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Study and Analysis of Routing Protocol in Manet

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***Abstract*:** *AMobile Ad-hoc Network (MANET) is a network that has the ability to communicate each other without any fixed network. It has the capacity to take decisions on its own. MANET has no infrastructure. The bridges in the network are known as a base station. Nodes can move freely anywhere, independent of each other and it makes routing more difficult if the nodes will keep on moving. The routing protocol in MANET should be more dynamic so that they quickly respond to topological changes.So in MANET topology changes frequently.Because of the dynamic property of mobile nodes MANET require an efficient routing protocol for best results[1]. This paper analyze the performance based on mobility model of Reactive routing protocol AODV (on demand distance vector), DSR (dynamic source routing) and proactive routing protocol DSDV (destination sequence distance vector). Performances are analyzed with respect to throughput, end to end delay and packet delivery ratio. Simulations were carried out using Network Simulator-2 (NS-2)version 2.35.*
Keywords: *Aodv, Dsr, Dsdv,Manet, Ns2.*

I. Introduction

A Mobile Ad-hoc Network (MANET) can be defined as collection of mobile nodes. It does not have any fixed infrastructure. Due to this the mobile nodes in the network dynamically setup paths among themselves to send packets from the source to destination and it is a self-configuring network[2]. These networks consist of multiple nodes and links. Each node requires a route for communication. Hence, each node participates in routing process by forwarding data to other nodes. We describe a comparative performance analysis of three routing protocols for mobile ad-hoc networks (MANETs):

Ad-Hoc On-Demand Distance Vector (AODV),Dynamic Source Routing (DSR) and Destination Sequence Distance Vector (DSDV).

Wireless networks are classified into two categories; Infrastructure networks and Ad Hoc networks.

1) Infrastructure networks: An Access Point (AP) represents a central coordinator for all nodes. Any node can be joining the network through AP. In addition, AP organizes the connection between the Basic Set Services (BSSs) so that the route is ready when it is needed. However, one drawback of using an infrastructure network is the large overhead of maintaining the routing tables.

2) Ad Hoc networks: A wireless ad hoc network is a decentralized type of wireless network. The network is ad hoc because it does not rely on a preexisting infrastructure, such as routers in wired networks or access points in managed (infrastructure) wireless networks[3]. Ad Hoc networks do not have a certain topology or a central coordination point. Therefore, sending and receiving packets are more complicated than infrastructure networks**.**

Advantages of MANET

1. It is very reasonable
2. Time taken to transmit data is less
3. Does not require any infrastructure to work
4. Can support Mobility
5. Self-configurable
6. More robust then cellular system

Challenges of MANET

1. Limitations of the Wireless Network
- packet loss due to transmission errors
- variable capacity links
- frequent disconnections/partitions
- limited communication bandwidth

2. Limitations Imposed by Mobility
- dynamically changing topologies/routes

- lack of mobility awareness by system/applications

3. Limitations of the Mobile Computer

- short battery lifetime
- limited capacities

Applications of MANET

1. Vehicle network
2. Emergency operations
3. Entertainment, education and commercial etc.
4. Military or police operation
5. Disaster relief operation

II. Related Work

The author SukhchandanLally [12]work include that wireless ad-hoc networks are decentralized wireless networks that do not rely on an infrastructure, such as base stations or access points. Routing protocols in ad-hoc networks specify communication between routers and enable them to select routes between a source and a destination. In this paper, we compared performance of various wireless ad-hoc routing protocols with a simulation study of 16 wireless LAN nodes in various environments. Based on the simulation results, AODV is the most flexible protocol among the three protocols and performs better in presence of movement while generating low routing traffic overhead. Scaling of MANET routing protocols such as AODV,DSR, and OLSR depends on node count, node density, traffic intensity, traffic path hop count, and network bandwidth.

The authorMohapatra, P.Kanungo[13] uses the routing strategic approach, mostly in wireless scenario, primary emphasis is given on path routing and routing protocol selection. Again in Mobile Ad hoc Network (MANET) a routing protocol is to be selected in such a way that the network can be suitably designed to give best data delivery as well data integrity. So performance analysis of the protocols is the major step to select these protocols. The comparative performance analysis like delay, throughput, control overhead, and PDR is done over protocols like Ad hoc On demand Distance Vector (AODV), Optimized Link State Routing (OLSR), and Destination Sequenced Distance Vector (DSDV) in NS2 Simulator. Based on these parameters a proper protocol can be designed for an efficient MANET.

III. Routing Protocols Of Manet

Ad-Hoc Routing Protocols -Ad-hoc routing protocols is a standard which keep total control on how nodes will route packetsbetween devices in a mobile ad-hoc network. Nodes in ad-hoc networks are not aware of the network topology and have to discover it themselves. MANET routing protocols can be classified as unicast, multicast, and broadcast. The main goal of unicast protocols is to establish and maintain a route between a pair of nodes. MANET can be further classified as reactive (on-demand) and proactive

(table-driven) routing protocols. In addition to these protocols, there arehybrid routing protocols that combine the merits of both reactive and proactive routing protocols. The advantage of on-demand routing protocols is that they generate less routing overhead compared to table-driven routing protocols. However, a source node may suffer from long delays required to obtain a route to a specific destination. The advantage of table-driven routing protocols is that a source node may obtain a routing path immediately if needed. However, they generate a high routing overhead

Ad-Hoc On-Demand Distance Vector (AODV) Algorithm :AODV is one of the most popular reactive routing protocols and is suitable for a dynamic self-starting network and ad-hoc networks[4-5]. It ensures loop-free routes even while repairing broken links. Since the protocol does not require global periodic routing advertisements, the overall bandwidth needed for the mobile nodes is considerably smaller than protocols that need such advertisements AODV defines Route Request(RREQ), Route Reply (RREP), and Route Error(RERR) message types. These message types are received via UDP and, hence, the usual Internet Protocol (IP) header processing applies. A source node initiates path discovery operation by sending RREQ packet to its neighbors in case it does not have a valid route to a specific destination but wishes to send a packet. The request is forwarded until the destination or an intermediate node responds with a "fresh enough" route. A reverse path may be established when intermediate nodes record the address of the neighbor in their routing tables. The destination or the intermediate node responds with a RREP that unicasts to the neighbor that first received the RREQ packet and routes back along the reverse path. When the nodes in the network move and the network topology changes or the links in the active path break, the intermediate node that discovers this link failure propagates an RERR packet.[6-7]

Dynamic Source Routing (DSR) Algorithm : Dynamic Source Routing is an on-demand routing protocol based on the concept of source routing where each routed packet carries in its header a complete and ordered list of nodes through which packet traverses[6]. Hence, intermediate nodes need not maintain up-to-date routing

information in order to route the packets. The protocol consists of two major phases: route discovery and route maintenance. When a source node wishes to send a packet to a destination, it obtains a source route by the route discovery mechanism. At first, a source node consults its route cache to determine whether it already has a route to the destination. If such a route is not available, it initiates route discovery by broadcasting a RREQ packet. The RREQ packet then answers with an RREP packet when RREQ reaches either the destination or an intermediate node with an un-expired route. The route maintenance mechanism uses RERR packets and acknowledgments. RERR packets are generated to notify the source node that a source route is broken.

Destination Sequence Distance Vector (DSDV) Algorithm :DSDV is the table driven routing protocol that is enhanced version of distributed Bellman-ford algorithm[7]. DSDV uses bidirectional links. It works on hope by hope basis. In this, each node maintain a list of all destination and number of hopes of each and every destination. Every entry is marked with a sequence number to provide loop freedom. To keep table up to date they are exchanged between neighbouring nodes at regular intervals or when a significant topology changes are observed. In practice updates are sent in every few seconds. The route labelled with highest sequence number is always used. To minimize the traffic generated, there are two types of packets in system. One is "full dump" and another is "incremental". First packet carries all the information about a variance. However, at the time of particular movement, second type is used, which will carry the changes only, thereby increasing the overall efficiency of the system. The data broadcasted by each and every mobile node will contain the new sequence number, number of hopes to reach the destination, destination's address.

Mobility model : Random way point model is widely accepted mainly, because of its simplicity of implementation and analysis [8]. Each node chooses random destination within the given simulated field and a speed between minimum and maximum bound. Then node moves to the destination, pauses are also there for a fixed period of time, and after that node chooses new destination. However, it is supposed that, this model is insufficient to capture spatial dependence of movements of nodes, temporal dependence of movements of nodes over a time and existence of barriers constraining mobility.

IV. Simulationsetup

We have conducted extensive simulation study to evaluate the performance of different mobile ad hoc networks routing protocols reactive AODV,DSR, proactive DSDV. Simulations were carried out using Network Simulator-2 (NS-2) version 2.35.In this work, we analyze the performance of Reactive and Proactive routing protocols within simulation time for Random Waypoint Mobility model. Simulation has been carried out by using Network Simulator (NS2). Constant Bit Rate (CBR) is used. Simulation environment area as 500m x 500m was selected with time 30 second for fixed maximum speed of 20m/s.

A) Simulation Parameters

Simulator	N 2.35
Routing protocol	AODV.,DSDV,DSR
Network type	Mobile
Terrian area	500x500
Connection pattern	Random
Connection type	Tcp/ftp
Number of nodes	5,10,15,20

A) Performance Metrics

For the simulation results, we have selected the following parameters as a metrics to evaluate the performance of the different protocols:

1. Throughput: It is defined as the total number of packets received by the destination, or how much data packets correctly delivered to the destination.
2. Packet delivery ratio: It is the ratio of the number of data packets delivered to destination. In other words, it depicts the level of delivered data to destination[11]

PDR = ∑number of packet receive / ∑number of packet sent

3. End to end delay: It is the average amount of time taken by a packet to reach from source to destination. All possible delays are included due to retransmission delays, route discovery latency and transfer times.

∑ (arrive time-send time)/ ∑number of connections

V. Result And Discussion

The simulation results are focused to analyze the performance of routing protocols based on throughput, end to end delay and packet delivery ratio. The results are compared between AODV, DSDV and DSR protocols on the basis of random waypoint mobility models.

A) Average Throughput

Throughput indicate rate of communication per unit time. Throughput in this experiment evaluate for AODV,DSDV and DSR for mobility model.Fig. 1 shows the throughput (bytes per simulation time 30 sec) versus increasing number of nodes of protocols by using random waypoint mobility model. Figure 2 shows throughput versus mobility.The performance analysis of all the three protocols we observe that AODV protocol have a stable throughput as compared to others. So, in an application where there is a fast change in the network topology and a requirement of stable date rate, AODV is more preferable.

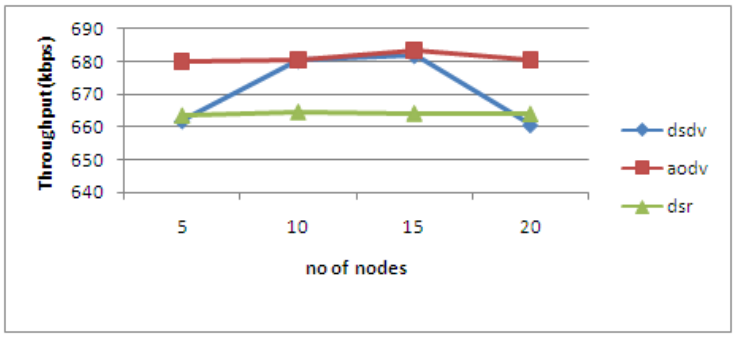

Fig 1: Throughput vs number of nodes

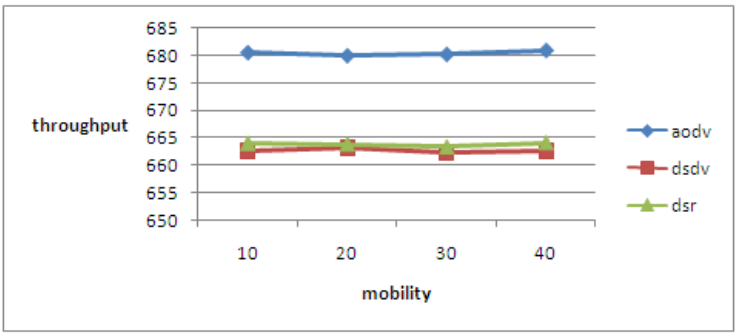

Fig 2: Throughput vs mobility

B) Packet delivery ratio

It is the ratio of data packets delivered to the destination to those generated by the source. It is calculated by dividing the number of packet received by the destination through the number of packet originated by the source. Figure 3 shows packet delivery ratio verses mobility. The packet delivery ratio of AODV, DSDV and DSR versus increasing the mobility.AODV have high value of PDR but DSR and DSDV have almost same but lower then AODV

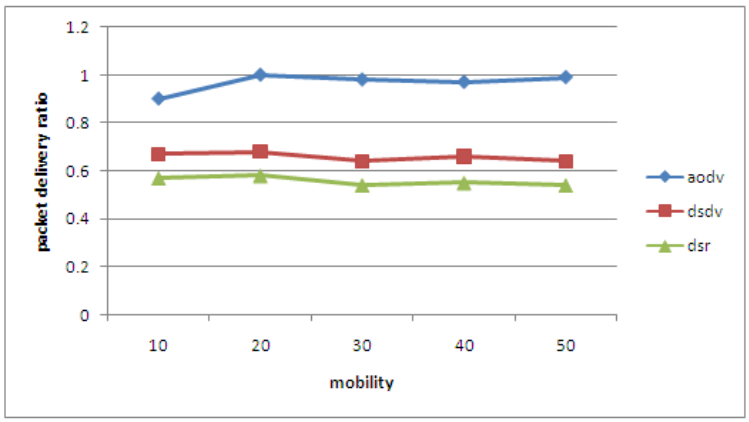

Fig 3: Packet delivery ratio vs mobility

C) End to end delay

It is the amount of time taken by packet to reach from one node to other. Fig. 7 shows end to end delay versus increasing mobility.figure 4 shows end to end delay versus mobility.

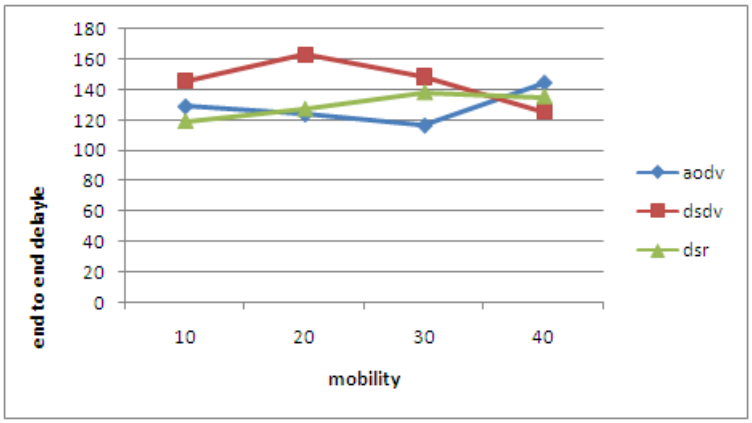

Fig 4: End to end delay vs mobility

VI. Conclusion

We have discusses the various aspects of mobile ad-hoc networking, the different routing protocols used for wireless sensor networks and the NS-2 network simulator. Also, we compared DSDV and AODV routing protocols for ad hoc networks using ns-2 simulations. DSDV uses the proactive table-driven routing strategy while AODV uses the reactive On-demand routing strategy. AODV performs better under high mobility simulations than DSDV. So we conclude that AODV perform better than DSDV and DSR in comparison

For AODV, we can see that it adapts quickly to the change of the network and has a relatively stable throughput with a moderate good put. So, in an application where there is a fast change in the network topology and a requirement of stable date rate, AODV is more preferable.

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