# PERFORMANCE ANALYSIS OF FIXED PROBABILISTIC ROUTE DISCOVERY ON AODV AND DSR IN MOBILE AD-HOC NETWORKS

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**Abstract:** *Mobile ad hoc network (manet) is a wireless network which consists of portable mobile devices such as mobile phones, personal digital assistance. Etc,. Due to mobility nature of the manet, it does not require fixed infrastructure and centralized administration. Since manet has limited radio range the sender node unable to sent the packet directly to the receiver node. So, the packet transmission depends on intermediate nodes. Therefore, the routing protocols plays important role in finding the shortest and valid route. The routing protocols are used forwards the packet from source to destination via multiple number of intermediate nodes. Most of the familiar routing protocols use the method named simple flooding for performs the route discovery process. Even though simple flooding ensures delivery of route request packet to every node in the mobile network, it results in broadcast storm problem. Hence, considering this issue in the simple flooding approach, this paper proposes an approach called probability routing in which the broadcasting is taken in the network based on the forwarding probability value. This proposed probability routing approach has been implemented in aodv (ad hoc on-demand distance vector routing) and dsr (dynamic source routing) in order to evaluate their performance in different mobility scenarios.*

*Keywords*: **Routing, MANET. DSR, AODV, Overhead, Probability**

## I. INTRODUCTION

With the basic principle anywhere and anytime connectivity, the wireless networks have numerous amounts of advantages over traditional wired networks. The installation of wires network is tedious process and also consumes morecost. Whereas, wireless networks deserves much attention from the investors and researchers on these aspects with cheaper cost on installation.Further, the wireless networks provide flexible and immediate connection setup to the users. The Internet Engineering Task Force (IETF) has created a MANET working group to standardize the Internet Protocol (IP) routing protocol functionality suitable for wireless routing application within both static and dynamic network topologies [4].

In spite of the striking applications, the nature of MANET leaves more challenges to the researchers that must be considered carefully before a wide commercial deployment can be expected. These includes [5,6],

**Routing:** Dynamic nature of the topology, the routing of packet from source to destination node is challenging one. It is also a major cause for frequent route failure in the network.

**Security and Reliability:** In MANET, Every source node relies on intermediate nodes to forward the packet to the destination. But, there is no guarantee for intermediate nodes to behave as good node. MANET has reliability problems, due to their limited radio range.

**Quality of Service (QoS):** Attaining a good level in different QoS of MANET is very difficult due to its dynamic topology, Limited available resources, less ratio range and limited bandwidth.

**Power Consumption:** Mobile devices are small in size and hence they are having less battery backup. Hence, it is a most challenging task to optimize the power consumption.

## BROADCASTING IN MANET

Broadcasting is a basic operation performed in MANET whereby a source node sends the route request packet to all the available nodes in the network. Due to limitations in radio range, the source node cannot have all the nodes as its neighbours, so that the request packet cannot be delivered directly to every node. Hence, the source node depends on intermediate node to forward the request packet to its neighbours. The intermediate nodes are assisting the transmission process by retransmitting it to its neighbour nodes in the network.However, these dissemination processes uses the valuable resources of network. Hence, it is more important to select intermediate nodes to avoid redundant transmission of same request packet [1].

In on-demand routing protocols, the broadcasting process performs propagation of Route REQuest (RREQ) packets to all the available nodes in the network for route discovery.For example, On-demand routing protocols such as AODV and DSR uses flooding as routing mechanism to disseminate the RREQ packet in the network. This simplest mechanism is known as simple flooding. Although it is a simplest method for route discovery, simple flooding generates numerous amounts of redundant control packets which increases the traffic in the wireless channel, further channel contention and it leads to packet collision. This trend is generally known as broadcast storm problem [2,3].

## HIGH READABILITY VS. LESS OVERHEAD

The foremost issue in broadcasting is how to reduce the number of nodes that rebroadcast the RREQ packets while maintaining a high degree of reachability to nodes of mobile networkduring the route discovery process. Broadcasting huge number of RREQ packet will guarantee the high reachability of mobile nodes and gives more chance to discovering the valid routes. However, the simple flooding may result in poor utilization of network resources.

Therefore, designing a new route discovery approachto strike the fair balance between attaining accepted level of reachability on mobile nodes and effective utilization of limited network resource such as battery, bandwidth [3].

# II. RELATED STUDY

The impact of mobile nodes mobility on probability value based flooding in a broadcast circumstances has been evaluated over a range of different forwarding probability values. The results are reveals that probabilistic based broadcast algorithms can gain some improvement in high mobility and dense networks in terms of reduced retransmissions. However, there has not been a performance evaluation of impact of probabilistic based broadcasting on route discovery with different network conditions [7].

From the above observations, this paper aims to conduct a performance analysis of probabilistic based route discovery in on-demand routing protocols, namely AODV and DSR. Here, NS-2 is used for simulation of above said protocols with the following simulation environment as listed in table1.

TABLE 1
SYSTEM PARAMETERS, MOBILITY MODEL AND PROTOCOL STANDARDS USED IN THE SIMULATION EXPERIMENTS

| Simulation Parameter | Value |
|---|---|
| Simulator | NS-2 (v.2.29) |
| Transmitter range | 250 meters |
| Bandwidth | 2 Mbps |
| Interface queue length | 50packets |
| Traffic type | CBR |

| | |
|---|---|
| Packet size | 512 bytes |
| Simulation time | 900 sec |
| Number of trials | 30 |
| Topology size | 1000m x 1000m |
| Number of nodes | 25, 50, 75, . . . , 225 |
| Maximum speed | 1m/sec 5m/s, 10m/sec, ... , 25m/s |

## INTIAL PROBABILITY (PF)

For the purpose of determining the initial probability $P_f$ to conduct the performance analysis on AODV, several simulation runs using NS-2 has been conducted by varying the probability value from 0.1 to 0.9. Figure1 depicts the connectivity success ratio against the different network densities which are varied from 25 to225 nodes. Figure2 shows the performance of AODV protocol in different routing overhead against network density which varies from 25 to 225 nodes with different forwarding probability values. The overall observation of results shows increasing in both connectivity success ratio and routing overhead when the forwarding probability increases [8,9].

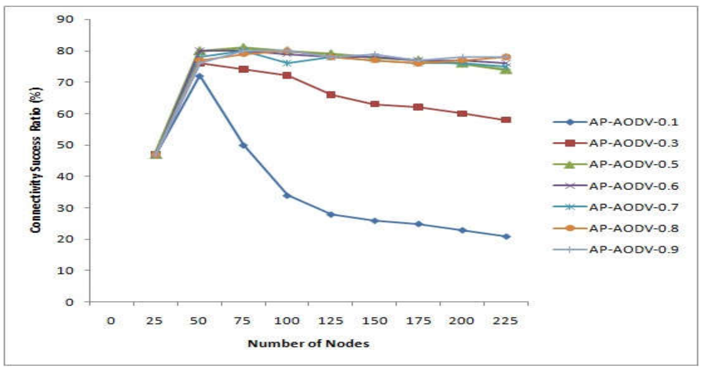


**Figure 1: Connectivity Success Ratio vs. Network Density for Different Initial Forwarding Probabilities in AP-AODV**

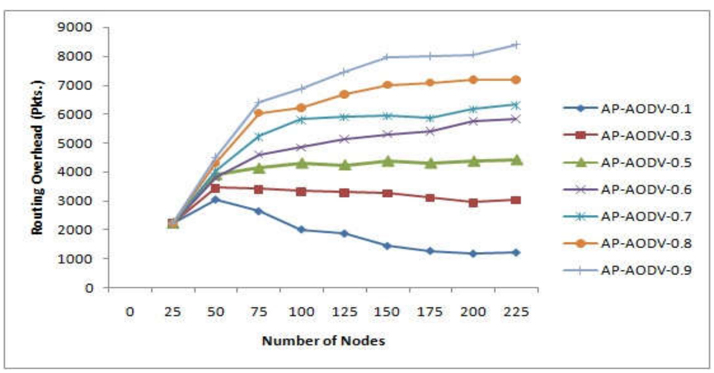


**Figure 2: Routing Overhead vs. Network Density for Different Initial Forwarding Probabilities in AP-AODV**

However, when comparing figure 1 &2, the connectivity success ratio is considerably good till the forwarding probability values 0.6 even the in increasing routing overhead. For the forwarding probability values >=0.7 the connectivity success ratio is getting reduced for all variations of routing overhead. This is because, increasing the probability value will increases the number of node to participate in the forwarding process, will lead to increase in the number of control packet and end with collision. Hence, to maintain the fair balance between the reduction in the routing overhead and increase in good network connectivity, the initial forwarding probability $P_f$ is set to 0.7 for further simulations.

## III. FIXED PROBABILISTIC ROUTE DISCOVERY APPROACH

After determining the route by route discovery process of an On-demand routing protocol which adapted the simple flooding, all the intermediate nodes along the route hold the responsibility of forwarding the packet. Therefore, there will be some redundant RREQ packets will be produced during this process. As a result, the performance of the routing protocol will be affected due to the numerous generations of redundant RREQ packets.

An intermediate mobile node, upon receiving the broadcast packet for the first time, it retransmits it with pre determined forwarding probability 1-p. In case of probabilistic route discovery, each intermediate node will receives the forwarded packet with the pre determined forwarding probability value from 0.1 to 0.9.If an intermediate node receives N RREQ packets of same type, then it will the forward the packet to its neighbour which has the highest forwarding probability value as shown in figure 3.

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Algorithm: Fixed Probabilistic Route Discovery
Upon Receiving a RREQ packet rq at a node
If RREQ is received for first time
    Set rebroadcast probability to p = p0
Endif

Generate a random number  RND Over the range [0,1]
If RND <= P
    Broadcast the RREQ Packet
Else
    Drop the packet
```

**Figure3: An Algorithmic Framework for Probabilistic Route Discovery**

The probabilistic based broadcasting approach has been implemented on two on-demand routing protocols namely AODV and DSR in view of evaluating their performance in different mobility values. In each routing protocol, the routing process is initiated once when the first packet is sent by the source node. For evaluation, the probability value is varied from 0.1 to 1 in steps of 0.1.

## IV. ANALYSIS OF FIXED PROBABILISTIC ROUTE DISCOVERY USING AODV AND DSR

This section conducts a performance analysis and comparison of the fixed probabilistic route discovery method in both AODV and DSR. This analysis will be conducted in one of the network condition of MANET, which is mobility of the node. The different quality of service parameters considered for this evaluation are routing overhead, average collision rate, end-to-end delay, network throughput and connectivity success ratio.

## EFFECTS OF NODE MOBILITY

This section shows the mobile node's mobility effects on on-demand routing protocols AODV and DSR. With random waypoint mobility model, 150 mobile nodes are placed over 1000 M X 1000 M simulation area.The nodes are moving with a maximum speed of $V_{max}$. 10 identical random source-destination connection is chosen for deriving the simulation values.

**Routing Overhead:** In Figure 4 the impact of node mobility on the performance of FP-AODV and FP-DSR in terms of the routing overhead is plotted against the different forwarding probability. For all the probability values the routing overhead increases when the mobility of the node also increases. This is due to link failure due to increasing mobility. So, once the link failure happens then it take the protocol to link repair which increases the control packet further. When the number of control packet increases, by default it also increases routing overhead.

**Average Collision Rate:** In Figure 5,the results are plotted between average collision rates of the network against different node's mobility. The curves shows that the collision rate increases when the forwarding probability along with mobility also increases. This is due to high link failure on increasing mobility leads to increasing in control packet retransmission. This will increases the congestion rate and ended with increasing collision.

**Connectivity Success Ratio:** Figure 6 shows the connectivity success ratio of AODV and DSR. When the forwarding probability value <= 0.5 or 0.6, the connectivity is high due to less congestion in the network. Because, with less probability value, the network allows minimum number of nodes to participate in the packet forwarding process, and with the minimum number of participating nodes, the networks allows almost all the nodes with successful connection. Whereas, when the probability value crosses 0.7, the network allows more number of nodes to participate in the packet forwarding process, which will increases the number of control packets in the networks. Hence, it will end with connectivity failure between the source and destinations.

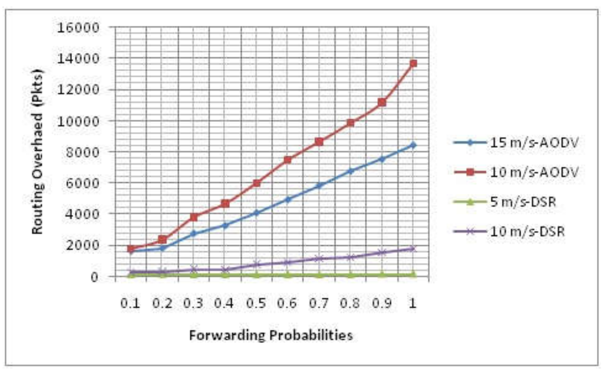


**Figure 4: Routing Overhead vs. Forwarding Probabilities with Different Node's Mobility**

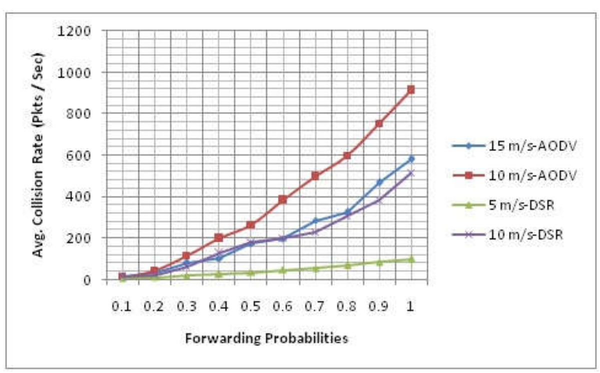


**Figure 5: Average Collision Rate vs. Forwarding Probabilities with Different Node's Mobility**

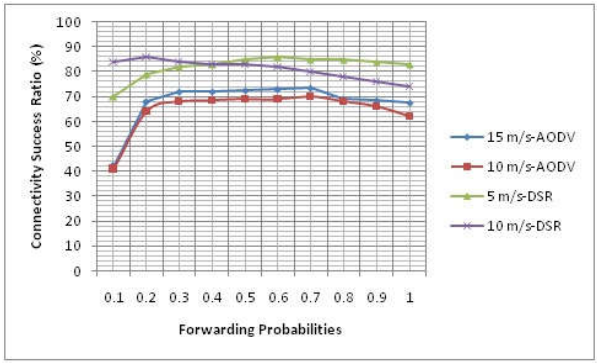


**Figure 6: Connectivity Success Ratio vs. Forwarding Probabilities with Different Node's Mobility**

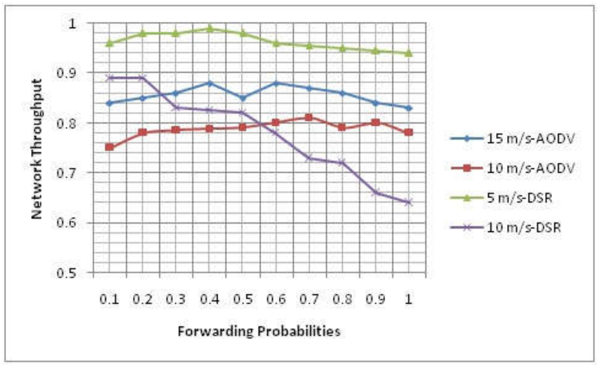


**Figure 7: Network Throughput vs. Forwarding Probabilities with Different Node's Mobility**

**Network Throughput:** Figure 7 depicts the throughput in both on demand routing protocols with different forwarding probability values versus varying mobility of the nodes. The figure reveals that, the throughput increases up to 94% when the probability increases till 0.7 from 0.1 for the node with mobility speed 5m/s. But, on the other hand it is deposed up to 89% when the probability value increases.

## V. CONCLUSION

This paper has conducted a performance analysis on two on demand routing protocols AODV and DSR on different forwarding probability values. Network's mobility condition is considered with different quality of service parameter to analyse the performance of protocols. The simulation has been conducted and results are obtained against different probability values and with different mobility conditions. The results are analysed and it shows that choosing the optimized probability value is important factor in MANET to attain the better network throughput. As per the above results, the reachability is less and it lead to poor utilization of system resources, when the forwarding probability is low. On the other hand, the network produces poor results on different quality of service parameters with the high forwarding probability value. Hence, this paper suggest the optimal forwarding probability value as 0.6 to achieve the maximum reachability with less overhead.

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