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# Performance Comparison of AODV, DSDV & DSR Routing Protocols in MANET

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***Abstract— A mobile ad hoc network (MANET) is an infrastructure less, autonomous, and standalone network. In such a network nodes arbitrarily change their positions resulting in a highly dynamic topology causing wireless links to be broken and re-established on the-fly. Every node in MANET has the responsibility to act as a router. Hence routing in MANET has been a challenging task ever since the wireless networks came into existence. 'In this paper three routing protocols AODV (Ad- Hoc on-Demand Distance Vector), DSDV (Destination Sequenced Distance-Vector) and DSR (Dynamic Source Routing) Protocols are compared'. The metrics used for performance analysis are Throughput and Normalized Routing Load.***

***Keywords— AODV, DSR, DSDV, MANET, NS-2.35.***

## I. Introduction

There are currently two variations of mobile wireless networks. The first is known as the infrastructured network (i.e., a network with fixed and wired gateways). The bridges for these networks are known as base stations. A mobile unit within these networks connects to, and communicates with, the nearest base station that is within its communication radius. As the mobile travels out of range of one base station and into the range of another, a "handoff" occurs from the old base station to the new, and the mobile is able to continue communication seamlessly throughout the network. Typical applications of this type of network include office wireless local area networks (WLANs). The second type of mobile wireless network is the infrastructureless mobile network, commonly known as an adhoc network. Infrastructureless networks have no fixed routers; all nodes are capable of movement and can be connected dynamically in an arbitrary manner. Nodes of these networks function as routers which discover and maintain routes to other nodes in the network. Example applications of adhoc networks are emergency search-and-rescue operations, meetings or conventions in which persons wish to quickly share information, and data acquisition operations in inhospitable terrain. MANET is a self configuring network and the topology of the network keeps on changing as the nodes move randomly and organize themselves in an arbitrarily manner. In order to facilitate communication within the network, a routing protocol is used to discover routes between nodes. Due to higher mobility in nodes and dynamic infrastructure of MANETS, Routing is important issue in ad hoc networks [1]. A number of protocols have been developed to accomplish this task.

## II. Related Work

Several researchers have done the quantitative and qualitative analysis of Ad hoc Routing Protocols by means of different performance parameters.

1.Charles E. Perkins, Elizabeth M. Royer, Samir R. Das and Mahesh K. Marina [2] ,compared the performance of two prominent on-demand routing protocols for mobile ad hoc networks: Dynamic Source Routing (DSR) and Ad Hoc On-Demand Distance Vector Routing (AODV). They analyzed that even though DSR and AODV share similar on demand behavior, the differences in the protocol mechanics can lead to significant performance differentials. The performance differentials are analyzed using varying network load, mobility, and network size.

2. Banoj Kumar Panda, Manoranjan Das, Benudhar Sahu and Rupanita Das [3] Described a detailed analysis of performance affected due to change in mobility in different terrain area. The parameter describing the reason of variation in performance is the number of packets delivered. Using GloMoSim simulator different performance parameters related to the AODV & DSR routing protocol are calculated and analyzed. They observed that in the Low terrain area and high density network the number of link break in AODV & DSR is comparatively less. In medium terrain area node density is comparatively less than low terrain area network. As the area increases link break also increases. So in high mobility condition AODV performance is better than DSR. In medium and low mobility condition DSR performance improves still AODV outperform DSR. In large terrain area node density is low; link break is very high the Packet delivery fraction of both the protocols still decreases in compare to low and medium terrain area.

3. Laxmi Shrivastava, Sarita S.Bhadauria, G.S.Tomar [4] presented their observations regarding the performance comparison of the AODV, DSDV & DSR routing protocols for varying traffic load in mobile ad hoc networks (MANETs). They performed extensive simulations, using NS-2 simulator. Their studies have shown that reactive protocols (AODV, DSR) perform better than proactive (DSDV) protocols.

4. Kapil Suchdeo, Durgesh Kumar Mishra [5] compared two on-demand routing protocol namely Ad hoc on demand distance vector (AODV) and Dynamic source routing (DSR) protocol. Performance is compared on the parameters like Packet delivery fraction, Average end to end delay and Normalized routing overhead using network simulator-2. The performance analysis is done by varying mobility pattern (pause time and speed) and traffic pattern (sending rate). Results of their work shows that DSR has performed slightly better than AODV for performance parameters like Packet Delivery Ratio and Normalized Routing Overload but performed slightly poor in terms of Average Delay. This might be due to fact that DSR uses route cache very aggressively.

5. Nidhi Sharma, Sanjeev Rana, R.M. Sharma [6] compared the two popular algorithms Ad-hoc on Demand Distance Vector (AODV) and Dynamic Source Routing (DSR), both being reactive routing protocols. They analyzed and compared their performance through simulation using NS2 simulator. They used performance metrics- packet delivery rate, average time delay and routing load overhead by varying network size and transmission range of the respective nodes.

6. Mehdi Barati, Kayvan Atefi, Farshad Khosravi and Yashar Azab Dafial [7] compared performance of Dynamic Source Routing (DSR) and Ad hoc On-Demand Distance Vector (AODV) routing protocols with respect to average energy consumption and routing energy consumption are explained thoroughly. Then, an evaluation of how the varying metrics in diverse scenarios affect the power consumption in these two protocols is discussed. A detailed simulation model using Network Simulator 2 (NS2) with different mobility and traffic models are used to study their energy consumption.

7. Asma Tuteja and Rajneesh Gujral [8] compared Mobile Ad-Hoc network routing protocols DSDV, AODV and DSR using network simulator NS2.34.They have compared the performance of three protocols together and individually too. The performance matrix includes PDR (Packet Delivery Ratio), Throughput, End to End Delay, Routing overhead. They compared the performance of routing protocols when packet size changes, when time interval between packet sending changes, when mobility of nodes changes.

8. P.Kuppusamy,Namakkal,Dr.K.Thirunavukkarasu and Dr.B.Kalaavathi [9] Compared characteristics of ad hoc routing protocols OLSR, AODV and TORA based on the performance metrics like packet delivery ratio, end–to–end delay, routing overload by increasing number of nodes in the network.

## III. DESCRIPTION OF ROUTING PROTOCOL

*A. Dynamic Source Routing (DSR) Protocol:*

DSR establishes a route to the destination when a source node requests one. DSR uses the source routing strategy. In this technique, the source node determines the complete sequence of nodes through which the data packets will be sent. In DSR, the source node initiates route discovery and broadcasts a route request packet. If the discovery operation is successful, the initiator receives a response packet that lists the sequence of nodes through which the destination can be reached. The route request packet thus contains a record field, which accumulates the sequence of nodes visited during propagation of the query in the network [10].

*B. Adhoc On demand Distance Vector (AODV) Routing Protocol:*

AODV is a reactive protocol that determines routes solely on-demand. It is based on the distance vector technology. The hosts only know the next hop to every destination. When a source host wants to send packets to the destination and cannot get the routes from its routing table, it will broadcast a Route Request (RREQ). The receivers may establish the routes back to the source host through the paths that they get the RREQ. If the receiver has an active route to the destination, it will be unicast a Route Reply (RREP) back to the source. Otherwise, the RREQ will be re-broadcast further. If a reply is sent, all hosts along that path may record the route to the destination through this packet. Because there may exist multiple exclusive paths between two hosts, a mobile host can receive the same RREQ more than once. To prevent the same request from being broadcast repeatedly, every request is uniquely identified by a Host ID, Broadcast ID_ couple. Every host keeps a record for the RREQs that have been processed. The mobile hosts send out the Route Error (RERR) packets to their neighbours to report broken paths and activate the route re-discovery procedure. To avoid routing loop and identify the freshness of the route, destination sequence number is introduced. The sequence number of a mobile host can only be updated by itself in monotonically increasing mode. A larger sequence number denotes a fresher route. The sequence number is carried in both RREQ and RREP. The sequence number in RREP must be larger than or equal to the one carried in corresponding RREQ to avoid the source host to adopt a stale path. When more than one path represented by different RREPs is available, the one with the largest destination sequence number is used. If several paths have the same sequence number, the shortest one is chosen. AODV's desirable features are its low byte overhead in relatively static networks and loop free routing using the destination sequence numbers [11].

*C. Destination Sequence Distance Vector (DSDV) Routing Protocol:*

The DSDV routing protocol is a proactive routing protocol, described in detail in this paper. It is based on the Bellman-Ford routing algorithm. Each node in the network maintains a routing table which contains all available destinations with associated next hop towards destination, metric and destination sequence number. Sequence number presents improvement of DSDV routing protocol compared to distance vector routing, and it is used to distinguish stale routes from fresh ones and avoid formation of route loops. Routing tables are updated by exchanging the information between mobile nodes. Each node periodically broadcasts its routing table to its neighbors. Broadcasting of the information is done in Network Protocol Data Units (NPDU) in two ways: a full dump and an incremental dump. A full dump requires multiple NPDUs, while the incremental requires only one NPDU to fit in all the information. A receiving node updates its table if it has received a better or a new route. When an information packet is received from another node, node compares the sequence number with the available sequence number for that entry. If the sequence number is larger, entry will be updated with the routing information with the new sequence number, whereas if the information arrives with the same sequence number, metric entry will be required. If the number of hops is smaller than the previous entry, new information will be updated. Update is performed periodically or when a significant change in the routing table is detected since the last update. If network topology frequently changes, a full dump will be carried out, since an incremental dump will cause less traffic in a stable network topology. Route selection is performed according to the metric and sequence number criteria. The sequence number is also the time indication that destination node sends, allowing routing table update. If we have two identical routes, the route with a larger sequence number will be saved and used, and the other will be destroyed [12].

## IV. SIMULATION ENVIRONMENT

### *A. Simulation Model:*

We have used Network Simulator (NS)-2 in our evaluation. The NS-2 is a discrete event driven simulator. NS-2 is suitable for designing new protocols, comparing different protocols and traffic evaluations. It is an object oriented simulation written in C++, with an OTcl interpreter as a frontend. NS uses two languages because simulator got to deal with two things: i) detailed simulation of protocols which require a system programming language which can efficiently manipulate bytes, packet headers and implement algorithms, ii) research involving slightly varying parameters or quickly exploring a number of scenarios [13].

### *B. Simulation Parameters:*

In our work the performance of Routing Protocols AODV, DSDV and DSR is evaluated by varying the network size (number of mobile nodes).

TABLE I
**SIMULATION PARAMETERS**

| **Parameter** | **Value** |
|---|---|
| Simulator | NS-2(Version 2.35) |
| Channel Type | Channel/Wireless Channel |
| Radio Propagation Model | Propagation/Two Ray Ground |
| Network Interface Type | Phy/Wireless Phy |
| MAC Type | Mac/802.11 |
| Interface Queue Type | Queue/DropTail/PriQueue,CMUPriqueue |
| Link Layer Type | LL |
| Antenna | Antenna/Omni Antenna |
| Maximum Packet in ifq | 50 |
| Area(M*M) | 2000*500 |
| Number of Nodes | 10,20,30,40,50 |
| Traffic Type | TCP |
| Simulation Time | 150 |
| Routing Protocols | AODV,DSDV & DSR |

## V. PERFORMANCE METRICS

There are different kinds of parameters for the performance evaluation of the routing protocols. We have used the following metrics for evaluating the performance of three routing protocols (DSDV, AODV & DSR):

### *A. Normalized Routing Load (NRL):*

NRL is the ratio of control packets to data packets in the network. It gives a measure of the protocol routing overhead; i.e. how many control packets were required (for route discovery/maintenance) to successfully transport data packets to their destinations. It characterizes the protocol routing performance under congestion. NRL is determined as:

NRL = Pc/Pd

Where Pc is the total control packets sent and Pd is the total data packets sent [10] Control packets include route requests, replies and error messages [14].

### *B. Throughput:*

The throughput is defined as the total amount of data a receiver receives from the sender divided by the time it takes for the receiver to get the last packet. The throughput is measured in bits per second (bit/s or bps) [15].

 

## VI. Simulation Result

The simulation results are shown in the following section in the form of line graphs. Graphs show comparison between the three protocols by varying different numbers of nodes on the basis of different performance metrics.

*A. Throughput*

As shown in figure 1-with increase in number of nodes, Throughput of all the protocols decreases. Performance of DSR & AODV is better than DSDV.

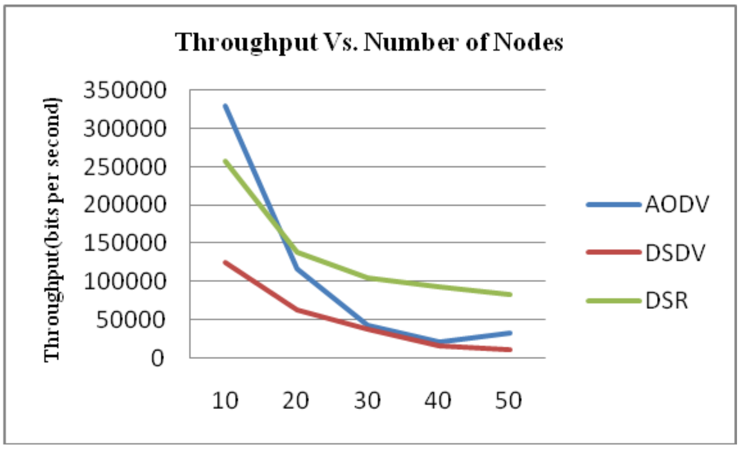


**Fig. 1 Throughput Vs. Number of Nodes**

*B. Normalized Routing Load*

Normalized Routing Load is shown in figure 2.With increase in number of nodes Normalized Routing Load also increases. According to our simulation result best performance is shown by DSR having lowest Normalized Routing Load.

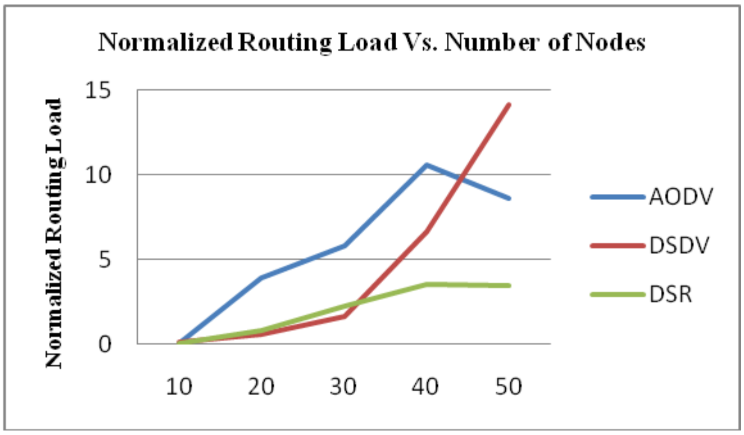


**Fig. 2 Normalized Routing Load Vs. Number of Nodes**

## VII. Conclusions

In this paper performance comparison of DSR, AODV & DSDV routing protocols for Mobile Adhoc Networks is presented as a function of number of nodes (network size).Performance of these routing protocols is evaluated with respect to performance metrics such as Normalized Routing Load & Throughput. As per our assumed scenario DSR shows best performance than AODV & DSDV in terms of Throughput & Normalized Routing Load. In the future, extensive complex simulations could be carried out using other existing performance metrics, in order to gain a more in-depth performance analysis of the adhoc routing protocols. Other new protocols performance could be studied too.

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