The Effect of Node Speed on Mobile Ad Hoc Network Performance

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Abstract: Announcement between mobile nodes is a challenging network especially via Mobile Ad Hoc Network (MANET), where mobile nodes are capable of moving on a continual basis, which is changeable and challenging to analyse the performance of its routing protocols and application. In this paper, we evaluate the performance of routing protocols over MANET for Ad Hoc on demand Distance Vector (AODV), Destination-Sequenced Distance Vector (DSDV), as well as Dynamic Source Routing (DSR). We use Network Simulator NS-allinone-2.31 tool for the practical testing and evaluation. We have tested the routing protocols AODV, DSDV, and DSR. So, different performance features are investigated including, Packet loss, Packet Delivery Fraction (PDF), End-to-End Delay. The results indicate that performance of routing protocols where the number of nodes start from 5 to 100 nodes during the entire scenario for node speeds equivalents to 10m/s, besides the delivery of packet size equivalents to 512kb.

Keywords: Mobile Ad hoc Network, Dynamic Source Routing, Packet Loss, End-to-End Delay, NS-2 Simulator.

1. Introduction

In Mobile Ad Hoc Network (MANET) the mobile nodes can work as router and characterized as random changing topology and dynamic in the last rapidly changing topology when mobile node communication with another node is very important to get routing protocol with multi hop paths. The new generation for mobile should be supported high frequency and high bandwidth for mobile area coverage so as to share wireless LAN in anticipated load situation when wireless mobile hosts collection from network without any base station (BS). It is very important for the enrolled mobile node to give support to any host even to send information or packet to another destination on this network however in MANET, the host act as route and all host consist of hops [1]. Mobile nodes that changes environment in MANET can result to failure of routing algorithms which is a big challenge in ad hoc network high number of node mobility which can be affected by rapid and unpredictable nodes [2]. As we have mentioned earlier in MANET, mobile host connection together can act as routing protocol. MANET consists of variant routing protocols which are: proactive, reactive and hybrid routing protocol as shown in Figure 1.

Proactive routing protocols are called "table-driven" routing protocols where a mobile node that connects with another mobile node get routing table immediately and most proactive routing protocol inherited this properties from algorithms used with wired network which have modified the wired network protocols. It uses the updated information from time to time to get information about the topology due to increasing the number of nodes or changing the location of the mobile nodes.

Reactive routing protocols are called "on demand" routing protocols, because these protocol are on demand, the basic is idea to create a route to another destination, when any mobile host

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Figure 1. Routing protocols for ad hoc network.

In this paper, we evaluate the performance of routing protocols over MANET for Ad Hoc on demand Distance Vector (AODV),
Destination-Sequenced Distance Vector (DSDV), as well as Dynamic Source Routing (DSR) are evaluated. In our previous work [7], we have measured the performance of the these routing protocols with node speed equivalents to zero. However, in this work, we investigate the effect of nodes speed, so we have used the number of nodes staring from 5 till 100 for node speed equivalents to 10m/s, besides the delivery of packet size equivalents to 512kb instead of 256k/b. Moreover, the simulation area we have used in this work was 1Km*1Km instead of 500m*500m in our previous work. Also, the transmitted maximum packet in the queue was 10,000 based on the UDP protocol.

The remainder of this paper is organized as follows. In the next section, we describe DSR, DSDV, and AODV protocols, which are used in our proposed scheme. In section 3, we introduce our experimental work. Finally, in section 4 we conclude the paper.

2. Literature Review

2.1. Dynamic Source Routing Protocol (DSR)

DSR routing protocol was considered as one of reactive routing protocols, as soon as it was designed for multi-hops using with mobile and wireless ad hoc network nodes. DSR have permitted connection of collection of mobile nodes freely without at all infrastructure and main center as administration as well as self-organization [8].

The most important two circumstances consequence on DSR routing protocols on its mechanism are route discovery and route maintenance and both of them can be exercise with mobile node able to maintenance and discover the source route for any neighbour host to transmit information to neighbour host as the host receives information from other node which updates the routing protocol and recognizes neighbour to its neighbour inside network topology. The node updates periodically for routing information to avoid loop freed because DSR have to utilize source routing to construct loop free inconsequential at what time it have completed update on routing information for the node.

2.2. The Destination-Sequenced Distance Vector routing protocol (DSDV)

DSDV routing protocol has been considered as one of proactive routing protocols. So, in this classification, the DSDV routing protocol was behaved first made groups of mobile nodes communicate using no infrastructure such as base station, while nodes be able to exchange information between them. When the mobile is out of coverage of this infrastructure and wants to be exchange data, the control message generate path between nodes to exchange information by creating ad hoc routing protocols. So, when routing table have been saved at all node network, information can be exchanged through transmitted packets between nodes through the way routing table have saved information about available destination and the values of hops for all nodes, and the destination node has initiated to be able to create sequence numbers for routing table as the entire node are updated periodically [8].

2.3. Ad Hoc on demand Distance Vector (AODV)

The ad Hoc on demand Distance vector was designed for ad Hoc network to provide elementary communication between nodes during communicate with borderline control overhead as well as borderline latency.

In AODV, there is no maintenance route for the entire nodes via network topology merely, the route is established when node requested and hold up route for specific of time depending on how long time node is needed while the link was broken and node attempt to discover route to offer free loop to reach it as well as free loop to be able to create through using sequence number where sequence number increment from time to another to realize change that occur at the network topology. AODV have multi-caste and uni-cast communication however, this kind of communication could be streamline by increasing uni-cast and multi-cast by searching and be able to obtained information for route.

AODV is proposed for only symmetric link between neighbour nodes where AODV is not suitable to work with wired and wireless media. So, the router table for AODV consists of IP address, next hop, destination, as well as the sequence number that maintaining the entire list nodes, and the structure for AODV routing protocols for Ad Hoc Networking [9, 10].

3. Experimental Work

3.1. Packet Loss

Figure 2 below shows the packet loss, it can be observed when the number of nodes are 20, AODV has the better recorded performance than DSR, while AODV reached to 0.1958, and DSR was 0.8878 as DSDV is 11.6991. By increasing the number of nodes, DSDV is better than before when it was at small number of nodes for packet loss, however it is still the worst routing protocol. Also, it can be observed that the AODV routing protocol is better than DSR when the number of nodes is increased, for instance, when it reached 90 nodes, DSR was 1.3718 and AODV was 0.1433. Because AODV and DSR have forwarded packet with better metric for route for DSDV 33.9013 due to the needless of advertising the routing information, there was no change in network topology.

3.2. Packet Delivery Fraction (PDF)

As shown below in Figure 3 which shows the packet delivery fraction, it can be observed when the number of nodes is 5, the AODV has better performance than DSR, while AODV is reached to 392 bytes, and DSR is 330 bytes, but DSDV was at 320. So, by increasing the number of nodes DSDV was better than before when it was at small number of nodes for PDF, at the same time it is still the worst routing protocol. Also, it can be observed that the AODV routing protocol is better than DSR routing protocol when the number of nodes is increased, for instance, when it reached to 90 nodes, DSR obtained better performance than AODV as well as the DSDV, where the DSDV had the worst performance, this is due to the reason that AODV and DSR construct the routing information when they were created and are more adaptive. However, DSDV...
routing table entry might have been directed to forward the
information over a broken link.

![Figure 3. Packet Delivery Fraction](image)

### 3.3. End-to-end Delay

In Figure 4, we observe that when the number of nodes is 30, the
information was carried about DSDV, DSR, and AODV, the
performance for routing table for DSDV is 5.54842 m/s, DSR is
7.3481 m/s, and AODV is equalled to 7.45089 m/s. Based on this
information, the DSDV has a better performance than DSR, but
has the worst performance in AODV routing protocol. This is
because, DSDV is proactive routing protocols and has
information about the entire destination. By increasing the
number of nodes, the DSR was still obtained the same value for
delay, but realized that the DSDV becomes better than before
because it was able to avoid extra traffic with incremental updates
instead of full dump updates and AODV performance still the
worst routing protocols. For instance, from node 100 it reached
maximally 107.479 m/s due to no routing protocols available
when nodes were requested.

![Figure 4. End-to-end delay](image)

### 4. Conclusion

In this paper, we have exploited a simulation for different routing
protocols over MANET. We have focused on DSR, AODV and
DSDV routing protocols in which we are able to investigate the
performance of the routing protocols through varying the number
of nodes for entire circumstances starting from 5 to 100 nodes
with entire nodes speed equivalents to 10 m/s, and delivery
packet size equivalents to 512 kilo bytes.

We have used NS-Allinone-2.31 tool for simulating and
investigating the variants of routing protocols. We have realized
well performance over MANET through the impression of
computing packet loss, PDF, and the delay.

We found the best performance for AODV routing protocols was
over PDF, packet loss. However, for end-to-end delay the greatest
performance was DSDV routing protocol as well as the good
performance for AODV routing protocol.

For future research work, it would be interesting to evaluate more
protocols that have been used in ad hoc networks.

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