A Comparative Study of the AODV and DSDV Routing Protocols for Smaller Mobile Ad Hoc Networks

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Abstract: ***The aim of my research result is to study the performance of routing in Mobile Ad hoc Network, a network consists of individual nodes connecting with each other creating a network without using infrastructure. Routing in MANET is the most challenging process as constant topology changes occur during the transmission. Simulation concludes that although DSDV perfectly scales to small networks with low node speeds, AODV is preferred due to its more efficient use of bandwidth.***

Keywords: Mobile Ad-Hoc, Routing, AODV, DSDV, Performance, Comparison

1. Introduction

A mobile ad-hoc network (MANET) is a network composed of mobile nodes mainly characterized by the absence of any fixed infrastructure, which makes any node in the network Mobile node act as a potential router. MANETs are also characterized by a dynamic, random and rapidly changing topology. This makes the classical routing algorithms fail to perform correctly, since they are not robust enough to accommodate such a changing environment. Consequently, more and more research is being conducted to find optimal routing algorithms that would be able to accommodate for such networks [1].Our objective in this paper is to carry out a performance comparison between two routing protocols, namely, AODV (Ad hoc On Demand Distance Vector) and DSDV (Destination Sequenced Distance Vector). While both routing protocols use sequence numbers to prevent routing loops and to ensure the current updates of routing information, AODV and DSDV differ drastically in the fact that they belong to two different routing families. Namely, AODV is a reactive protocol (routes are only

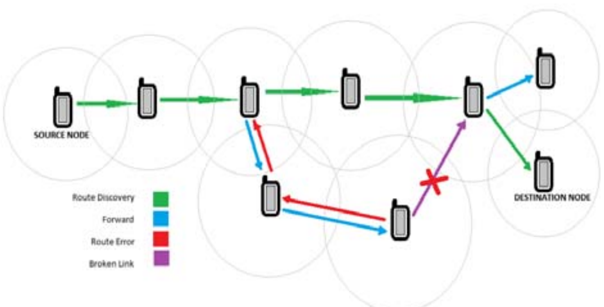

Figure 1: Mobile Ad Hoc Network

Generated on demand, in order to reduce routing loads), and DSDV is a proactive protocol (with frequent updates of routing tables regardless of need).The rest of this paper is organized as follows: In the next section, we will introduce an overview of both routing protocols. In Section 3 we present the simulation environment of the NS2 simulator in which the algorithms were tested. Section 4 deals with a comparison of both routing algorithms while varying parameters of importance such as speed, pause time and number of nodes.

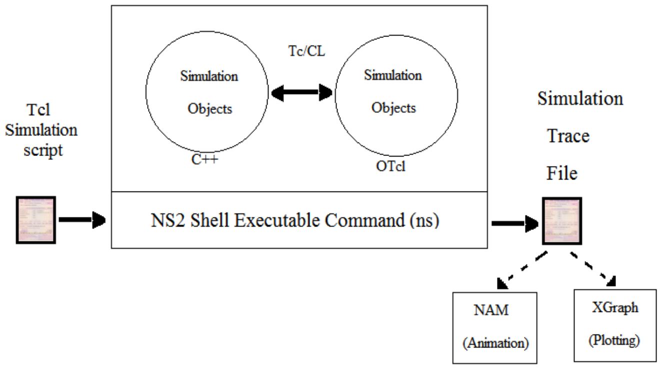

Figure 2: Network Simulation Models

2. Protocol Description

2.1 Ad Hoc on Demand Distance Vector

The Ad Hoc on Demand Distance Vector (AODV) routing algorithm is a source initiated, on demand driven, routing protocol. The routing is "on demand", a route is only traced when a source node wants to establish communication with a specific destination node. The route remains established as long as it is needed for next communication. Furthermore, another feature of AODV is its use of a "destination sequence number" for every route entry. This number is included in the RREQ (Route Request) of any node that desires to send information or data. These numbers are used to ensure the "freshness" of routing updated information. For instance, a requesting node always chooses the route with the greatest sequence number to communicate with its destination node. Once a fresh path is found, a RREP (Route Reply) is sent back to the requesting node.

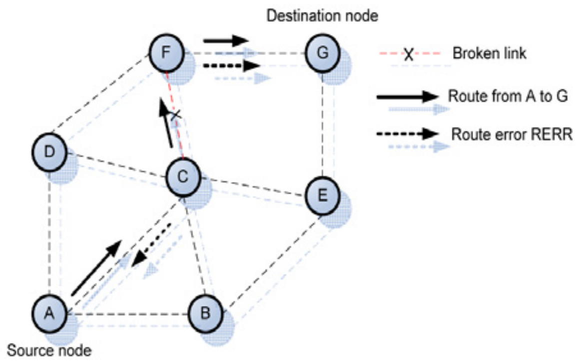

Figure 3: Route discovery mechanisms in AODV

AODV also has the necessary mechanism to inform network nodes of any possible link break that might have occurred in the network [3] [4].

2.2 Destination Sequenced Distance Vector

DSDV belongs to the proactive or table driven family where a correct route to any node in the network is always maintained and updated [5]. Although it was based on the famous distributed

Routing Table for Node 2

Destination	Next Hop	Metric	Dest. Seq. No.
1	1	1	123
2	0	0	516
3	3	1	212
4	4	1	168
5	4	2	372
8	1	INF	432

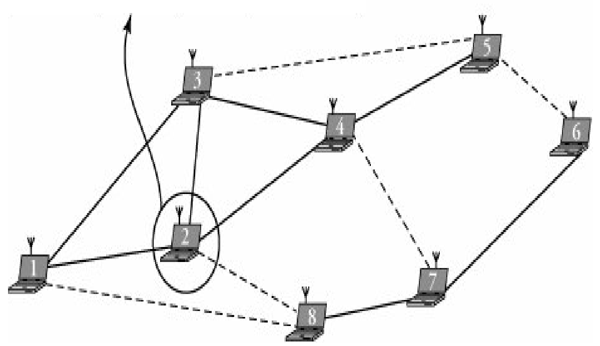

Figure 4: A DSDV routing table

Bellman-Ford distance vector, some major modifications were introduced to make it suitable for wireless schemes, and specifically solve the *count-to-infinity* problem [2]. The regular methods for solving this problem (such as *poison reverse* or *split horizon*) are not suitable for mobile topologies because of the broadcast nature of the medium. Instead, DSDV adds a *sequence number* for each routing table entry, to distinguish old from new routing information [3].

In DSDV, each node keeps a routing table that lists all available destinations, and the number of hops to each destination. Each entry is tagged by a sequence number created by the destination node [4]. Any routing table changes are relayed to all the other nodes, which imposes a large overhead on the whole network. To reduce this potential traffic, routing updates are classified into two categories. The first is known as "full dump" which includes all available routing information. This type of updates should be used as infrequently as possible and only in the cases of complete topology change. In the cases of occasional movements, smaller "incremental" updates are sent carrying only information about changes since the last full dump. Each of these updates should fit in a single Network Protocol Data Unit (NPDU), and thus significantly decreasing the amount of traffic [6].

3. Simulation

Both routing techniques were simulated in the same environment using Network Simulator (ns-2) [8]. Both AODV and DSDV were tested by varying the number of nodes to account for system scalability. The algorithms were tested using 06 nodes. Two different experiments were carried out. While the *pause time* was varied. The pause time is defined as the period of time a node stays stationary before heading to a new random location. The simulation environment consisted of a 500m by 500m region where nodes were randomly moving with a constant average speed. For each protocol, we investigated three performance criteria:

- Throughput
- Packet Receive ratio
- Packet loss ratio

4. Simulation Results

The results of our simulation will be presented in this section. First we will discuss the results of the two same experiments conducted for both protocol and for same node numbers. Then, we will choose a specific case from each simulation (with 06 nodes) to perform the comparison between the two protocols.

4.1 AODV Results

4.1.1.2 Throughput vs. Pause Time

As nodes become gives more and more update stationary, the path from source to destination becomes more stable.Therefore, data sent along transient routes (resulting from quick node movement) decreases, thus reducing the overall throughput (Fig.5).This is due to the fact that TCP retransmissions are counted as part of the useful network throughput. Furthermore, as the number of nodes increases, more routing information will be transmitted, consuming a portion of the useful throughput bandwidth. Figure 5: AODV throughput vs. pause time. (AODV packet receive & loss)

4.1.2 Routing Overhead

- As the number of nodes increases, more nodes will be flooding the network with RREQs and consequently more nodes will be able to send RREPs as well.

- As the node speed increases, a source node A will have to generate more RREQs to find a freshenough route to node B.

4.1.3 Packet Loss Ratio

Clearly, the percentage of packets dropped increases as both the speed and the number of nodes increases.

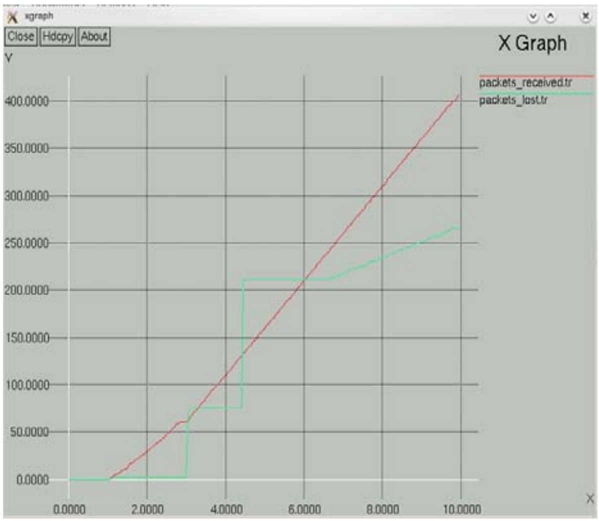

Figure 5: AODV packet receive & loss

As per the speed increases, the position of a node will change more rapidly. A source node will still use the last route it has for a destination (if it didn't expire yet), but due to the fast mobility pattern, this route will frequently be invalid which causes the packet to be dropped. This will cause more and more packets to time out before reaching their destinations. This was also noticed during our simulation, as almost all of the packets were dropped because they exceeded their maximum TTL (Time to Live).

As the number of nodes increases, a packet sent from node A will have more hops to traverse before reaching node B, therefore increasing the risk of Time to live timeouts.

4.2 DSDV Results

4.2.1 Throughput vs. Pause Time

In DSDV, nodes issue routing table updates node information periodically, almost independent of route changes, throughput is virtually not affected by fluctuations in the pause time Figure 6: DSDV throughput vs. pause time

4.2.2 Routing Overhead

The results of the simulation show that DSDV imposes a huge routing overhead, as shown in Figure 6. This is not surprising due to the extensive and regular updates of the routing tables at the nodes. Note that within the same node group, the percent quickly saturates to a certain limit. Moreover, as the number of nodes increases, the routing overhead clearly increases since more table updates are being sent.

4.2.3 Packet Loss Ratio

As shown from Figure 6, the ratio is almost constant with Respect to speed for each node group. This is a direct consequence of the routing algorithm DSDV uses, which maintains a correct route for each node at all times.

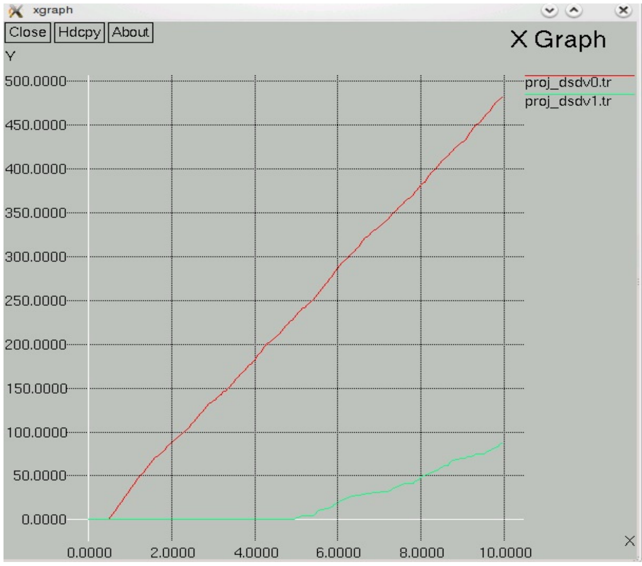

Figure 6: DSDV packet received and lost

As the number of nodes increases, so does the probability that a node transmits a packet during the transient time where the update of routing tables is taking place (a node sends a packet according to the old routing information it has in its table before receiving the update)

5. Comparison

In what follows, we will compare AODV and DSDV based mainly on the simulation results we obtained. To avoid redundancy, we will limit our study to a scenario with 06 nodes here some result show in the table of AODV and DSDV routing protocols. The ratio of receiving and lost a packet is depend on protocol scenario, because of one is on proactive and another is reactive protocol. So that the final result was give us to better protocol for smaller network is DSDV. Because of a comparison of both protocol DSDV is more efficient and successive protocol for packet receiving and minimizing for packet losing in compare to AODV.

5.1 Comparison Ratio Packet Loss Ratio

Table 1: A Comparison Table of Lost and Received Packet Ratio between AODV and DSDV

SR NO	*Pause Time*	*LOST Packet Quantity*		*RECEIVED Packet Quantity*	
		AODV	*DSDV*	*AODV*	*DSDV*
0	0	0	0	0	0
1	1	0	0	0	25
2	2	0	0	40	90
3	3	75	0	52	140
4	4	75	0	110	190
5	5	220	0	160	235
6	6	220	25	210	290
7	7	250	40	260	335
8	8	260	50	310	390
9	9	280	75	360	435
10	10	300	90	410	480

As shown in table no: 1, DSDV results in lower packet drop than AODV. This is due to the extensive routing information exchanged between the nodes at regular intervals providing a correct, up to date route at all times. Also, no additional packet drop is noticed as speed increases, since the routing updates become more frequent, making the packet drop rates almost unaffected. This feature is not present in AODV. Since the routes are only generated upon request, a route may become outdated by the time the route request is generated and the route reply would arrive. The packets transmitted during this transient period run the risk of being dropped by the network.

6. Conclusion

The study gives that, 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 study, it can be assumed that DSDV routing protocols works better for smaller networks but not for larger networks. So, 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. DSDV perfectly scales to a small network with low node speeds. In this case, the simplicity of DSDV is preferred over the other more complex techniques without sacrificing the performance.

7. Future Work

We did compare simulation of proactive and Reactive Routing Protocol of MANET. My future work is focus on the security attacks in MANET protocol in terms of end to end delay, routing overhead and network load.

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