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Performance Analysis of DSDV Protocol Using NS-2

Meenakshi [1], Dr.Paramjit Singh[2]

[1]**M.Tech. Student, Department of CSE, P.D.M. College of Engineering, Bahadurgarh (India)** ***meenakshi.davim@gmail.com***

[2]**Professor, Department of CSE, P.D.M. College of Engineering, Bahadurgarh (India)** ***drparamjit@hotmail.com***

Abstract

The instantly created network does not have any base infrastructure as used in the conventional networks, but it is compatible with the conventional networks. DSDV is a modification of the conventional Bellman-Ford routing algorithm. It addresses the drawbacks related to the poor looping properties of RIP in the face of broken links. The modification adapted in DSDV makes it a more suitable routing protocol for ad hoc networks. This paper reviews the DSDV protocol under different mobility models. The paper is organized under different sections. Section 1 includes the introduction of the MANETs, Section 2 describes the mobility models under consideration, Section 3 is about the overview of DSDV protocol and last section i.e., Section 4 is about the simulation environment. Section 5 presents the simulation model and the results.

Keywords: *MANETs, Routing protocol, DSDV, NS-2.*

1. Introduction

A MANET (Stands for "Mobile Ad Hoc Network) is a type of ad hoc network that can change locations and configure itself on the fly. Because MANETS are mobile, they use wireless connections to connect to various networks. This can be a standard Wi-Fi connection, or another medium, such as a cellular or satellite transmission.[1]

Wireless ad-hoc networks have gained a lot of importance in wireless communications. Wireless communication is established by nodes acting as routers and transferring pack- etc from one to another in ad-hoc networks. Routing in these networks is highly complex due to moving nodes and hence many protocols have been developed.[2]

1.1 Problems with routing in Mobile Ad-hoc Networks

1. Asymmetric links

Most of the wired networks rely on the symmetric links which are always fixed. But this is not a case with ad-hoc networks as the nodes are mobile and constantly changing their position within network. For example con- sider a MANET(Mobile Ad-hoc Network) where node B sends a signal to node A but this does not tell anything about the quality of the connection in the reverse direction.

1. Routing Overhead

In wireless adhoc networks, nodes often change their location within network. So, some stale routes are generated in the routing table which leads to unnecessary routing overhead.

2. Interference

This is the major problem with mobile ad-hoc networks as links come and go depending on the transmission characteristics, one transmission might interfere with another one and node might overhear transmissions of other nodes and can corrupt the total transmission.

3. Dynamic Topology

This is also the major problem with ad-hoc routing since the topology is not constant. The mobile node might move or medium characteristics might change. In ad-hoc networks, routing tables must somehow reflect these changes in topology and routing algorithms have to be adapted. For example in a fixed network routing table updating takes place for every 30sec. This updating frequency might be very low for ad-hoc networks.[3]

1.2 Desirable properties of Ad-hoc Routing Protocols

The properties that are desirable in Ad-Hoc Routing protocols are

1. Distributed operation

The protocol should be distributed. It should not be dependent on a centralized controlling node. This is the case even for stationary networks. The difference is that the nodes in an ad-hoc network can enter or

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leave the network very easily and because of mobility the network can be partitioned.

2. **Loop free**

To improve the overall performance, the routing protocol should guarantee that the routes supplied are loop free. This avoids any waste of bandwidth or CPU consumption.

3. **Demand based operation**

To minimize the control overhead in the network and thus not waste the network resources the protocol should be reactive. This means that the protocol should react only when needed and that the protocol should not periodically broadcast control information.

4. **Unidirectional link support**

The radio environment can cause the formation of unidirectional links. Utilization of these links and not only the bi-directional links improves the routing protocol performance.

5. **Security**

The radio environment is especially vulnerable to impersonation attacks so to ensure the wanted behavior of the routing protocol we need some sort of security measures. Authentication and encryption is the way to go and problem here lies within distributing the keys among the nodes in the ad-hoc network.

6. **Power conservation**

The nodes in the ad-hoc network can be laptops and thin clients such as PDA's that are limited in battery power and therefore uses some standby mode to save the power. It is therefore very important that the routing protocol has support for these sleep modes.

7. **Multiple routes**

To reduce the number of reactions to topological changes and congestion multiple routes can be used. If one route becomes invalid, it is possible that another stored route could still be valid and thus saving the routing protocol from initiating another route discovery procedure.

8. **Quality of Service Support**

Some sort of Quality of service is necessary to incorporate into the routing protocol. This helps to find what these networks will be used for. It could be for instance real time traffic support. It should be noted that none of the proposed protocols have all these properties, but it is necessary to remember that the protocols are still under development and are probably extended with more functionality.[3]

1.3 General classification for routing protocols

There are number of routing protocols currently available in Adhoc networks. There is a need for a general technique to classify protocols available. Traditionally classification was done by dividing protocols to table driven and to source initiated. Table Driven routing protocols attempts to maintain consistent up to date routing information for each and every node in the network. These protocols require to maintain a consistent view. The area in which they differ are the number of necessary routing related tables and the methods by which changes in network structure are broadcast. A very different approach from table driven routing scheme is source initiated routing. This type of routing creates routes only when needed by the source node. When a node needs a route to a destination, it initiates a route discovery process with in the network. This process is completed once route is found or all possible route permutations has been established, it is maintained by a route maintenance procedure until either the destination becomes inaccessible along every path from the source or until the route is no longer required. An efficient classification was introduced by Feeney. This classification is based on to divide protocols according to following criteria, reflecting fundamental design and implementation choices.

1. **Communication model**

What is the wireless communication model? Multi- or single channel?

2. **Structure**

Are all nodes treated uniformly? How are distinguished nodes selected? Is the addressing hierarchical or flat?

3. **State Information**

Is network-scale topology information obtained at each node?

4. **Scheduling**

Is route information continually maintained for each destination?

This model does not care for if a protocol is unicast, multicast or geocast. Also it does not deal with how links are measures. In order to overcome this, Finnish Defence force naval academy modified the model by introducing Type cast routing and Cost function routing.

There are no measures taken to classify the protocols according to power consumption and awareness in routing protocols. In order to overcome this, we add power aware routing to this model.

1.4 Communication Model

The routing protocols presently available can be categorized according to communication model to protocols that are designed for multi-channel or single channel. The example of multichannel protocol is clustered Gateway switched routing (CGSR).Single channel presumes one shared media to be used.

1.5 Structure

Routing protocols can be categorized according to structure as:

Uniform routing

In uniform routing, all nodes acts as same manner as that of other nodes. Sending and receiving messages are control in same way by each and every node. No hierarchy is present in network.

Non-Uniform routing

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In this type, there is an effort for the limiting of routing complexity by reducing the number of nodes participating in routing computation.

1.6 State of Information

Protocols can be divided according to state of information obtained at each node as under:
Topology Based routing: This maintains a large scale topology information for each node to participating in topology based protocols. The topology based protocols follows the basic principle of link state protocols.

1.7 Destination Based routing

This does not maintain a large scale topology information but maintains topology information needed to know the nearest neighbors. i.e., each node exchanges its distance
estimates for all network nodes with each of its immediate neighbors.

1.8 SCHEDULING

Depending on when the route is computed, routing protocols can be divided into two categories.

Proactive

Also known as table – driven routing .In this metho d, the route to all destinations are computed a priori. In order to compute routes in advance, nodes need to store the entire or partial information about link and network topology. To keep the information up to date, nodes need to update their information periodically or whenever the link state or network topology changes. There is no latency.

Re-Active

Also known as on-demand routing. In this method, the route to a destination may not exists in advance and it is computed only when the route discovery process usually initiates the route requested. Once a route has been established, it is inaccessible or until is no longer used or expired.[4]

1.9 Type Cast Routing

Another type of classification can be done via, type caste property. i.e., whether they use

1. UniCast
2. GeoCast
3. MultiCast

Unicast:

Unicast forwarding means one to one communication. i.e., one source transmits data packets to a single destination.

GeoCast:

The main aim of Geocast is to deliver the data to a group of nodes situated inside a specified geographical area.

Multi Cast:

Multicast means one to many i.e., when a node needs to send same data to multiple destinations.[4]

2. Mobility models

2.1 Introduction

Mobility models represent the movement of mobile users, and how their location, velocity and acceleration change over time. Such models are frequently used for simulation purposes when new communication or navigation techniques are investigated. Mobility management schemes for mobile communication systems make use of mobility models for predicting future user positions.[5]

In the performance evaluation of a protocol for an ad hoc network, the protocol should be tested under realistic conditions including, but not limited to, a sensible transmission range, limited buffer space for storage of messages, representative data traffic models, and realistic movement of mobile users. The Random Waypoint Mobility model represents mobile nodes whose movements are independent of each other.
In the study of a new Mobile ad hoc network protocol, it is important to simulate the protocol and evaluate its protocol performance. Protocol simulation has several key parameters, including mobility model and communicating traffic pattern. Mobility models characterize user movement patterns, i.e. the different behaviors of subscribers. Traffic models describe the condition of the mobile services.

For mobility modeling, the behavior or activity of a user’s movement can be described using both analytical and simulation models. The input to analytical mobility models are simplifying assumptions regarding the movement behaviors of users. Such models can provide performance parameters for simple cases through mathematical calculations. In contrast, simulation models consider more detailed and realistic mobility scenarios. Such models can derive valuable solutions for more complex cases. Typical mobility models include

Brownian model
Random waypoint model
Random walk model
Random direction model
Random Gauss-Markov model Markovian model
incremental model
reference point group model (RPGM) and others[6]

2.2 Random Waypoint Mobility Model

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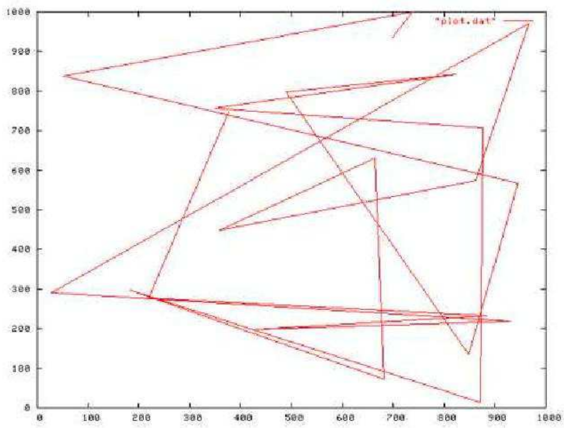
The Random Way Point Mobility Model includes pauses between changes in direction and/or speed. A Mobile node begins by staying in one location for a certain period of time (i.e pause). Once this time expires, the mobile node chooses a random destination in the simulation area and a speed that is uniformly distributed between *[min-speed, max-speed]*. The mobile node then travels toward the newly chosen destination at the selected speed. Upon arrival, the mobile node pauses for a specified period of time starting the process again.[5]



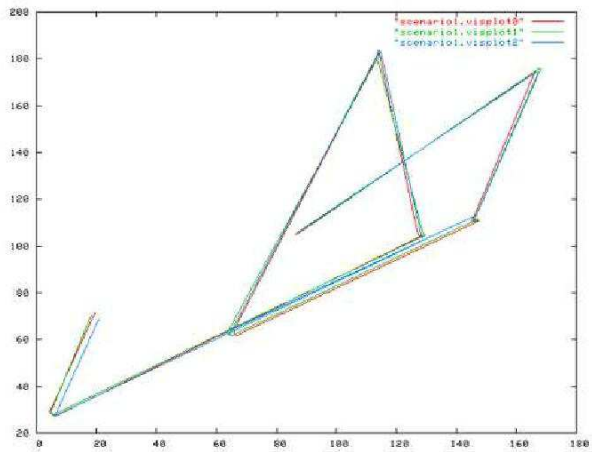
2.2 Group Mobility Model

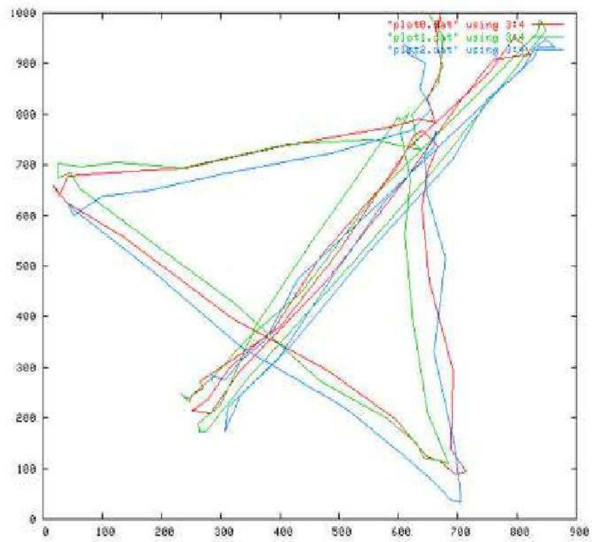
We discuss mobility models that represent multiple mobile nodes whose action are completely independent of each other. In an ad hoc network, however, there are many situations where it is necessary to model the behavior of mobile nodes as they move together.

2.2.1 RPGM (Reference Point Group mobility Model)

The Reference Point Group Mobility model represents the random motion of a group of mobile nodes as well as the random motion of each individual mobile node within the group. Group movements are based upon the path traveled by a logical center for the group. it is used to calculate group motion via a group motion vector, *GM*. The motion of the group center completely characterizes the movement of this corresponding group of mobile nodes, including their direction and speed. Individual mobile nodes randomly move about their own pre-defined reference points whose movements depend on the group movement. As the individual reference point move from time *T* to*T+1*, their locations are updated according to the group's logical center. Once the

updated reference group points, *RP(T+1)* are calculated, they are combined with a random vector, *RM*, to represent the random motion of each mobile node about its individual reference point. The length of *RM* is uniform distributed within a specified radius centered at *RP(T+1)* and its direction is uniformly distributed between *0* and *PI[5]*.





3. Overview of DSDV protocol

3.1 Destination-Sequenced Distance Vector routing

Destination-Sequenced Distance-Vector Routing (DSDV) is a table driven routing scheme for ad hoc mobile networks based on the Bellman-Ford algorithm. It was developed by C. Perkins and P.Bhagwat in 1994. The main contribution of the algorithm was to solve the Routing Loop problem. Each entry in the routing table contains a sequence number, the sequence numbers are generally even if a link is present; else, an odd number is used. The number is generated by the destination, and the emitter needs to send out the next update with this number. Routing information is distributed between nodes by sending full dumps infrequently and smaller incremental updates more frequently. [7]

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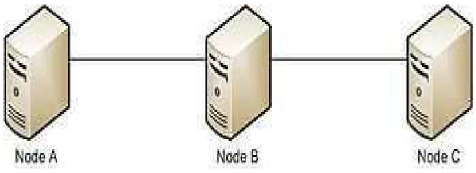

For example the routing table of Node A in this network is:

Destin ation	Next Hop	Number of Hops	Sequence Number	Install Time
A	A	0	A 46	001000
B	B	1	B 36	001200
C	B	2	C 28	001500

Our proposed routing method allows a collection of mobile computers, which may not be close to any base station and can exchange data along changing and arbitrary paths of interconnection, to afford all computers among their number a (possibly multi-hop) path along which data can be exchanged. In addition, our solution must remain compatible with operation in cases where a base station is available. By the methods outlined in this paper not only will routing be seen to solve the problems associated with ad-hoc networks, but in addition we will describe ways to perform su routing functions at Layer 2, which traditionally has not been utilized as a protocol level for routing. [8]

Packets are transmitted between the stations of the network by using routing tables which are stored at each station of the network. Each routing table, at each of the stations, lists all available destinations, and the number of hops to each. Each route table entry is tagged with a sequence number which is originated by the destination station. To maintain the consistency of routing tables in a dynamically varying topology, each station
periodically transmits updates, and transmits updates immediately when significant new information is available, since we do not assume that the mobile hosts are maintaining any sort of time synchronization, we also make no assumption about the phase relationship of the update periods between the mobile hosts. These packets indicate which stations are accessible from each station and the number of hops necessary to reach these accessible stations, as is often done in distance-vector routing algorithms. It is not the purpose of this paper to propose any new metrics for route selection other than the freshness of the sequence numbers associated with the route; cost or other metrics might easily replace the number of hops in other implementations. The packets may be transmitted containing either layer 2 (MAC) addresses or layer 3 (network) addresses.

Routing information is advertised by broadcasting or multicasting the packets which are transmitted periodically and incrementally as topological changes are detected - for instance, when stations move within the network. Data is also kept about the length of time between arrival of the first and the arrival of the best route for each particular destination. Based on this data, a decision may be made to delay advertising routes which are about to change soon, thus damping fluctuations of the route tables. The advertise-ment of routes which may not have stabilized yet is delayed in order to reduce the number of rebroadcasts of possible route entries that normally arrive with the same sequence number.[8]

The DSDV protocol requires each mobile station to advertise, to each of its current neighbors, its own routing table (for instance, by broadcasting its entries). The entries in this list may change fairly dynamically over time, so the advertisement must be made often enough to ensure that every mobile computer can almost always locate every other mobile computer of the collection. In addition_ each mobile computer agrees to relay data packets to other computers upon request. This agreement places a premium on the ability to determine the shortest number of hops for a route to a destination we would like to avoid unnecessarily disturbing mobile hosts if they are in sleep mode. In this way a mobile computer may exchange data with any computer in the group even if the target of the data is not within range for direct communication. If the notification of which other mobile computers are accessible from any particular computer in the collection is done at layer 2, then DSDV will work with whatever higher layer (e.g., Network Layer) protocol might be in use.

All the computers interoperating to create data paths between themselves broadcast the necessary data periodically, say once every few seconds. In a wireless medium, it is important to keep in mind that broadcasts are limited in range by the physical characteristics of the medium. This is different than the situation with wired media, which usually have a much more well defined range of reception. The data broadcast by each mobile computer will contain its new sequence number and the following information for each new route:

• The destination’s address.

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The number of hops required to reach the destination; and
The sequence number of the information received regarding that destination, as originally stamped by the destination; [8]

3.2 Example for DSDV operation

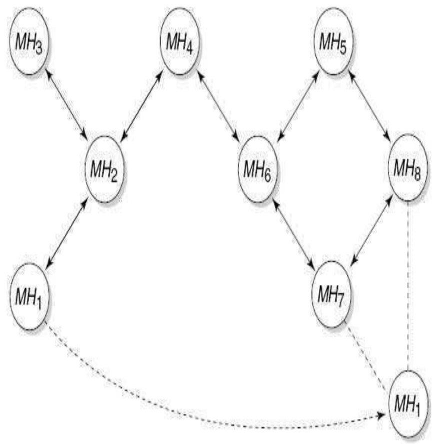

Figure 3.1: Movement of Mobile host in Ad-hoc Networks.

Consider the above fig. 3.1 which has 8 hosts in the network. We will have a look at the changes to the MH4 routing table with reference to the movements of MH1. Initially, all the nodes advertise their routing information to all the nodes in the network and hence the routing table at MH4 initially looks like

Table 3.1: Routing table of MH4

DEST INAT	NEXT HOP	ME TR	SEQU ENCE	INSTA LL	STAB LE
MH1	MH2	2	S406	T001	PTR1
MH2	MH2	1	MH1	MH4	MH1
MH3	MH2	2	S128	T001	PTR1
MH4	MH4	0	MH2	MH4	MH2
MH5	MH6	2	S392	T002	PTR1
MH6	MH6	1	S076	T001	PTR1
MH7	MH6	2	S128	T002	PTR1
MH8	MH6	3	S050	T002	PTR1
			MH8	MH4	MH8

And the forwarding table at the MH4 would look like this

DESTINATION	METRIC	SEQUENCE NUMBER
MH1	2	S406 MH1
MH2	1	S128 MH2
MH3	2	S564 MH3
MH4	0	S710 MH4
MH5	2	S392 MH5
MH6	1	S076 MH6
MH7	2	S128 MH7
MH8	3	S050 MH8

Table 3.2: Forwarding table at MH4

But, when the host MH1 moves its location as shown in the fig. 3.1 nearer to MH7 and
MH8 then, the link between MH2 and MH1 will be broken resulting in the assignment of infinity metric at MH2 for MH1 and the sequence number will be changed to odd number in the routing table at MH2.MH2 will update this information to its neighbor hosts. Since, there is a new neighbor host for MH7 and MH8; they update their information in the routing tables and they broadcast. Now, MH4 will receive its updated information from MH6 where MH6 will receive two information packets from different neighbors to reach MH1 with same sequence number, but different metric. The selection of the route will depend on less hop count when the sequence number is the same. Now the routing table will look like

DESTI NATIO	NEXT HOP	M ET	SEQU ENCE	INST ALL	STAB LE
MH1	MH6	3	S516	T001	PTR1
MH2	MH2	1	MH1	MH4	MH1
MH3	MH2	2	S238	T001	PTR1
MH4	MH4	0	MH2	MH4	MH2
MH5	MH6	2	S674	T001	PTR1
MH6	MH6	1	MH3	MH4	MH3
MH7	MH6	2	S820	T001	PTR1
MH8	MH6	3	MH4	MH4	MH4
			S502	T002	PTR1
			MH5	MH4	MH5
			S186	T001	PTR1
			MH6	MH4	MH6
			S238	T002	PTR1
			MH7	MH4	MH7
			S160	T002	PTR1
			MH8	MH4	MH8

Table 3.3: Routing table after MH1 movement

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DESTINATION	METRIC	SEQUENCE NUMBER
MH1	3	S516 MH1
MH2	1	S238 MH2
MH3	2	S674 MH3
MH4	0	S820 MH4
MH5	2	S502 MH5
MH6	1	S186 MH6
MH7	2	S238 MH7
MH8	3	S160 MH8

Table 3.4: Forwarding table at MH4 after Movement of MH1

3.3 Advantages of DSDV

1. DSDV protocol guarantees loop free paths.
2. Count to infinity problem is reduced in DSDV.
3. We can avoid extra traffic with incremental updates instead of full dump updates.
4. Path Selection: DSDV maintains only the best path instead of maintaining multiple paths to every destination. With this, the amount of space in routing table is reduced.

3.4 Limitations of DSDV

1. Wastage of bandwidth due to unnecessary advertising of routing information even if there is no change in the network topology.
2. DSDV doesn't support Multi path Routing.
3. It is difficult to determine a time delay for the advertisement of routes.
4. It is difficult to maintain the routing table's advertisement for larger network. Each and every host in the network should maintain a routing table for advertising. But for larger network this would lead to overhead, which consumes more bandwidth.

3.5 Algorithm employed

Bellman–Ford is in its basic structure very similar to Dijkstra's Algorithm, but instead of greedily selecting the minimum-weight node not yet processed to relax, it simply relaxes all the edges, and does this $|V| - 1$ times, where $|V|$ is the number of vertices in the graph. The repetitions allow minimum distances to accurately propagate throughout the graph, since, in the absence of negative cycles; the shortest path can only visit each node at most once. Unlike the greedy approach, which depends on certain structural assumptions derived from positive weights, this straightforward approach extends to the general case.

Bellman–Ford runs in $O(|V|\cdot|E|)$ time, where $|V|$ an d $|E|$ are the number of vertices and edges respectively.

Coding:

```
procedure Bellman Ford(list vertices, list edges, vertex source)
   // This implementation takes in a graph, represented as lists of vertices
   // and edges, and modifies the vertices so that their distance and
   // predecessor attributes store the shortest paths.

   // Step 1: initialize graph
   for each vertex v in vertices:
       if v is source then v.distance := 0
       else v.distance := infinity
       v.predecessor := null

   // Step 2: relax edges repeatedly
   for i from 1 to size(vertices)-1:
       for each edge uv in edges: // uv is the edge from u to v
           u := uv.source
           v := uv.destination
           if u.distance + uv.weight < v.distance:
               v.distance := u.distance + uv.weight
               v.predecessor := u

   // Step 3: check for negative-weight cycles
   for each edge uv in edges:
       u := uv.source
       v := uv.destination
       if u.distance + uv.weight < v.distance:
           error "Graph contains a negative-weight cycle"
```

4. Simulation

4.1 Implementation details

1. NS-2 i.e., Network Simulator is the tool used.
2. Front end in TCL.
3. Back end in C++.
4. Ubuntu is the OS used.

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4.2 Simulation Strategy

For the simulation of the developed system, latest version 2.35 of NS-2 has been used in this paper. NS-2 is a discrete event simulator targeted at networking research [6]. It began as a part of the REAL network simulator and is evolving through an ongoing collaboration between the University of California at Berkeley and the VINT project.

4.2.1 Scenario

- Topology of 900*900 is taken for simulation.
- 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

4.2.2 Node Characteristics

- Link Layer Type: Logical Link (LL) type
- MAC type: 802_11
- Queue type: Drop-Tail
- Network Interface type: wireless
- Channel type: wireless

Table 4.1 Simulation parameters

PARAMETER	VALUE
SIMULATOR	NS-2 (VERSION 2.35)
CHANNEL TYPE	CHANNEL/WIRELESS CHANNEL
RADIO-PROPAGATION MODEL	PROPAGATION/TWO RAY ROUND WAVE
NETWORK INTERFACE TYPE	PHY/WIRELESSPHY
MAC TYPE	MAC /802.11
INTERFACE QUEUE TYPE	QUEUE/DROP TAIL
LINK LAYER TYPE	LL
ANTENNA	ANTENNA/OMNI ANTENNA
MAXIMUM PACKET IN IFQ	60
AREA (M*M)	900 * 900
NUMBER OF MOBILE NODE	6,10
SOURCE TYPE	UDP, TCP
SIMULATION TIME	150 SEC
ROUTING PROTOCOLS	DSDV

4.2.3 Performance Metrics

The following different performance metrics are evaluated to understand the behavior of DSDV routing protocol:

- Throughput
- The average end to end delay.

5. SIMULATION MODEL AND RESULTS

5.1 Simulation Model

The objective of this paper is the performance evaluation of routing protocol DSDV for mobile ad hoc networks by using an open-source network simulation tool called NS-2

Whole simulation study is divided into two part one is create the node (that may be cell phone, internet or any other devices) i.e. NS-2 output. It's called NAM (Network Animator) file, which shows the nodes movement and communication occurs between various nodes in various conditions or to allow the users to visually appreciate the movement as well as the interactions of the mobile nodes. And another one is graphical analysis of trace file (.tr).Trace files contain the traces of event that can be further processed to understand the performance of the network. The parsing can be done using the awk command (in UNIX and LINUX, it is necessary to use gwak for the windows environment) or perl script.

5.2 Results

Generated trace file that is (.tr)

s 10.006348737 _1_ MAC --- 3 ack 118 [13a 0 1 800] ------- [1:0 0:0 32 0] [0 0] 0 0
r 10.007293041 _0_ MAC --- 3 ack 60 [13a 0 1 800] ------- [1:0 0:0 32 0] [0 0] 1 0
s 10.007303041 _0_ MAC --- 0 ACK 38 [0 1 0 0]
r 10.007318041 _0_ AGT --- 3 ack 60 [13a 0 1 800] ------- [1:0 0:0 32 0] [0 0] 1 0
s 10.007318041 _0_ RTR --- 4 tcp 1560 [0 0 0 0] ------- [0:0 1:0 32 1] [1 0] 0 0
s 10.007318041 _0_ AGT --- 5 tcp 1540 [0 0 0 0] ------- [0:0 1:0 32 0] [2 0] 0 0
r 10.007318041 _0_ RTR --- 5 tcp 1540 [0 0 0 0] ------- [0:0 1:0 32 0] [2 0] 0 0

1. First field is event type; it may be r, s, f, d for “received”, “sent”, “forwarded” and “dropped” respectively.
2. The second field is the time.
3. The third field is the node number.
4. The fourth field is MAC to indicate, if the packet concerns a MAC layer; it is AGT to indicate the transport layer (e.g. tcp) packet, or RTR if it concerns the route packet. It can be IFQ for drop packets.
5. After the dashes comes the global sequence number of the packet (not tcp sequence number).

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6. At the next field comes more information on the packet type (e.g. tcp, ack, or udp).
7. Next is the packet size in byte.
8. The 4 numbers in the first square brackets concern MAC layer information. The first hexadecimal number specifies the expected time in seconds to send this data packets over the wireless channel. The second number stand for the MAC-id of the sending node third is for receiving node. And fourth number, 800, specifies that the MAC type is ETHERTYPE_IP.
9. The next number in the second square brackets concern the IP source and destination addresses, then the ttl (time to live) of the packet (in our case 32).
10. The third brackets concern the tcp information: its sequence number and acknowledgement number.

5.2.1 Nam file output

NAM is a Tcl/TK based animation tool for viewing network simulation traces and real world packet traces. A network animator that provides packet-level animation and protocol-specific graphs to aid the design and debugging of new network protocols have been described. Taking data from network simulators (such as ns) or live networks, NAM was one of the first tools to provide general purpose, packet-level, and network animation, before starting to use NAM, a trace file needs to create [7]. This trace file is usually generated by NS. Once the trace file is generated, NAM can be used to animate it.

A snapshot of the simulation topology in NAM for 10 mobile nodes is shown in Figure 4.1, which is visualized the traces of communication or packets movements between mobile nodes [9]. And Figure 4.2 shows the running TCL script .

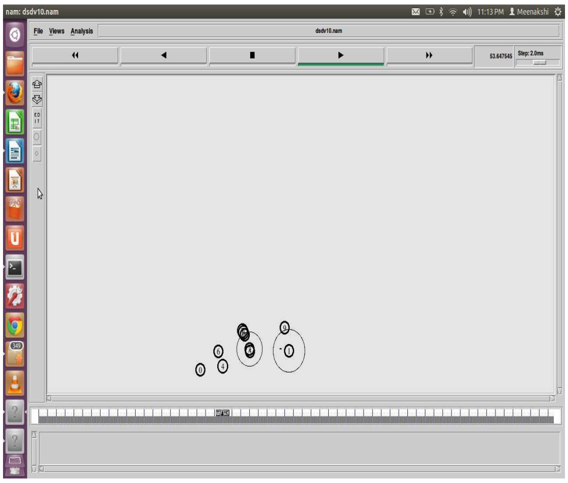


Figure 4.1 A snapshot of the simulation topology in NAM for 10 mobile nodes

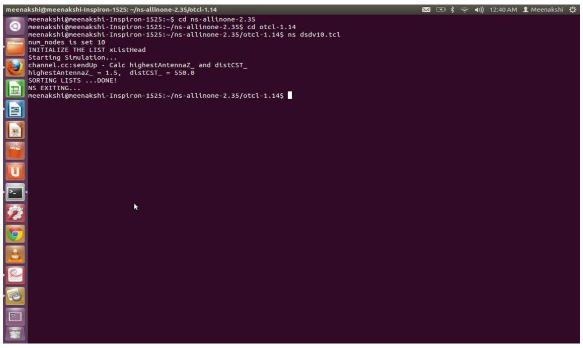


Figure 4.2 Running TCL script

5.2.2 Analysis of result

5.2.2.1 Throughput

Throughput is the number of packet that is passing through the channel in a particular unit of time. This performance metric show the total number of packets that have been successfully delivered from source node to destination node and it can be improved with increasing node density.

5.2.2.1 Throughput

A specific packet is transmitting from source to destination node and calculates the difference between send Times and received times. Delays due to route discovery, queuing, propagation and transfer time are included in the delay metric [5].

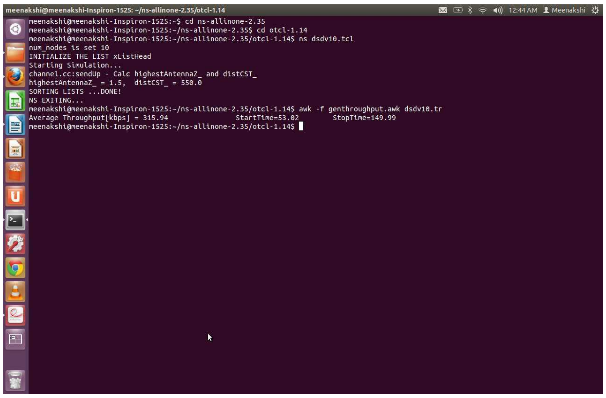
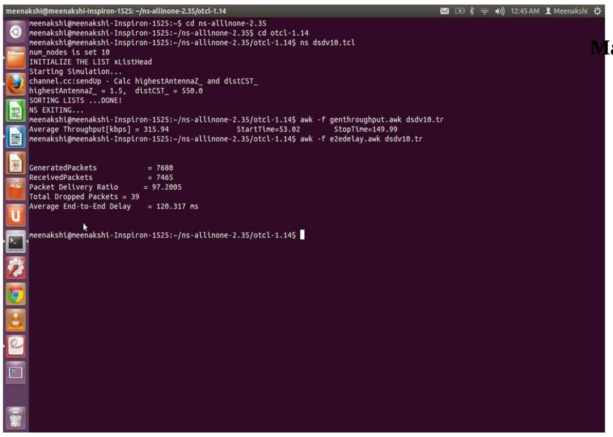
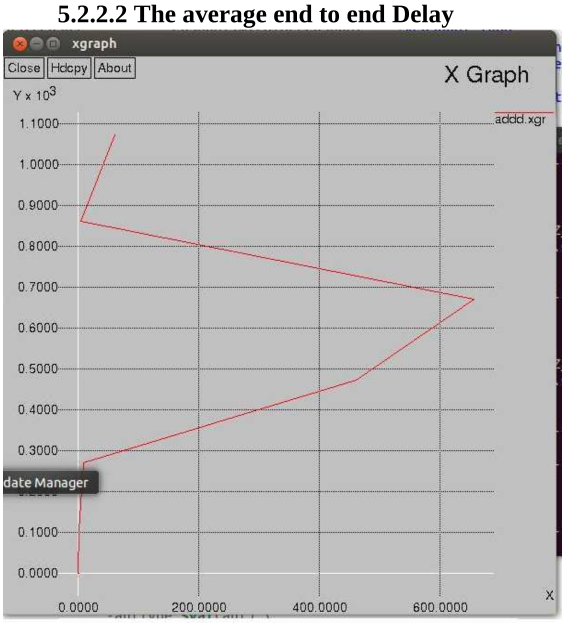


Figure 5.2.2.1 Throughput



5.2.2.2 The average end to end Delay



Graphical Representation of Throughput

6. Conclusion

We have studied the DSDV protocol under different mobility models. We have calculated the throughput and end2end delay for the various mobility model of dsdv protocol.

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