Performance Evaluation of AODV, DSDV and DSR routing protocols in ad hoc network

Abstract

A Mobile Ad hoc NETWORK (MANET) is a kind of wireless ad-hoc network and is a self-configuring, network of mobile routers connected by wireless links. In this article, some main routing algorithm used in Ad Hoc network, such as DSR, DSDV and AODV are analyzed with the help of NS2 simulator. Firstly, performances of these four routing protocols are tested in NS2.Different routing protocols, which can be classified into two main categories proactive and reactive.

1. INTRODUCTION

In recent years, the use of mobile devices in various applications has increased. A main reason for this increase has been the progress made in wireless networks research. Mobile ad hoc networks (MANETs) are an important class of wireless networks that allows their nodes to move freely. Nodes in a MANET can exchange data directly if they are within the same radio range, and when they are far apart they exchange data through other nodes. Thus, a node in a MANET acts both as a communication end and a router. Because MANETs have limited radio communication bandwidth and use battery power, their protocols, including the routing protocols, must be efficient in the use of bandwidth and energy. A major way to conserve bandwidth and energy is reducing control overhead. There are two classes of ad hoc routing protocols, the proactive and the on-demand protocols. In

the proactive routing protocols, a node typically maintains a local routing table that has an entry for each destination in the network. Examples of proactive routing protocols are Destination-Sequenced Distance-Vector Routing protocol (DSDV).

2. three Kinds of Route Algorithm in Ad Hoc

2.1 AODV (Ad hoc On-Demand Distance Vector Routing)

AODV is an improved version of DSDV. As a matter of fact, the essential difference between them lies in reactive route protocol. In order to find route to destination, the source node will broadcast a request. Moreover, adjacent nodes will broadcast that packet until it reaches a node which contains the route information about destination node. When the node forward packets, it type in ID in its table so that it constructs route from destination node to source node. If the source node moves, it will start route discovery again. If the intermediate node moves, the link will be invalid and the node will send this message to source nodes. Then, the source node will start route discovery again.

AODV utilizes periodic beaconing (HELLO packets) for route maintenance. If a node does not receive a HELLO packet within a certain time, or it receives a route break signal that is reported by the link layer, it sends a route error packet by either unicast or broadcast, depending on the precursor lists (i.e. active nodes towards the destination), in its routing table. AODV avoids the stale route cache problem of DSR and it adapts the network topology changes quickly by resuming route discovery from the very beginning.

2.2 DSDV (Destination - Sequenced Distance-Vector Routing)

DSDV [4] is an enhancement to distance vector routing for ad-hoc networks. A sequence number is used to tag each route. A route with higher sequence number is more favorable than a route with lower sequence number. However, if two routes have the same sequence number, the route with fewer hops is more favorable. In case of route failure, its hop number is set to infinity and its sequence number is increased to an odd number where even numbers are reserved only to connected paths. 3

The detailed implementation of DSDV by NS-2 is: a packet will be cached if it doesn't find route Information. At the same time, the node send checking information continuously until it find reacting message from the receiver. When cache is overflowed, the latest packets will be abandoned.

2.3 DSR (Dynamic Source Routing)

DSR is composed of two parts; route discovery and route maintenance. It is based on source routing which means that the node sending a data packet lists in its header the nodes that the packet shall go through. A brief discussion for route maintenance and route discovery is given in the following subsection.

2.3.1 Route discovery

When an initiating node (initiator) wants to send a data packet to a target node (target), it looks in its route cache for a route to the target node, if a route is found it is used to send the packet. In case no route is found in the route cache the initiator node broadcasts a route request with a unique identifier with respect to the route requests recently sent before from this node to the nodes in its direct radio transmission range in the ad hoc network. In case a receiving node has seen a route request from the initiator with the same identifier before; it discards the route request, otherwise, if it is the target of the route request; it sends a route reply with the passed nodes, otherwise, it looks for a route to the target of the route request in its route cache and sends a route reply with the route if found, if not found, it appends its address to the passed nodes in the route request and re-broadcasts the route request to the surrounding nodes in its direct radio transmission range.

2.3.2 Route maintenance

Route maintenance in DSR is the process of making sure that a sent data packet has reached the destination and there are no broken hops through the route because two nodes became too far, for example. To apply this process, each node receiving a data packet throughout the route listed in the packet's header sends an acknowledgment to its previous node. In case, no acknowledgment is received after a fixed number of re-transmission of a data packet this hop is considered as broken and a route error is sent to the sending node using the same route used by the packet to reach the current node. Then, the initiator removes the broken hop from the routes in its route cache and initiates a route request to the target if needed. Many optimizations have been made to DSR, 4 but, we are focusing here on securing DSR with no optimizations using mobile agents.

3. Simulate and Result

For the simulation of the developed system, latest version 2.26 of NS-2 has been used in this paper. Ns-2 is a discrete event simulator targeted at networking research.

3.1 scenario

- Topology of 500*500 is taken for simulation.
- Nodes are being generated randomly at random position.
- Nodes are generated at random time as if few nodes are entering into the topology.
- Nodes are moving at constant random speed.
- Radio propagation model used is Two-Ray Ground.
- Antenna model used is Omni Antenna
- Movement is linear and node speed is constant for a simulation

3.2 Node Characteristics *:*

- Link Layer Type: Logical Link (LL) type
- MAC type: 802_11
- Queue type: Drop-Tail
- Channel type: wireless
- The simulation parameters are listed in Table

3.3 Performance Metrics
The following different performance metrics are evaluated to understand the behavior of DSDV, AODV and DSR routing protocols .

- Throughput
- The average end to end delay.
- packet delivery.

Table1: simulation parameters

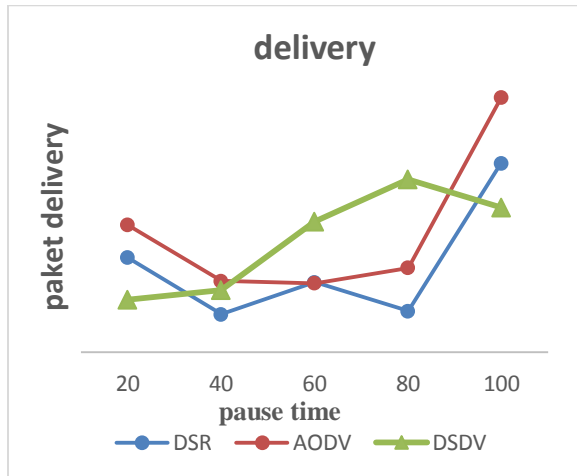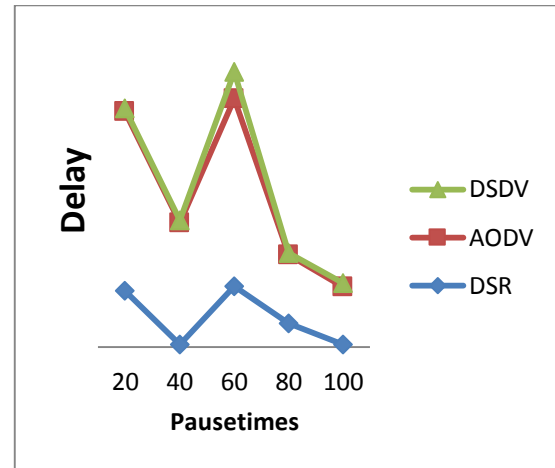| Parameter	Value
Simulator	Ns-2
Channel type	Channel/Wireless channel
Radio-propagation	Propagation/Two ray round wave
MAC Type	Mac /802.11
Inter queue Type	Queue/Drop Tail
antenna	Antenna/Omni Antenna
Maximum packet in ifq	50
Area (M*M)	500*500
Maximum speed	10 m/s
Number of mobile node	50
Source Type	UDP
Pause time	20,40,60,80,100s
Simulation Time	500s
Routing protocol	AODV,DSDV,DSR

Figure 1. packet delivery vs pause times
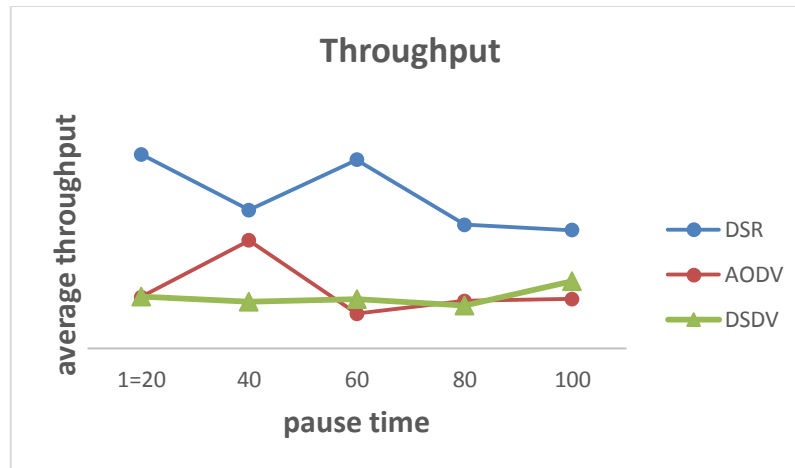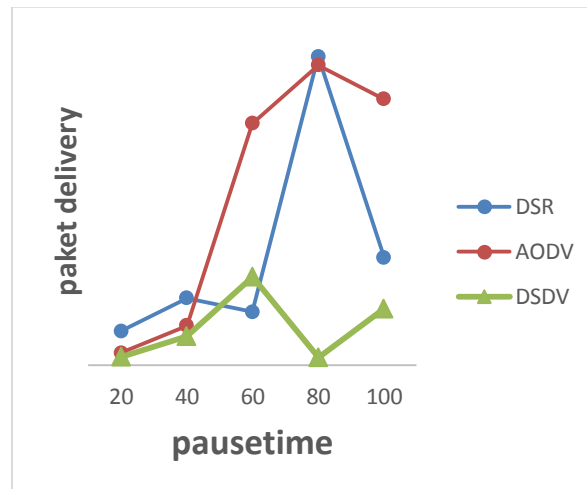

Figure 2. Average Delay vs pause times

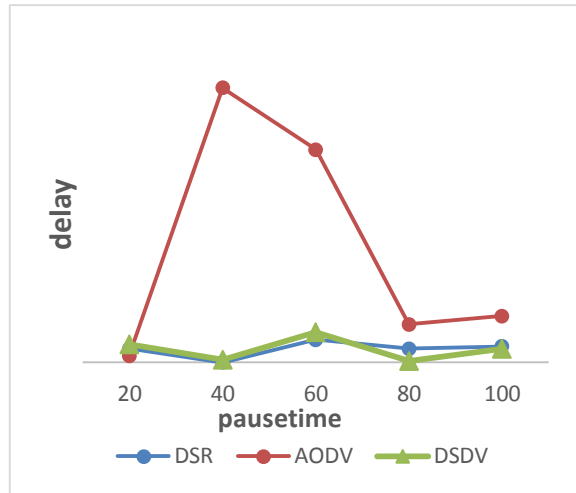**Figure 3. Average Throughput vs pause times**

Simulation 2

In this simulation pause time is varying and considered 20, 40, 60, 80, and 100 second. The network parameters we have used in this simulation shown in the table2.

Table2: simulation parameters

Parameter	Value
Simulator	Ns-2
Channel type	Channel/Wireless channel
Radio-propagation	Propagation/Two ray round wave
MAC Type	Mac /802.11
Inter queue Type	Queue/Drop Tail
antenna	Antenna/Omni Antenna
Maximum packet in ifq	50
Area (M*M)	500*500
Maximum speed	10 m/s
Number of mobile node	70
Source Type	UDP
Pause time	20,40,60,80,100s
Simulation Time	500s
Routing protocol	AODV,DSDV,DSR

Figure 4. packet delivery vs pause times

Figure 5. Average Delay vs pause times
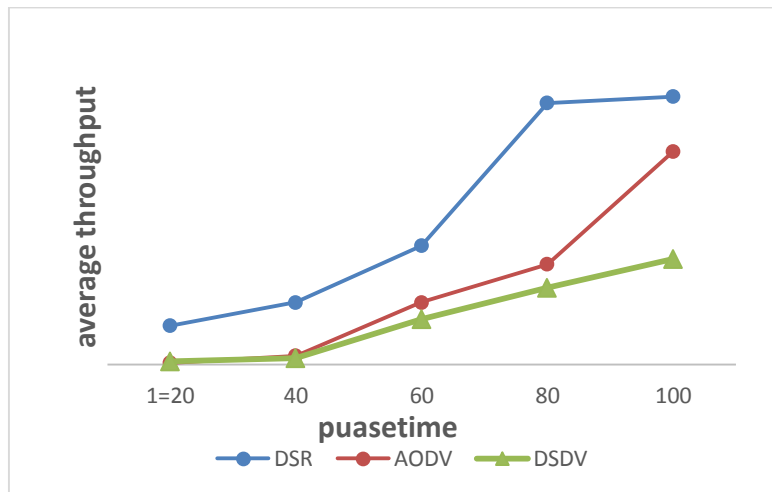
Figure 3. Average Throughput vs pause times

4. Conclusion

With the help of NS network simulator, we contrasted and compared the routing algorithm in four Ad hoc networks which are based on the 802.11 MAC protocol. We designed two simple experiments to analyze those four routing protocols. We mainly focused on the effects on the throughput, delay and the packet delivery on MAC layer which are caused by the number of nodes and the pause times, and we obtained a conclusion in the end.

References

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[4] Eman Abdelfattah & Guinshin Liu**, "Performance Evaluation of Mobile Ad-Hoc Routing Protocols",** Springer Journal on Novel Algorithms and Techniques in Telecommunications, Automation and Industrial Electronics, pp. 330-334, Dec 2008.

[5] Nor Surayati Mohamad Usop**, "Performance Evaluation of AODV, DSDV & DSR Routing Protocol in Grid Environment**", IJCSNS International Journal of Computer Science and Network Security, VOL.9, Issue 1, pp. 261-268, July 2009.