
Performance Evaluation of AODV and DSR Routing Protocol in MANETs

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Abstract

Mobile Ad hoc Network (MANET) is a collection of mobile devices, a self configured, multi-hop network. Mobile Adhoc Network (MANET) is a wireless network without infrastructure and centralized administration. The present paper discusses the critical issues of MANET. Ad hoc on Demand Distance Vector Routing Protocol (AODV) is the effective reactive routing protocol in MANET. Also there is a random and dynamic change network topology due to the mobility of host therefore the need for a robust dynamic routing protocol (DSR) is required. The paper presents a implementation of two routing protocols DSR and AODV using Qualnet 6.1 and compare its performance in terms of average jitter, average end-to-end delay and Throughput.

Keywords

Ad Hoc Network, Routing Protocol, AODV, DSR, End to End Delay, Throughput, Jitter

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Introduction

A MANET is an autonomous group of mobile users that communicate over reasonably slow wireless links. Mobile Ad hoc Networks (MANETs) are decentralized and mobile nodes act as router and also as host. Mobile nodes can transmit the packets to the nodes which are in its proximity. The nodes are free to move randomly and organize themselves arbitrarily; thus, the network's wireless topology may change rapidly and unpredictably. Mobile nodes that are within each other's radio range communicate directly via wireless links, while those far apart rely on other nodes to relay messages as routers^[1]. In ad hoc network each node acts both as a host and a router which forwards the data intended for some other node. MANETs offer several advantages over traditional networks including reduced infrastructure costs, ease of establishment and fault tolerance, as routing is performed individually by nodes using other intermediate network nodes to forward packets^[2], this multi-hopping reduces the chance of bottlenecks, however the key MANET attraction is greater mobility compared with wired solutions. The objective of this paper is to perform a comparative study of two MANET routing protocols namely DSR(Dynamic Source Routing Protocol) and AODV (Ad Hoc On-demand Distance Vector) on various parameters. The rest of the paper is organized as follows: Section 2 describes an idea of both routing protocols, Section 3 deals with the comparison of both routing protocols on various parameters such as average jitter ratio, average end-to-end delay, Throughput.

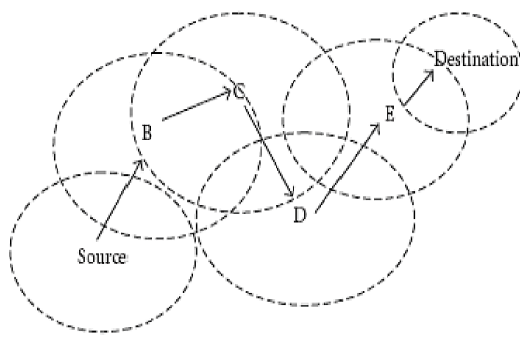


Figure 1. Mobile ad-hoc network

Routing Protocols for MANET

Dynamic source routing (DSR)

The Dynamic Source Routing (DSR) Protocol is a Reactive routing Protocol there are two major phases in DSR namely: The Route Discovery Phase and Route Maintenance Phase. The key distinguishing feature of DSR^[3] is the use of *source routing*. That is, the sender knows the complete hop-by-hop route to the destination. These routes are stored in a route cache. The data packets carry the source route in the packet header^[7]. DSR makes very aggressive use of source routing and route caching. No special mechanism to detect routing loops is needed. When a node in the ad hoc network attempts to send a data packet to a

destination for which it does not already know the route, it uses a route discovery process to dynamically determine such a route^[8].

Ad-Hoc on Demand Distance Vector Routing Protocol (AODV)

The AODV Routing Protocol uses an on-demand approach for finding routes, that is, a route is established only when it is required by a source node for transmitting data packets^[9]. The Ad-hoc On-Demand Distance Vector routing Protocol (AODV), is one of more considered routing algorithm in ad hoc networks and is based on the law of find out routes as required^[10]. AODV routing algorithm is a famous method for structure routes paths among network nodes. In AODV^[4], when a source node requirement to send packets to the destination but no route is available, it begins a route discovery operation.

Experimental Setup

The performance is analyzed beside parameters such as maximum speed and pause time^[4]. Research has been carried out in order to evaluate performance of MANETs. The aim is to decrease end to end delay and increase throughput. Experiments are run on 6 diverse mobility speeds and also on dissimilar number of nodes. The mobility model is Random Waypoint model of 1000 * 1000 meters area size^[11].

Table 1. Simulation parameters^[5]

Parameter	Value
Number of nodes	20
Simulation time	500 sec
Pause time	0s,30s,60s,90s
Environment size	1000*1000meter2
Traffic type	CBR
Packet size	512bytes
Maximum speed	10,20,30,40m/sec
Simulator	Qualnet6.1
Mobility model	Random waypoint
Transmission range (m)	250 m
Packet rate	2.0 packet/sec
Routing protocol	AODV, DSR
Propagation model	Two ray ground
Antenna type	Omni antenna
Network interface	PHY/wireless PHY
Mac type	Mac802.11

Result analysis of mobility based AODV and DSR

Average Throughput

Throughput or network throughput is the average rate of successful message delivery over a communication channel^[6]. The throughput is usually measured in bits per second (bit/s or bps), and

sometimes in data packets per second or data packets per time slot. From graph it is analyzed as number of node increase in network throughput gets better.

The end to end delay

The time difference between every CBR packet sent and received was recorded, dividing the total time difference over the total number of CBR packets received gave the average end-to-end delay for the received packets. It is defined as the time a data packet is received by the destination minus the time the data packet is generated by the source.

Average jitter

Jitter is the variation in the time between packets arriving, caused by network congestion timing Drift or route changes. Jitter should be small for a routing protocol to perform better.

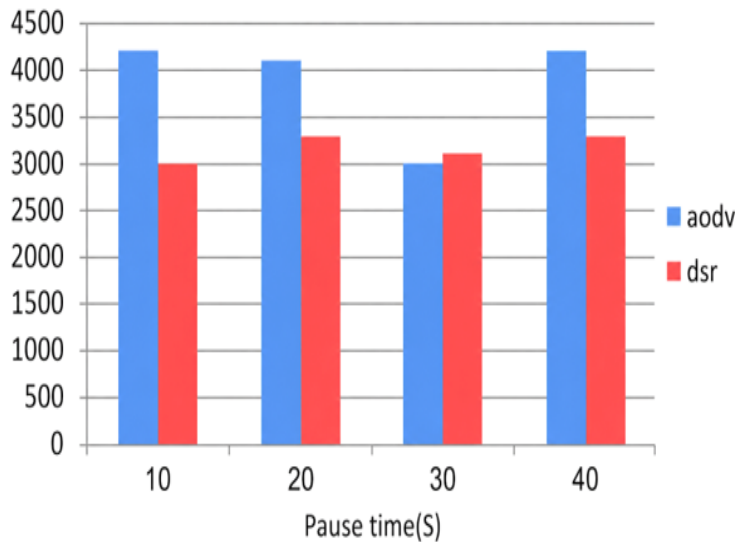


Figure 2. Pause Time Vs Average Throughput

Figure 2 it is clear that at 10m/s onwards AODV outperforms than DSR because as the throughput of DSR decreases with node velocity. The throughput is usually measured in bits per second (bit/s or bps), and sometimes in data packets per second or data packets per time slot. From graph it can analyze as number of node increase in network throughput gets better.

Figure 3 shows the average end-to-end delay of each protocol. It should be noted that the delay is considered for the packets that actually arrive at the destinations. It can see that AODV has lower delay than DSR. This metric describes the lower the end-to-end delay the better the application performance. The reason is that DSR chooses route earlier, AODV chooses recent route according to turn around request.

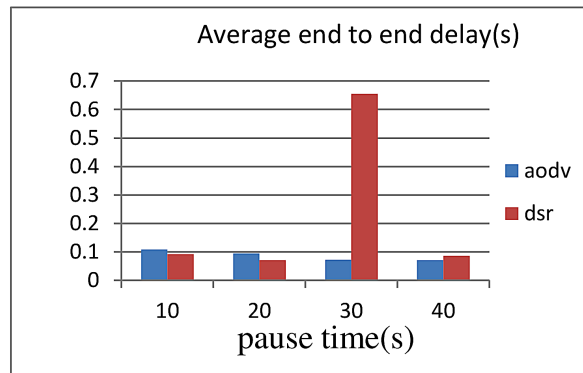


Figure 3. pause time Vs End to End Delay

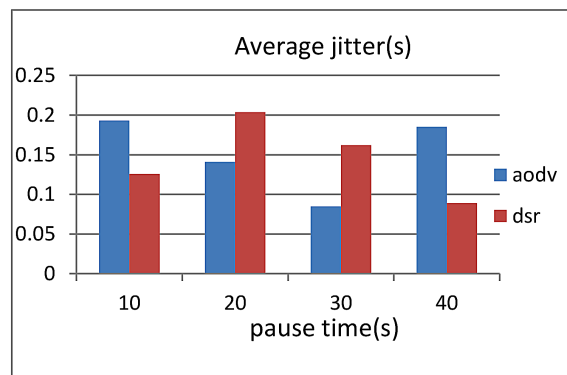


Figure 4. Pause Time Vs Average Jitter

Figure 4 show the average jitter. According to simulation results, DSR shows best performance and AODV shows worst performance in terms of average jitter. In DSR there is more chance for jitter as source node initiates route discovery mechanism by Broadcasting, a route request packet to its neighbors AODV.

Conclusion

The research paper is compared two on-demand routing protocols, namely, Ad hoc On-Demand Distance Vector Routing (AODV) and Dynamic Source Routing (DSR). It observed that the end to end delay is very high in case of DSR, initially but it decrease substantially on the number of node increases. In AODV the numbers of node increase probability of finding destination increases. The results show that DSR improves the performance of AODV in most metrics, as the end to end delay, average jitter and average throughput especially in high speed mobility of nodes and as well as in pause time.

Future Work

In present research work recognized that, deploying a MANET security is one of the important features that should be considered. Future work will be to evaluate the performance of AODV and DSR routing protocols by taking different metrics like by varying traffic source, Quality of services and packet delivery ratio. Some of the aspects in this study are still under observation as the performance is still to be compared by other routing protocols with more metrics.

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