Performance Comparison of (AODV and DSDV) Routing Protocols in Mobile Ad Hoc Networks.

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Abstract

MANET is a collection of wireless nodes that can dynamically form a network to exchange information without using any pre-existing fixed network infrastructure. In an Ad-Hoc network nodes cooperate to maintain network connectivity and perform various functions including routing. This paper focuses on two flat routing protocols the reactive Ad- Hoc on Demand Distance Vector Routing protocol (AODV), and the proactive Destination-Sequenced Distance-Vector Routing (DSDV).Where a comparison between these two protocols was done using the well-known Network Simulator 2 (NS2).

Keywords: Ad-Hoc Network, mobile nodes, Network Simulator 2(NS2)

1. Introduction

The rapid growing of using mobile devices (e.g. laptops, mobile phones, personal digital assistants [PDAs]) in the recent years has made a need of some system or network that collect these omnipresent devices together, therefore people can get access the electronic platforms and searching for the information they need wherever and whenever they might be [1].The nature of these omnipresent devices

makes Mobile Ad-Hoc networks (MANETs) the most appropriate solution for such as this situation.

Mobile Ad-Hoc networks (MANETs) are independent systems which contain a collection of mobile devices that communicate each other over wireless connection. They are self-organized and self-controlled infrastructure-less networks. In this type of network each device is equipped with a wireless vector and receiving system which allows it to communicate with other devices over wireless channels. All devices can behaviour as routers to guarantee data packets to be arrived to their final destination. Which means that, ad-hoc networks allow for multi-hop transmission of data packets between devices out of the transmission range of each other .These networks can be created or deployed in any place and at any time because they are decentralized and they not need any existing network infrastructure. These networks have been using by different community users such as military, researchers, business, students, and emergency services [2].

Ad-hoc network routing protocols can be divided into proactive, reactive and hybrid routing [3]. A proactive routing protocol is also called "table driven" routing protocol. Using a proactive routing protocol, nodes in a mobile ad hoc network continuously evaluate routes to all reachable nodes and attempt to maintain consistent, up-to-date routing information, the Destination-Sequenced Distance-Vector (DSDV) protocol is an example of proactive routing protocols. However, the property of reactive routing protocols only requests a route when it is needed, and does not require mobile nodes to maintain routes to unreachable destinations [4]. The Ad hoc on-demand Distance Vector routing (AODV) is an another example for reactive routing protocols for mobile ad hoc networks.

These protocols have varying qualities for different wireless routing aspects. It is due to this reason that choice of a correct routing protocol is critical. In this paper a simulation model of a simple Ad-Hoc

network is done using two flat routing protocols the reactive Ad- Hoc on Demand Distance Vector Routing protocol (AODV), and the proactive Destination-Sequenced Distance-Vector Routing (DSDV) these two protocols has been chosen to be experimented which one performs better during the run of the simulation.

This paper addresses the question. 'Which routing protocol provides a better performance in Mobile Ad hoc Networks?' This question addresses the overall performance of the two routing protocols investigated in this research.

The Network simulator 2 (NS2) is used to do the simulation and the result is focused on the throughput , the routing overhead and the packet loss with same number of nodes and mobility level for both AODV and DSDV routing protocols.

2. Literature Review

Balram Swamia and Ravindar Singh [11] states that DSDV is a table driven routing and this protocols manage the route information in tables and that route information is broadcast to other neighbours through this method DSDV reduces the route detection time periods. DSDV is less energy consumption in mobile communications. OWL is on demand routing protocol which uses the DFS instead of RREQ. The main feature of OWL is less energy and time ingesting in route discovery it includes few nodes in route detection procedure and remaining nodes are able to accepts other route request by this reduce the interruption and recover the delivery ratio.

A.A. Chavana , Prof. D. S. Kurule and Prof. P. U. Dere [12] defined that routing protocols DSDV and AODV are tested in deferent terms PDR, overhead and end to end delay. AODV is superior to DSDV. These protocols compare in different terms routing overhead, PDR and throughput. DSDV is a table driven routing and this protocols manage the route information in tables and that route information is

broadcast to other neighbours through this method DSDV minimize the path discovery time periods. When some node needs to drive any data to its destination, it firstly checks the table to decide if it has route to final node, if sure then it transfer the data packet to next hop node. If not sure then it begins a route detection process that is path discovery and path maintains process. AODV performance is affected by black hole attack.

V. Rajeshkumar, P.Sivakumar [13], presents a performance comparison and study of reactive and proactive protocols AODV, DSR and DSDV based on metrics such as throughput, control overhead ,packet delivery ratio and average end-to-end delay by using the NS-2 simulator. They conclude that AODV performance is the best considering its ability to maintain connection by periodic exchange of data's. As far as Throughput is concerned, AODV and DSR perform better than the DSDV even when the network has a large number of nodes. Overall, their simulation work shows that AODV performs better in a network with a larger number of nodes whereas DSR performs better when the number of nodes is slight. Average End-to-End Delay is the least for DSDV and does not change if the number of nodes is increased. Thus, they find that AODV is a viable choice for MANETs.

3. Ad Hoc Network Routing Protocols Classification

There are many measures to be followed when designing and classifying routing protocols for a network. For example, what routing information is exchanged between hosts, when and how the routing information is exchanged, when and how routes are computed, etc. mainly, for ad hoc networks, routing protocols may be classified according to the routing strategy, which is, proactive (also known as table-driven) and reactive (known as on-demand), or they can be classified according to the network structure underlying routing protocols as it shown in figure (1) [5].

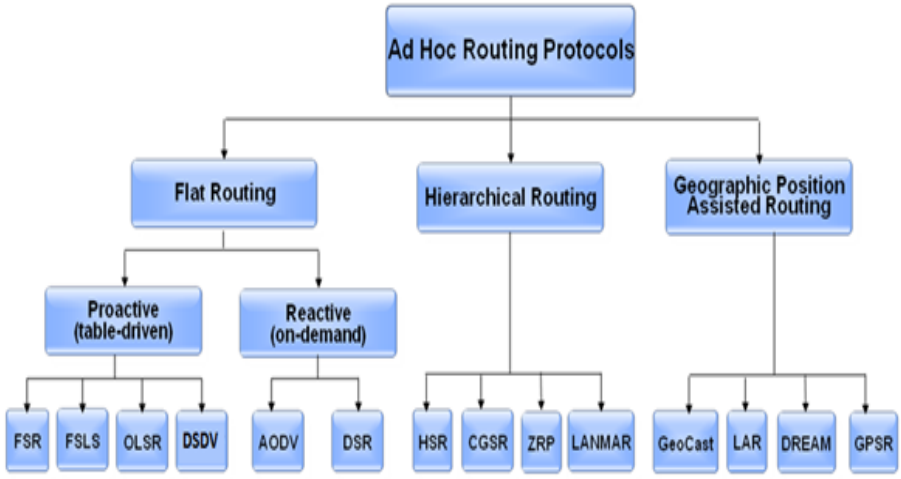

Figure 1: Classification of ad hoc routing protocols

3.1 Flat Routing

Flat routing approaches follow a flat addressing where all nodes in a network are at the same level and have the same routing functionality. Flat routing schemes generally can be divided into two classes proactive and reactive. Proactive protocols purpose to find and maintain consistent, up-to date routes between all source destination pairs regardless of the need or the use of suchlike routes here routing strategies are either link state or distance vector. But in reactive protocols routes are created only when a source device request them and data forwarding is accomplished according to source routing or hop by- hop routing [6].

3.2 Hierarchical Routing

Hierarchical routing is another possible routing approach for mobile ad hoc networks, in contrast of flat routing where every device knows about every other device in the topology, in this routing protocol, each device knows only about those devices in its level, and for all other destinations outside its level it forwards the packets to the border

router of its level. As following the per-mentioned classification four types of this routing protocol will be explained, these are, Hierarchical State Routing (HSR), Clusterhead-Gateway Switch Routing (CGSR), The Zone Routing Protocol (ZRP), and Landmark Ad Hoc Routing Protocol (LANMAR).

3.3 Geographic Position Assisted Routing

Geographic Position Assisted Routing protocols are another routing approach that should be indicated as they can be implemented in ad-hoc networks, and as they use different strategies to work. These protocols unlike other protocols use geographical addresses instead of link-specific addresses such as IP-addresses to find path from source to destination.

4. Comparison of AODV and DSDV

When a node using an on-demand protocol desires a route to a new destination, it will have to wait until such a route can be discovered. This feature, although useful for datagram traffic, incurs substantial signaling traffic and power consumption. Since both bandwidth and battery power are scarce resources in mobile computers, this becomes a serious limitation.

4.1 The Ad hoc On-Demand Distance Vector (AODV)

is a reactive routing protocol [7]. That means it tries to find a route when it is needed. AODV is intended for use by mobile devices in an ad-hoc network, it enables dynamic, self-starting, multi-hop routing between participating mobile devices wishing to establish and maintain an ad- hoc network. AODV allows mobile devices to find routes quickly for new destinations, and does not require devices to maintain routes to destinations that are not in active communication.

Routing Tables: For each routing table the following information have to be contained:

- Destination
- Next hop
- Number of hops
- Destination sequence number
- Active neighboring devices for this route
- Expiration time for this route table entry
- Expiration time, (is also as lifetime), is reset each time the route has been used. The new expiration time is the sum of the current time and a parameter called active route timeout.

Ad Hoc On-Demand Distance Vector Routing (AODV): AODV [8] is essentially a combination of both DSR and DSDV. It borrows the basic on-demand mechanism of Route Discovery and Route Maintenance from DSR, plus the use of hop-by-hop routing, sequence numbers, and periodic beacons from DSDV. It uses destination sequence numbers to ensure loop freedom at all times and by avoiding the Bellman-Ford ”count-to -infinity” problem offers quick convergence when the ad hoc network topology changes In this research paper we attempted to present an overview of two main categories of mobile ad-hoc routing protocols and performance comparison of both the protocols based on Random way point model and the simulation of two routing protocols focusing on their differences in their dynamic behaviours that can lead to performance differences.

4.2 Destination Destination-Sequenced Distance Vector (DSDV)

DSDV is a Routing Algorithm which is based on the classical Bellman-Ford routing algorithm. DSDV can prevent the routing loops. These routing protocols work to discover routes before they are needed that is why these types of protocols called Proactive. Each

node maintains a routing table in which there are possible destinations and possible number of hops for every destination is stored. It also store time between first and best announcement of a path. It also slows down updates if it seems to be unstable. This decision is based on the stored time values the nodes with this routing protocol only know the next hop to destination so these protocols are Table Driven. All nodes with DSDV run identical algorithms so these protocols are Flat protocols. Physical location of the nodes is unknown so DSDV is a non-location based protocol.

One of the proactive or table-driven mobile ad-hoc networks protocols is Destination-Sequenced Distance Vector (DSDV) [9] which is based on the idea of the classical Bellman-Ford routing algorithm with some enhancements.

In Destination-Sequenced Distance Vector protocol each and every node maintains a routing table that stores all potential destinations with number of hops required to access the destination and the sequence number that is allocated by the destination node. So a routing table in DSDV includes:

- Potential destinations
- Number of hops
- Sequence number

Table (1) Sample DSDV Routing Table

Destination Address	Metric	Address of Next hop	Sequence no.
Host 1	2	Host 2	Seq 1
Host 2	1	Host 2	Seq 2

5. Simulation Modelling

5.1 Network Simulator 2

The well-known Network Simulation (NS2) version ns-allinone2.28 has been used to do this simulation. NS2 is an event driven simulation tool that can simulate wired and wireless networks effectively as well as it can evaluate their functions and protocols (e.g., routing algorithms, TCP, UDP) [10].

5.2 Simulation Modelling in General

As shown in table (2) for this study a simulation of a virtual environment of 200 * 200 m for 600 sec of simulation time is used. The channel data rate and transmission range set to 2 Mbps and 100 m, respectively. Each run of the simulator accepts as input a scenario file that describes the exact motion of each node and the exact time at which each change in motion or packet origination is to occur. A total of 50 different scenario files with varying network size, movement patterns and traffic loads were generated and then the two routing protocols were run against each of these scenario files.

Table 2: Simulation parameters

Simulation Parameter	Value
Simulator	NS2
Network Range	200m × 200m
Transmission Range	100m
Mobile Nodes	20
Traffic Generator	Constant Bit Rate
Band Width	2 Mbps
Packet Size	512 Bytes
Packet Rate	10 Packet Per Second
Simulation Time	600s

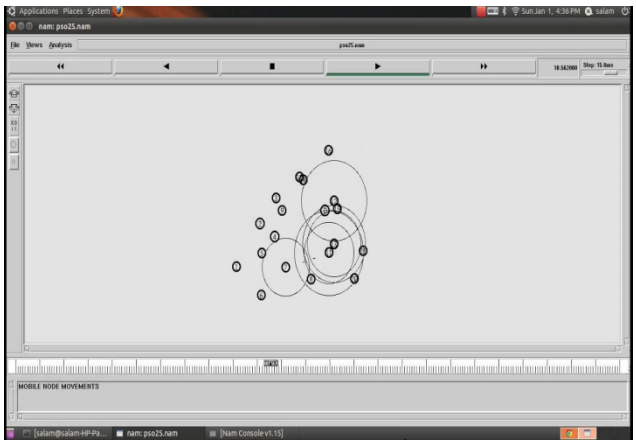

Figure 2: the execution of the simulation

5.3 Mobility Pattern

The nodes in the **simulation** move according to the 'random way point' model. At the start of the simulation, each node waits for a pause time, then randomly selects and moves towards a destination with a speed lying from zero and some maximum speed. When reaching this destination it pauses again and repeats the above procedure until the end of the simulation.

6. Results and Discussion

6.1Throughput

As it can be seen by the table (3) and the graph (4) the performance of the AODV protocol is better for nearly 9% than DSDV for the same number of nodes and same level of mobility, where the throughput of the protocol AODV did not decreased as much as the peer protocol did for the same parameters .which is due to the difference in working mechanism of both of them.

Table 3: Comparison between DSDV and AODV Throughput

Throughput		Mobility (m/s)
DSDV	**AODV**	
1.52	1.44820	1.000
1.5175	1.43230	2.000
1.4825	1.45770	4.000
1.362	1.34520	10.000
1.1124	1.27560	13.000
1.0263	1.26000	15.000
0.9911	1.25500	18.000
0.9776	1.15500	25.000
0.8994	1.25011	35.000

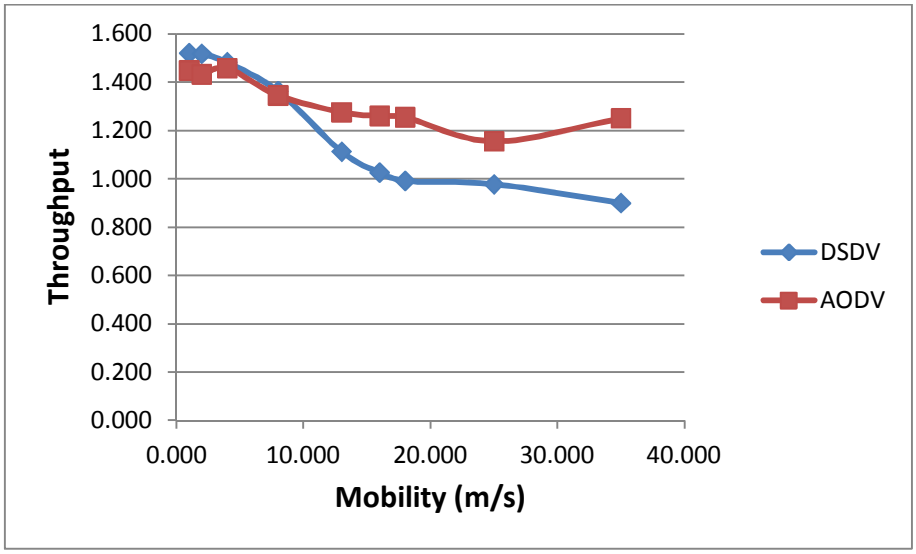

Figure 4: Comparison between DSDV and AODV Throughput

6.2 Packet Loss

It can be easily concluded from figure (5) that as the network traffic and node movement are increased the packet loss is sufficiently increased in DSDV. This is because the packet has to travel more to reach the destination and network is also getting congested.

However, the increase level of mobility results in higher packet loss in AODV. The reason why is simple because the packet have to traverse through hops and the last used link may be not valid because of the change in topology.

Table 4: packet loss in DSDV and AODV

Mobility (m/s)	DSDV	AODV
1	0	0
2	0.0613	0.0669
4	0.0864	0.0799
10	0.088	0.0996
13	0.178	0.1577
15	0.1896	0.1976
18	0.1946	0.513
25	0.196	0.588
30	0.1886	0.598

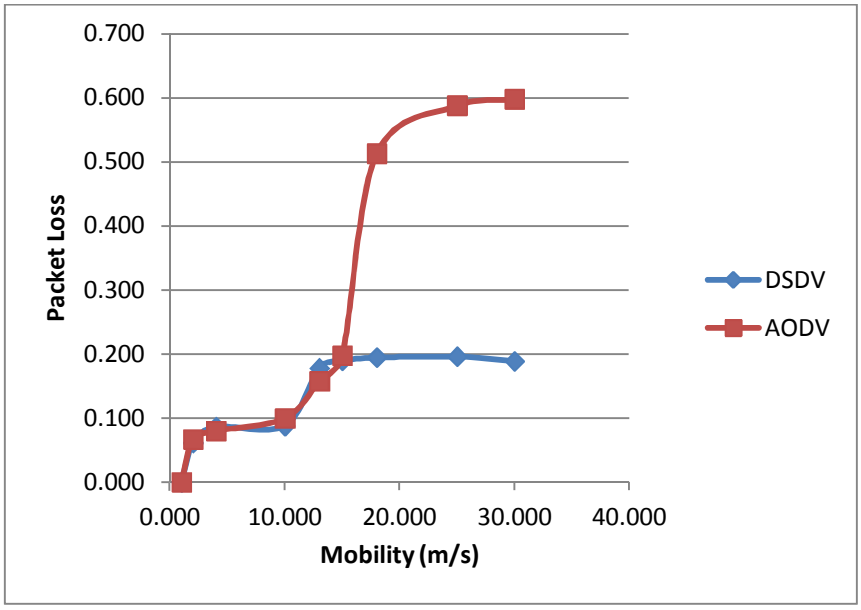

Figure 5: packet loss in DSDV and AODV

6.3 Routing Overhead

As shown in figure (6) DSDV protocol the effect of the increasing the level of mobility can be clearly seen. The routing overhead is increasing drastically by the increase in the level of mobility in the nodes. This is because the DSDV protocol is proactive so it is must to know the route before required but the change in topology will increase the routing overheads.

We can conclude by looking carefully at (figure 6) that the routing overhead in DSDV is significantly higher than the routing overhead in AODV which is nearly 950%.

Table 5: the Routing Overhead in DSDV and AODV

Mobility (m/s)	DSDV	AODV
0	0	0
5	9.55	0.1653
10	10.549	1.2011
15	13.25	1.3996
20	15.78	1.499
25	16.85	1.5985
30	17.9	1.5775
35	18.77	1.8877
40	19.121	2.0175

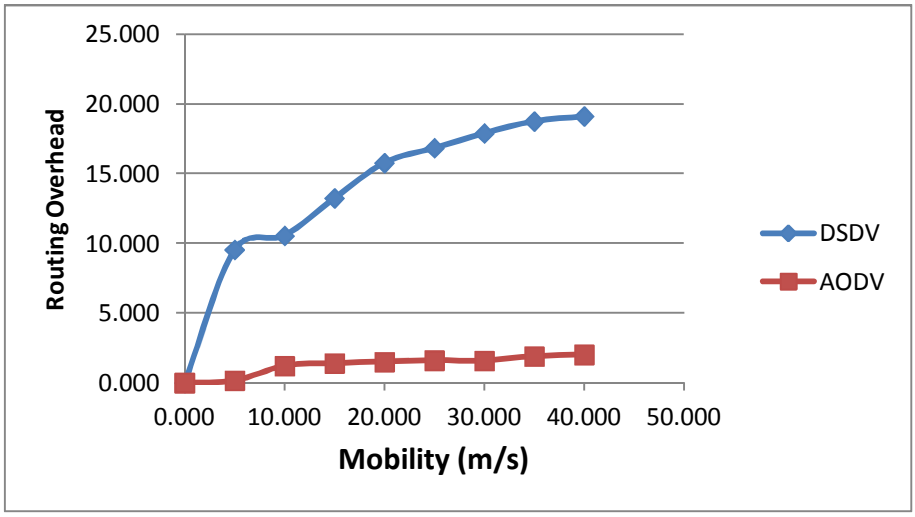

Figure 6: Routing Overhead in DSDV and AODV

7. Conclusion

MANET is a collection of mobile nodes, dynamically establishing short-lived networks where no prefixed infrastructure is needed. In this research we had a look on some routing protocols of this type of networks, which are differentiated in the working mechanism and how and when they build the routing table. And because of the time constraints we have focused on two different grouped protocols which are the reactive AODV and the proactive DSDV routing protocols, these routing protocols are proposed for ad-hoc mobile networks. In DSDV routing protocol, mobile nodes periodically broadcast their routing information to the neighbours. Each node requires to maintain their routing table. AODV protocol finds routes by using the route request packet and route is discovered when needed. The comparison of these protocols is done with random movement of the nodes which is changed over time. The parameters throughput, routing overhead, and packet loss have shown that AODV performs better than DSDV in throughput and routing overhead. However, figures have shown that packet loss in AODV is higher than in DSDV.

8. Future Work

As my future studies and to observe the protocols more objectively, it is worth trying different applications with different traffic types in.

A comparison of two routing protocols, AODV and DSDV has been carried out. Which can be proposed to compare all other routing protocols considering the same simulation parameters so that an exhaustive comparison of various routing protocols can be made.

By studying and analysing the building block of Routing Protocols it make possibilities to create better routing protocol by new change in these routing protocols.

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