Delay Analysis of DSDV Protocol using NS 2.34

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ABSTRACT
Mobile ad hoc network is very much popular due to its flexibility, easy to install and low cost. The aims of this paper it to analyze delay of mobile ad hoc network for DSDV routing protocol. Delay is most important parameter to evaluate performance of a mobile ad hoc network. It measures total time taken by the packet to reach the destination. Delays in ad hoc network get affected by mobility of nodes, packet transmission speed, and length of route and interference level along the route. In this paper delay of ad hoc network is measured by changing various parameters of ad hoc network such as number of nodes, pause time, speed and connections between the nodes. Network simulator ns2.34 is used for simulation

Keywords
Ad-hoc Network, DSDV, NS2.34, Performance Measurements, Delay.

1. INTRODUCTION
In ad hoc network nodes can enter and leave a network as per their wish. Hence routes may break or new route forms during data communication process. Various routing protocols are designed for ad hoc mobile network. The major challenges researchers have to face while designing routing protocols are mobility of nodes, hidden and exposed terminal problem [2][12].Ad hoc routing protocols are broadly classified as proactive, reactive and hybrid protocol.

Proactive protocols are also known as table driven protocols which maintain list of destinations and their routes by periodically distributing routing table. Reactive protocols are also known as on demand routing protocols because route are discovered on demand [8]. Hybrid protocols combine merits of both proactive and reactive protocols. DSDV protocol is example of proactive protocol.

Due to self-organized nature of ad hoc network it is very much popular now days. Ad hoc networks are mostly used to transmit multimedia data. Requirement for such transmission is minimum delay. In this research paper delay of ad hoc network is analyses in different scenario.

2. DESTINATION-SEQUENCED DISTANCE-VECTOR (DSDV) ROUTING PROTOCOL
It is a first table driven ad hoc network protocol. It is a hop by hop table distance vector routing protocol. In this protocol each node maintain routing table that contains all possible destinations within network and number of routing hops to each destination. The information in routing table is updated by increasing sequence number which avoid count to infinity problem. The sequence number shows freshness of route and route with higher sequence number are favorable. Each mobile node of ad hoc network maintain a routing table which stores information about all available destinations, number of hop and a sequence number. Using this routing table packets are transmitted between the nodes. Routing tables can be exchanged between neighbors at regular interval to keep an up to date view of network topology. The tables are also forwarded if a node observes a significant change in local topology [4], [7][12].

3. SIMULATION MEASUREMENT TECHNIQUE
As configuration of mobile ad hoc network is not stable, simulation techniques are best option to measure performance. Network simulators implemented in software are valuable tools for researchers to develop, test, and diagnose network protocols. Simulation is economical and flexible because it can carry out experiments without the actual hardware. Simulation results are easier to analyze than experimental results because important information at critical points can be easily logged to help researchers diagnose network protocols [13]. A broad survey of 8370 papers published in the selected IEEE Journal and Conference proceedings reveals that majority network researchers are using ns-2 for simulation tasks [11].

In this paper delay of ad hoc network is analyses using network simulator ns2.34 when DSDV routing protocol is used.

3.1 Performance Metric
Efficient routing protocol provides significant benefits to ad hoc network. Efficiency of routing protocol can be measured by considering various performance metrics like throughput, end to end delay, packet delivery ratio, normalized load and packet drop. Here researcher focusing on end to end delay performance parameter. A network's end-to-end delay is defined as the average time interval between the generation and successful delivery of data packets, for all nodes in the network, during a given period of time. Packets that are discarded or lost are not included in the calculation of this metric [1][7]. In this paper ad hoc network performance parameter delay is analyses when DSDV protocol is used for routing.

3.2 Simulation Process
The simulations were performed using Network Simulator (NS2.34). Initially scenario and traffic files are generated. These files are used as input for TCL script. After execution of TCL script two files are created i.e. NAM file and trace files. Trace files are used to analyze the behavior of network. Trace files are analyzed using AWK scripts. Detailed simulation process steps are as follows.

1. Select the performance parameters.
2. Generate scenario and topology files using cbrgen and setdest commands.

3. Write TCL script (.tcl Extension file)
4. Execute TCL script (Use ns Command)
5. Generate Trace and NAM file.
6. Execute AWK script to measure Performance of protocol.
7. Plot the graph.

3.3 Experimental Setup

The goal of the experiments is to examine and compute delay of ad hoc network when DSDV routing protocol is used. Each run of the simulator accept as input a scenario file that describe exact motion of each node and sequence of packets originated by each node together with exact time at which change in packet or motion occurs. To evaluate delay of ad hoc network we consider 9 random simulation runs to generate 9 random scenario patterns. Result is calculated by taking average of those 9 outputs.

Experimental simulations is carried out by varying only one parameter (pause time, number of nodes, max. connections, max. speed) at a time and other parameters are kept constant. The values set for experiment is shown in Table 1.1. Total four simulation experiments performed and data is represented in Table 1.2.

Table 1.1. Values Set for Parameters

Experiment no.	Variable Parameter	Constant Parameter	Values set
1.	Pause Time (0- 90)	Nodes	60
		Max. Speed	10
		Max. Connections	10
2.	Nodes (15 – 60)	Pause Time	0
		Max. Speed	10
		Max. Connections	10
3.	Max. Speed (5 – 50)	Pause Time	0
		Nodes	60
		Max. connections	10
4.	Max. Connections (5 – 50)	Pause time	0
		Nodes	60
		Max. Speed	10

Table 1.2. Experimental Data

Exp. No 1		Exp. No 2		Exp. No 3		Exp .No 4	
(Pause Time Vs. Delay)		(Nodes Vs. Delay)		(Max. Speed Vs. Delay)		(Max. Connections Vs. Delay)	
P. T.	**Delay**	**Nodes**	**Delay**	**M. S.**	**delay**	**M. C.**	**Delay**
0	25.3978	15	20.8811	5	17.8193	5	8.0732
10	20.5222	20	11.9512	10	32.7326	10	15.7002
20	10.7184	25	22.2656	15	52.2981	15	19.1635
30	11.883	30	15.3304	20	38.8622	20	11.7855
40	10.6073	35	10.0033	25	27.2053	25	12.8076
50	14.3643	40	20.5615	30	56.2937	30	14.849
60	12.9492	45	16.9044	35	24.7179	35	15.4024
70	12.7268	50	10.0625	40	44.3834	40	14.99
80	13.9889	55	10.1917	45	36.7122	45	15.4006
90	14.2314	60	19.8352	50	61.1404	50	15.4006

3.4 Graphical Representation

Graphical representation of simulation result is shown with respect to delay of ad hoc network. Fig 1.1 shows graphical representation of pause time vs. delay. Similarly fig 1.2, 1.3 and 1.4 shows graphical representation for Nodes vs. delay, Max. Speed vs. delay, and Max. Connections vs. delay respectively.

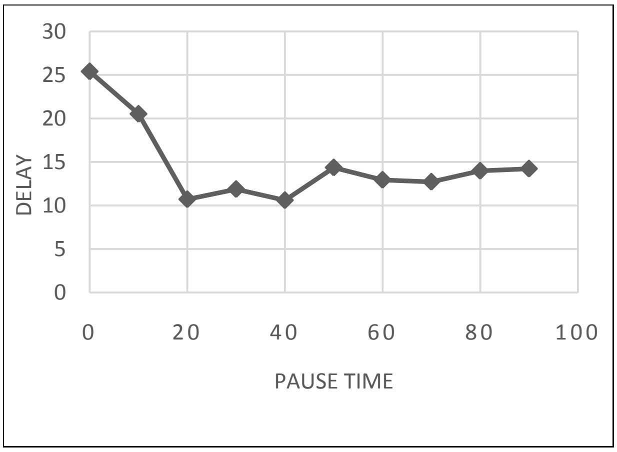

Figure 1.1 Pause time vs. delay

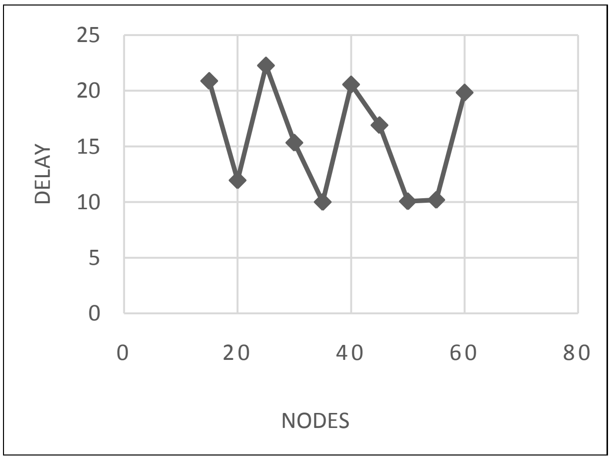

Figure 1.2 Nodes vs. delay

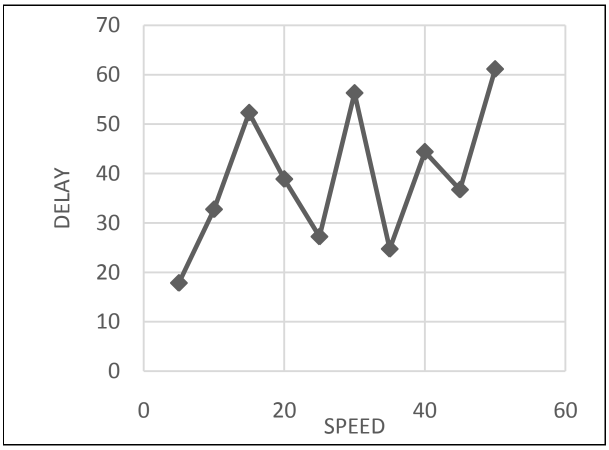

Figure 1.3 Max. Speed vs. delay

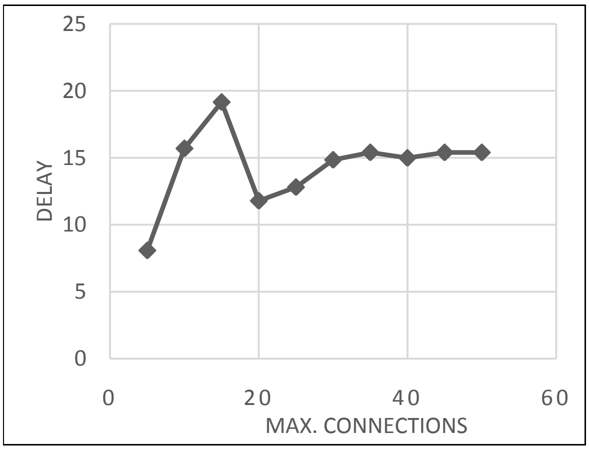

Figure 1.4 Max. Connections vs. delay

3.5 Performance Analysis

Data is collected in text file after execution of awk scripts. Collected performance data can be export to the Excel file. Built in Excel data transformation techniques are used to reduce size of experimental data. For Data visualization Microsoft Excel built in graph tool is used. Experimental performance data is presented in graphical format against delay.

1. Pause time vs. Delay

As shown in Table1.2 and 1.3 input parameters i.e. number of nodes, connections between nodes and speed of nodes are kept constant. Only parameter pause time is variable. It is observed from Fig 1.1, as mobility changes from high to low and rest of the parameters are constant then delay in the network maintain at certain level. This is because when Pause time is increasing nodes does not enter or exit the network frequently. Node movement is slow down as connection between nodes are not changing frequently. Delay is approximately remains in between 10-15msec.

2. Nodes vs. Delay

Table 1.3 shows experimental data for the nodes changing from 15 to 60 and other input parameters are constant. Density of nodes has significant effect on delay. Low density causes frequent connection failure and high density increases traffic in the network which increases delay. Here in this experiment nodes are increasing and at the same time pause time is 0 means nodes are continuously moving. Graphical representation of nodes vs. delay is shown in figure 1.2. It represents that delay is highly unstable as number of nodes increases in high mobility scenario. This is because nodes are frequently entering and exiting a network which required frequent updating of routing tables. If the number of nodes in the network grows, the size of the routing tables and the bandwidth required to update them also grows which reflect in unstable nature of delay.

3. Max. Speed vs. Delay

Table 1.3 represents experimental data for variable speed of nodes. As shown in fig 1.3 speed of node affect the delay of network. As speed of node increases delay become unstable. As speed increases nodes enter and exit a network frequently and route changes frequently which reflect in unstable delay.

4. Max connections vs. Delay

Table 1.3 shows experimental data for number of connections and delay. It has been observed from graphical representation of fig 1.4 i.e. as numbers of connections between the nodes are increasing delayis increasing slightly then maintain constant level. Routing is achieved in DSDV protocol by maintaining routing tables by each node. The complex task in DSDV is in generating and maintaining these routing tables. Routing table contain information about destination node, next hop, metric and destination sequence number. As connections between the nodes increases updates packets are broadcasted throughout the network so every node in the network knows how to reach every other node. Thus increasing connections in between the nodes provides alternate route in case of route break. This maintains delay at desired level in the network.

4. CONCLUSION

This simulation based study was conducted to analyze delay of ad hoc network when DSDV routing protocol is used. Ad hoc network has dynamic topology which raises various performance issues. Delay is important parameters for performance measurement. It is observed from the simulation experiments that in high mobility scenario if number of nodes and speed of nodes are variable then delay in ad hoc network become unstable. Lower delay is always desirable in ad hoc network. it is observed form the experiment that if number of connections in between the nodes increases it helps to reduce delay in ad hoc network.

The study helps to minimize and stable delays in the ad hoc network by maintaining scenario parameters.

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