over the three traffic types. Yet, the graph shows clearly that the AODV has a higher throughput.

The next histogram represents the average throughput versus traffic types.

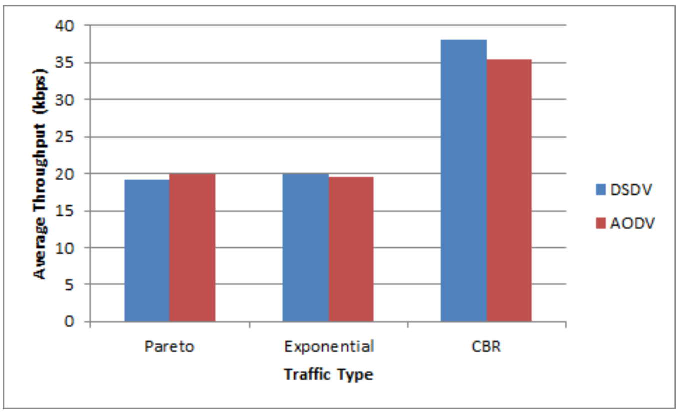
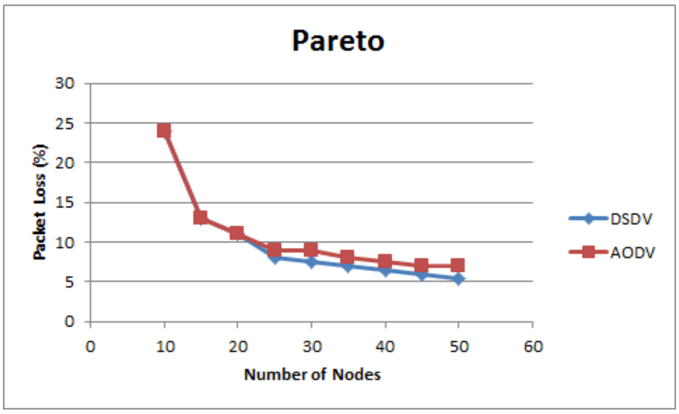


Figure 6. Average throughput vs. traffic types

The next figure shows the packet loss versus number of nodes over the three traffic types.



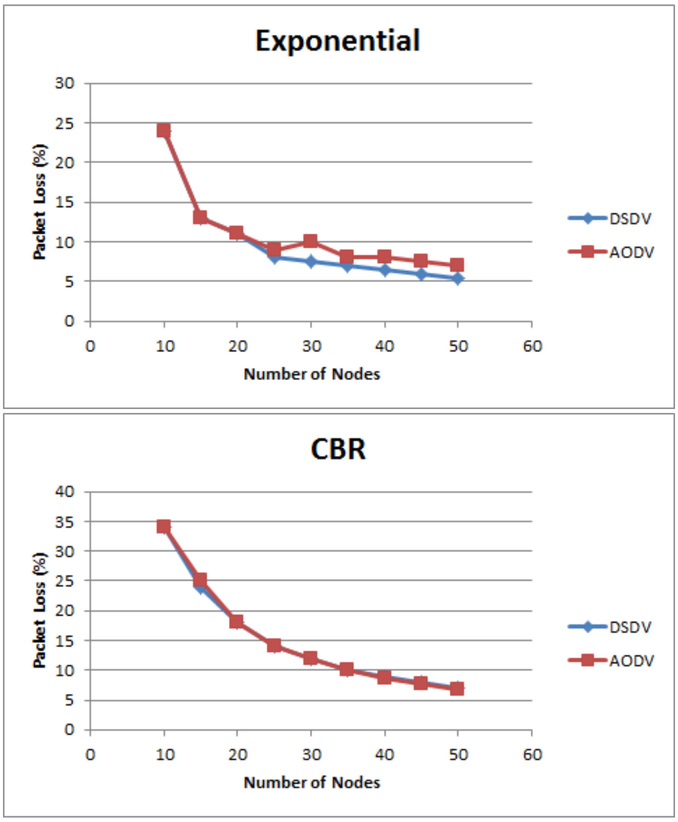


Figure 7. Packet loss vs. number of nodes.

For both protocols AODV and DSDV, as number of nodes increases, packet loss decreases, and almost identical in the three traffic types.

The next histogram represents the average packet loss versus traffic types.

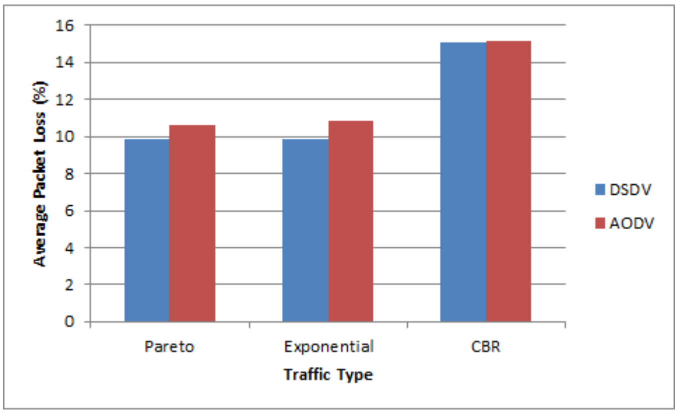


Figure 8. Average packet loss vs. traffic types.

2) Dynamic case:

The next graph represents the average delay versus number of nodes for the three traffic types.

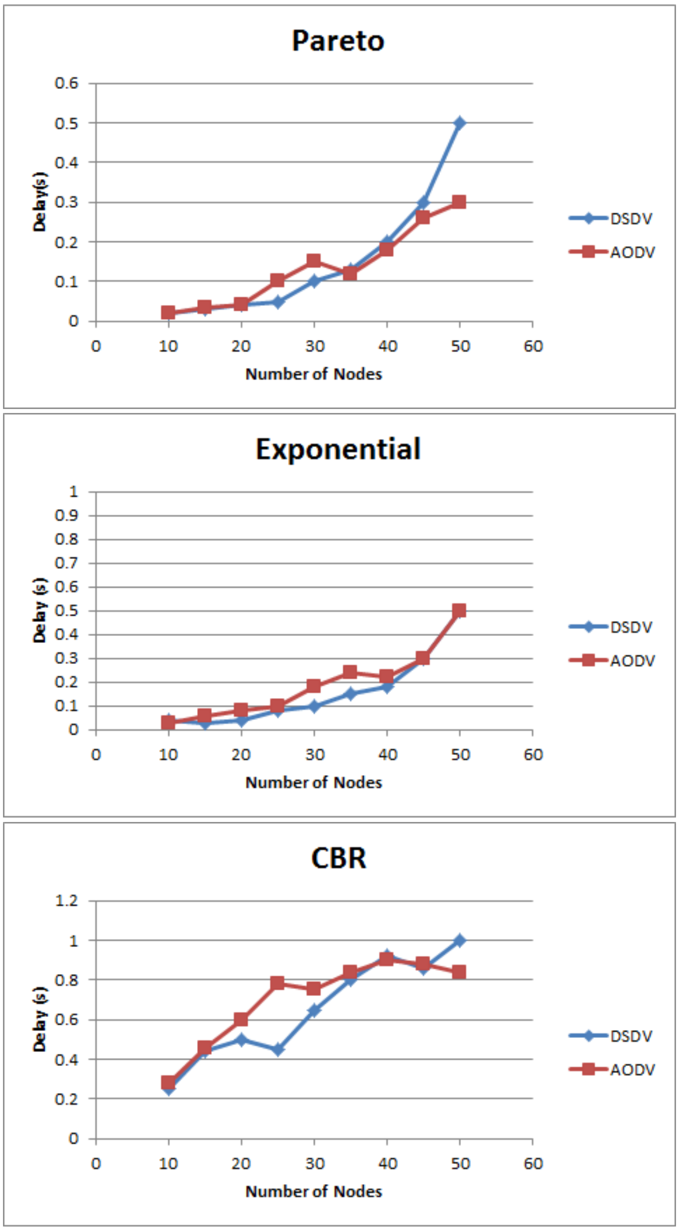


Figure 9. Delay vs. number of nodes

We observed that delay increases as the number of nodes increase for both protocols AODV and DSDV and in the three traffic types.

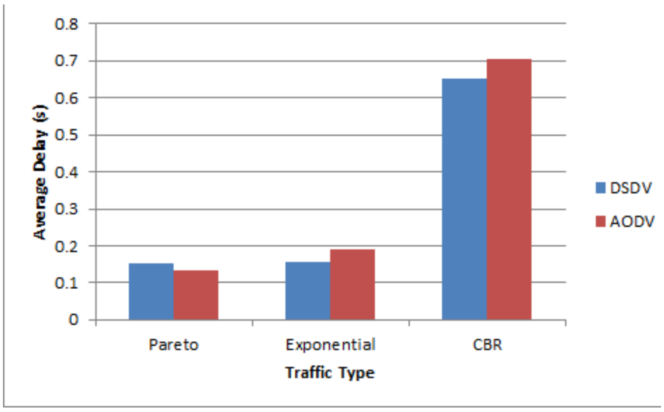
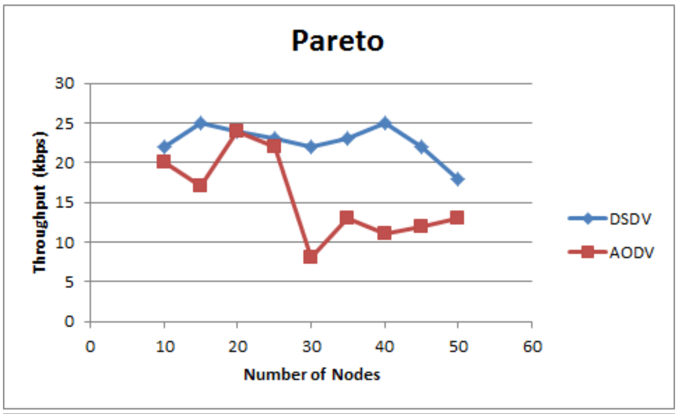
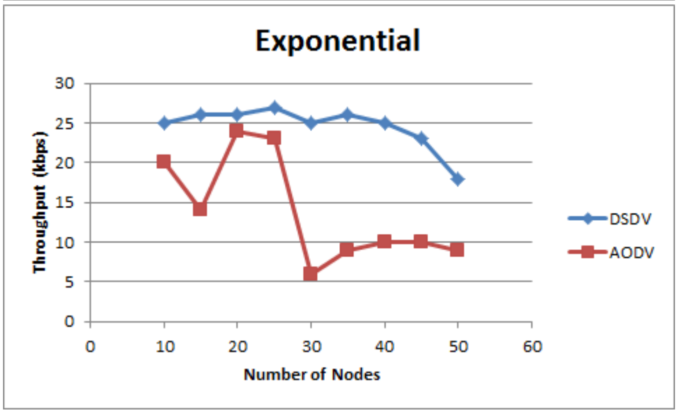


Figure 10. Average delay vs. traffic types.

The next graph represents the throughput versus number of nodes for the three traffic types.





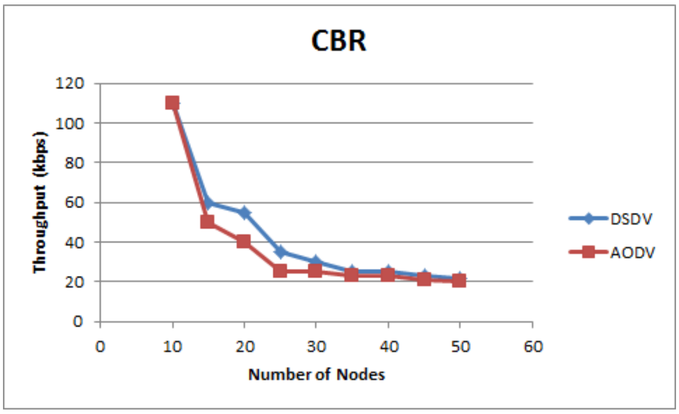


Figure 11. Throughput vs. number of nodes.

The above figure shows that for CBR traffic, the throughput decreases as number of nodes increases for both protocols. But for pareto and exponential traffic throughput is decreased as number of nodes increases in DSDV protocol.

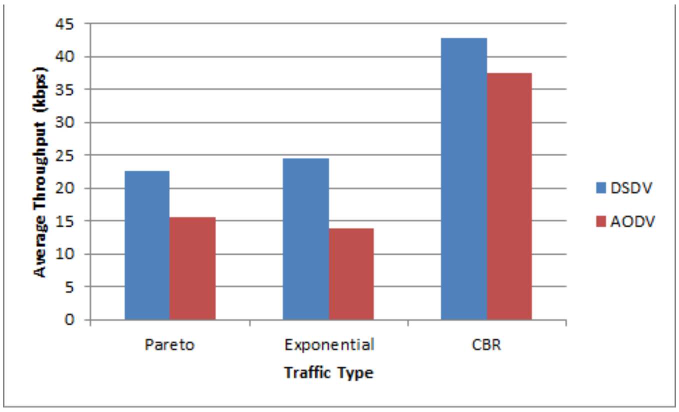
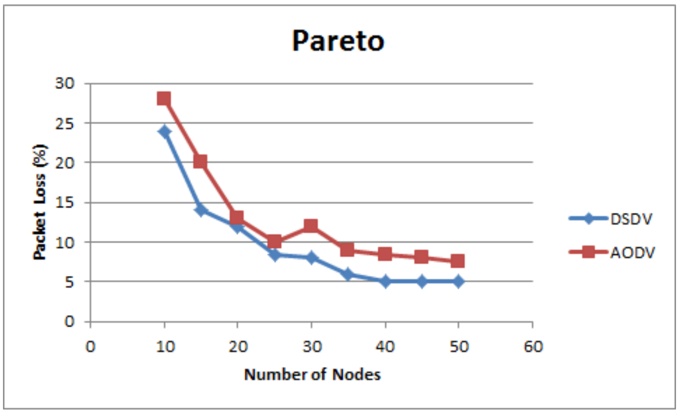


Figure 12. Average delay vs. traffic types

The next figure represents the packet loss versus number of nodes for the three traffic types.



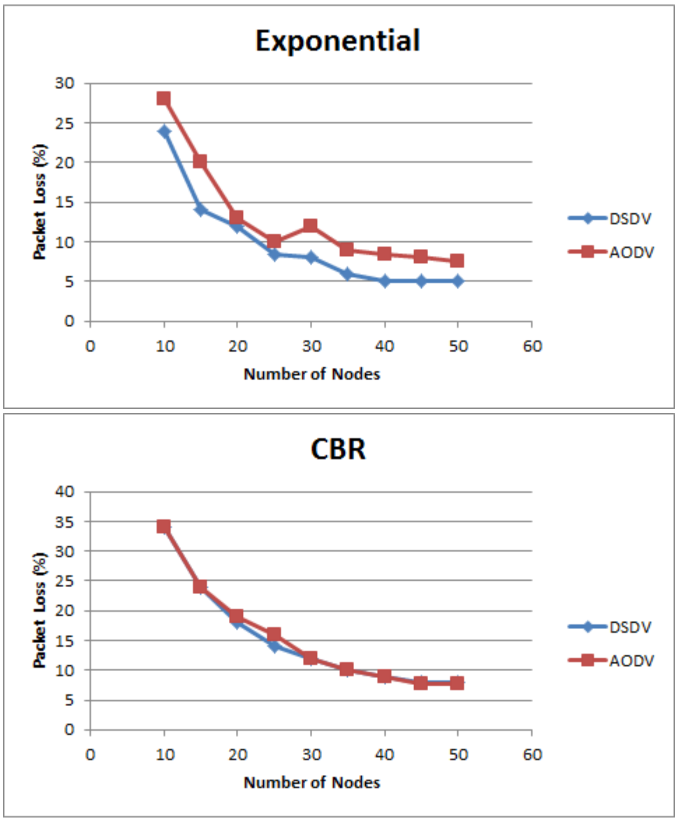


Figure 13. Packet loss vs. number of nodes

For both protocols as number of nodes increases packet loss decreases for the three traffic types and it is identical in CBR traffic.

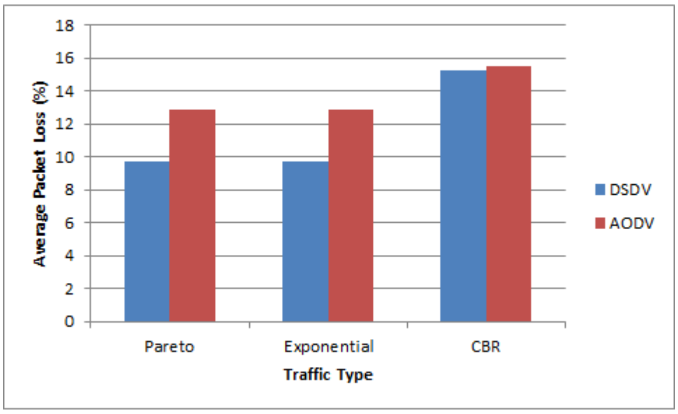


Figure 14. Average delay vs. traffic types

The next figure represents the average delay, packet loss and throughput versus time of simulation for CBR traffic.

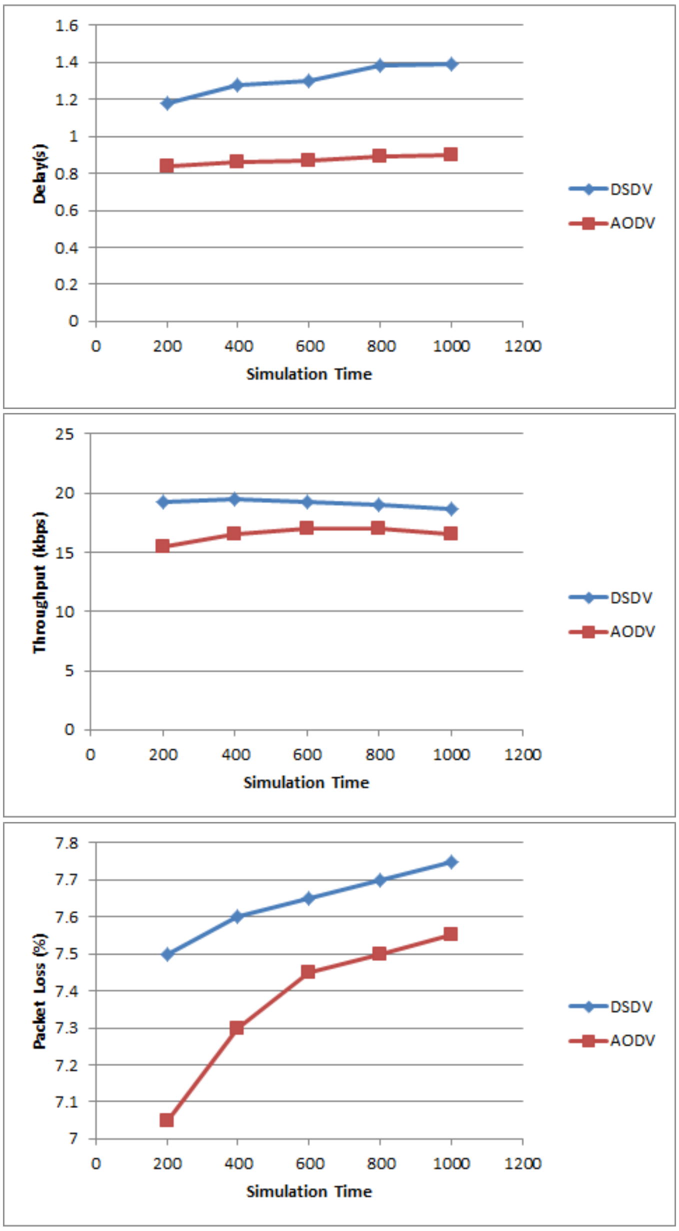


Figure 15. Delay, packet loss and throughput vs. time of simulation

We observed that for both protocols, as time of simulation increases, the average delay and packet loss increases. But the throughput increases as time of simulation increase for AODV protocol. However, for DSDV protocol, as time of simulation increases, the throughput was stable. For the three metrics (delay, packet loss and throughput), AODV protocol it still less than DSDV protocol.

The next figure represents the average delay, packet loss and throughput versus speed for CBR traffic.

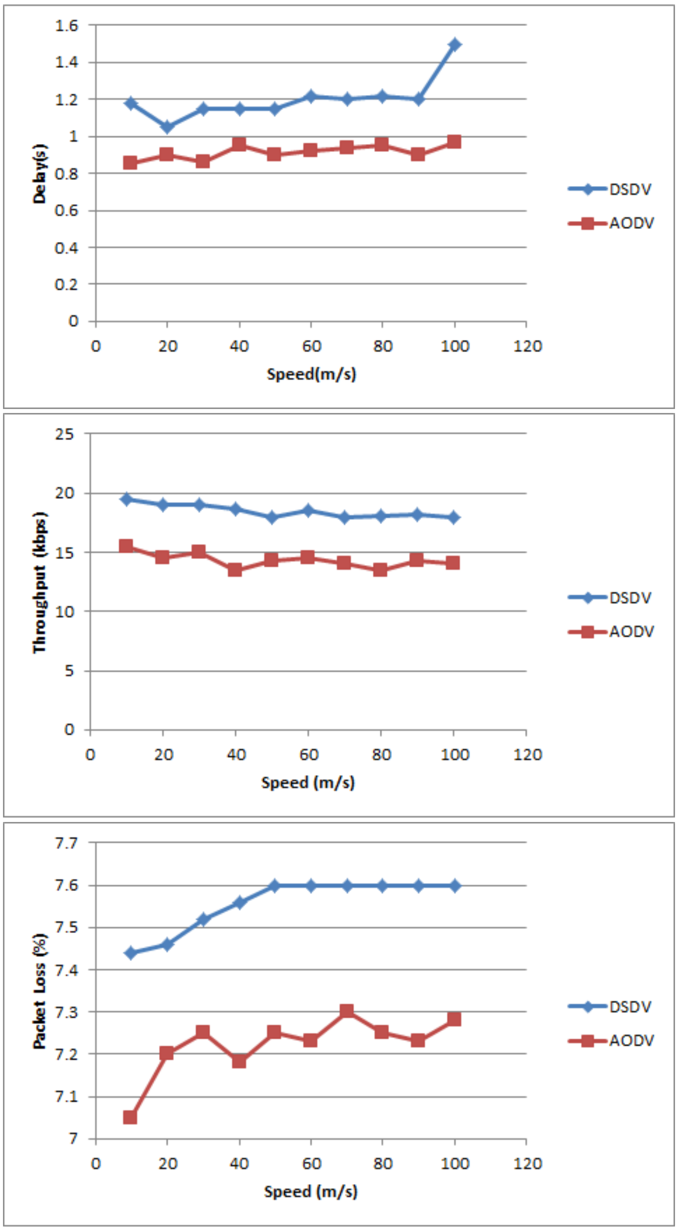


Figure 16. Delay, packet loss and throughput vs. speeds

For both protocols as speed increases, delay and packet loss are slightly increases. On the other hand, the throughput slightly decreases as speed increases, but the AODV protocol is lesser than DSDV protocol for the three metrics.

V. CONCLUSION

In this paper, the Quality of service (QoS) of DSDV and AODV routing protocols were measured using the different performance metrics such as throughput, average end-to-end delay and packet loss ratio under three different scenarios while changing number of nodes, speed and time of simulation.

We observed that the QoS of AODV routing protocols is much higher compared to the DSDV routing protocol in terms of delay and packet loss while changing speeds and time of simulation, but DSDV was better than AODV in term of throughput while changing the number of nodes. This was due to the frequent routing information broadcasting. Both protocols showed almost the same results in some cases but it was observed that performance of AODV became much better compared to DSDV routing protocol.

As a conclusion, the AODV on-demand routing protocol for mobile ad hoc networks has a better QoS compared to DSDV while changing speed, time of simulation and number of nodes. As a future work, we suggest to compare other routing protocols and involve other quality of service metrics such as jitter.

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