SIMULATION STUDY OF AODV AND DSR ROUTING PROTOCOL IN WIRELESS AD-HOC NETWORKS

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ABSTRACT

Ad-hoc wireless networks are defined as the category of wireless networks that utilize multi hop radio relaying and are capable of operating without the support of any fixed infrastructure. Wireless mesh networks and wireless sensor networks are specific examples of wireless ad-hoc networks. This paper discusses in detail the functioning of AODV and DSR routing protocol in different propagation modes. More specifically, in our study, we mainly focus on the performance of routing protocol (AODV, DSR) for each propagation model by using the well known network simulator NS-2.34. Ad-hoc networks exhibit reduced the data rates as compared to wired network, with an order of magnitude, this is the main difference between the ad-hoc and wired networks.

Keywords: Ad-hoc: Routing Protocol: AODV, DSR, NS-2.34: Propagation model.

I. INTRODUCTION

Ad-hoc networks [2] are composed of mobile wireless nodes that are generally moving freely within a certain area. These nodes cooperate together in order to route traffic from a source to a specific destination. Several routing protocol have been devised to handle the routing duties within the mobile ad-hoc networks. A mobile ad-hoc networks [15] consists of mobile devices communicating [15] with each other via wireless connection to both exchange information of mutual interest as well as to maintain the network connectivity in general. These devices are free to move about arbitrarily, and could be located on airplanes, in cars, with people, etc. We refer to these mobile devices as “network nodes” within this study.

Routing protocols [5] can be divided into two categories: table-driven (or proactive) and source-initiated on-demand driven (or reactive) protocols [13]. The table-driven protocols’ strategy is to maintain up-to-date routing information in routing tables that are maintained at each network node. These protocols respond to changes in network topology by propagating updates throughout the network to maintain a consistent network view. Example protocols are the DSDV routing protocol and the OLSR routing protocol Source-initiated on-demand routing protocols [13] on the other hand create routes only when desired by the source node. When a source node needs to communicate with a destination node, it initiates a route discovery process within the network. The process is completed when at least one route is discovered. Once a route is established, it is maintained by some sort of maintenance procedure until the route is no longer needed or the destination [7, 14] is not at all accessible. Example protocols are the DSR and the AODV routing protocols. In this study we used on-
demand routing protocol (DSR and AODV). The paper is organized as follows: in Sec. 2 the routing protocols in comparison are presented. Section 3 describes the most relevant propagation models [4] and simulation results are discussed in Sec. 4 and in Sec. 5 the related work is presented.

II. Routing Protocol

An ad-hoc routing protocol [5] is a convention, or standard, that controls how nodes decide which way to route packets between computing devices in a mobile ad-hoc networks. Routing protocols [5] for different types of wireless networks [3] have been proposed by a number of researchers. Traditionally classify these protocols as Proactive protocols and Reactive protocol [8]. Proactive routing protocols keep routes continuously updated, while reactive routing protocols react on demand [13].

A) Proactive Routing Protocol

As stated earlier, proactive routing protocols maintain routes to all destinations, regardless of whether or not these routes are needed. In order to maintain correct route information, a node must periodically send control messages. Therefore, proactive routing protocols may waste bandwidth since control messages are sent out unnecessarily when there is no data traffic. The main advantage of this category of protocols is that hosts can quickly obtain route information and quickly establish a session. For example, GSR introduced below is a proactive routing protocol. The drawbacks of GSR are the large size of the update messages, which consume a considerable amount of bandwidth and the latency of the LS information propagation, which depends on the LS information update interval time. ‘Fisheye" technology can be used to reduce the size of update messages. In this case, every node maintains highly accurate network information about the immediate neighboring nodes, with progressively fewer details about farther nodes.

B) Reactive Routing Protocol

Reactive routing protocols can dramatically reduce routing overhead because they do not need to search for and maintain the routes on which there is no data traffic. This property is very appealing in the resource-limited environment.

i) Dynamic Source Routing (DSR)

The Dynamic Source Routing (DSR) protocol uses the source routing approach (every data packet carries the whole path information in its header) to forward packets. Before a source node sends data packets, it must know the total path to the destination. Otherwise, it will initiate a route discovery phase by flooding a Route Request (RREQ) message. DSR is simple and loop-free. However, it may waste bandwidth if every data packet carries the entire path information. The response time may be large since the source node must wait for a successful RREP if no routing information to the intended destination is available. In addition, if the destination is unreachable from the source node due to a network partition, the source node will continue to send RREQ messages, possibly congesting the network.

ii) Ad-hoc on Demand Routing Protocol (AODV)
Ad-hoc On-Demand [13] Distance Vector (AODV) Routing tries to improve performance by keeping the routing information in each node. The main difference between AODV and DSR is that DSR uses source routing while AODV uses forwarding tables at each node. In AODV, the route is calculated hop by hop. Therefore, the data packet need not include the total path. In AODV, any node will establish a reverse path pointing toward the source when it receives an RREQ packet. When the desired destination or an intermediate node has a fresh route to the destination, the destination/intermediate node responds by sending a route reply (RREP) packet back to the source node using the reverse path established when the RREQ was forwarded. When a node receives the RREP, it establishes a forward path pointing to the destination. The path from the source to the destination is established when the source receives the RREP [16].

AODV saves bandwidth and performs well in a large MANET [15] since a data packet does not carry the whole path information. As in DSR, the response time may be large if the source node's routing table has no entry to the destination and thus must discover a path before message transmission. Furthermore, the same problems exist as in DSR when network partitions occur.

### III. PROPAGATION MODEL

Radio channels are much more complicated to analyze than wired channels. A change rapidly and randomly. There are large differences between simple paths with line of sight (LOS) and those which have obstacles like buildings or elevations between the sender and the receiver (Non Line of Sight (NLOS)). To implement a channel [4] model generally two cases are considered: large-scale and small-scale propagation models. Large scale propagation models [5] account for the fact that a radio wave has to cover a growing area when the distance to the sender is increasing. Small scale models (fading models) calculate the signal strength depending on small movements or small time frames. Due to multi path [7,14] propagation of radio waves, small movements of the receiver can have large effects on the received signal strength. In the following, frequently used models for the NS-2.34[11,12] network simulator are described in more detail.

#### A) Free Space Model

This is a large scale model. The received power is only dependent on the transmitted power [12], the antenna’s gains and on the distance between the sender and the receiver. It accounts mainly for the fact that a radio wave which moves away from the sender has to cover a larger area. So the received power decreases with the square of the distance. The free space propagation model assumes the ideal propagation condition that there is only one clear line-of-sight path between the transmitter and receiver.

#### B) Two Ray Ground Model

The Two Ray Ground model is also a large scale empirically determined by field measurement. From model, it is assumed that the received energy is the sum of the direct line of sight path and the path including one reflection on the ground between the sender and the receiver. A limitation in NS-2.34[11, 12] is that sender and receiver have to be on the same
height. It is shown that this model gives more accurate prediction at a long distance than the free space model. However, the two-ray model does not give a good result for a short distance [7, 14] due to the oscillation caused by the constructive and destructive combination of the two rays. Instead, the free space model is still used when distance is small.

C) Shadowing Model

The shadowing model of NS-2.34 [9, 11, 12] realizes the log-normal shadowing model. It is assumed that the average received signal power decreases logarithmically with distance. A Gaussian random variable is added to this path loss to account for environmental influences at the sender and the receiver. The shadowing model consists of two parts. The first one is known as path loss model, which also predicts the mean received power at distance. The second part of the shadowing model reflects the variation of the received power at certain distance.

IV. SIMULATION RESULT

Table 1: Simulation Parameter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network Simulator</td>
<td>NS-2.34</td>
</tr>
<tr>
<td>Channel type</td>
<td>Wireless channel</td>
</tr>
<tr>
<td>Radio-propagation model</td>
<td>Two Ray Ground, Free Space, Shadowing.</td>
</tr>
<tr>
<td>Antenna type</td>
<td>Omni Antenna</td>
</tr>
<tr>
<td>Interface queue type</td>
<td>DropTail/PriQueue, CMUPriQueue</td>
</tr>
<tr>
<td>Routing protocols</td>
<td>AODV/DSR</td>
</tr>
<tr>
<td>MAC type</td>
<td>802_11</td>
</tr>
<tr>
<td>No. of Nodes</td>
<td>10, 20, 30, 40, 50</td>
</tr>
<tr>
<td>Traffic Type</td>
<td>CBR</td>
</tr>
<tr>
<td>Maximum packet in Queue</td>
<td>70</td>
</tr>
<tr>
<td>Simulation Time</td>
<td>7 ms</td>
</tr>
</tbody>
</table>

The results corresponding to the PDR, Delay and Routing Overhead are shown in Figure-1, Figure-2, Figure-3

A) Packet Delivery Ratio

Packet Delivery Ratio uses the ratio of the total number of CBR (constant bit rate) packets received in the network to the total number of CBR packets sent during the simulation.

Figure-1(a, b) displays, AODV and DSR routing protocols performances in terms of the number of Nodes for all propagation models. The charts display that if the number of connections increases the delivery Ratio of the packets decreases for all models. Thus, there is network congestion. In this scenario, in comparison of AODV and DSR, DSR performs better than AODV because DSR delivery ratio is very high.
B) End to End Delay

End to End Delay is time taken for the packets to reach the next node. If there is Delay increases than performance is decreases.

Figure-2 displays, AODV and DSR routing protocols performances in terms of the number of Node. It shows that overall DSR end to end Delay is higher in comparing of AODV for all models. AODV is better.
C) Routing Overhead
Routing Overhead indicates the ratio of the number of routing packets (total number of control packets) required to route a CBR generated data packets.
Figure 3 displays, AODV and DSR routing protocols performances in terms of the number of node for all models. It indicates the overall AODV routing overhead is higher than DSR routing overhead at minimum to higher number of nodes for all models. This high routing overhead is further responsible for the reduction in PDR. DSR routing performance is better in comparison to AODV.

**Fig-3.a: AODV Routing Overhead vs No. of nodes.**

**Fig-3.b: DSR Routing Overhead vs No. of nodes.**
V. CONCLUSION

In this paper we study the performance of on-demand routing protocols (AODV, DSR) for different propagation models (Two-Ray ground, Free Space, Shadowing) by using the Network Simulator, NS-2.34. In this paper we calculate the performance on the basis of simulation parameters (Delay, Routing-Overhead, and Packet Delivery Ratio). After simulation, we find that in packet delivery ratio, DSR performance is better than AODV. In Delay parameter we find that AODV is better than DSR and at last we find that in Routing Overhead parameter DSR is also better than AODV. Finally we have concluded that DSR is better than AODV in this study.

REFERENCES