

Performance Analysis of Different Routing Protocols In Mobile Ad-Hoc Networks

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Abstract- MANET stands for Mobile Adhoc Network also called a wireless Adhoc network or Adhoc wireless network that usually has a routable networking environment on top of a Link Layer ad hoc network. A MANET can be defined as an autonomous system of nodes or MSs(also serving as routers) connected by wireless links, the union of which forms a communication network modeled in the form of an arbitrary communication graph. The characteristics of an ad-hoc network can be explored on the base of routing protocols. The dynamic topology is the vital characteristic in which nodes frequently change their position. In the ad-hoc networks, there are mobile nodes such as personal digital assistance (PDA), smart phone and laptops; they have limited operational resources like battery power and bandwidth. We have performs in this paper different routing protocols in mobile ad-hoc networks.

Keywords- Ad-hoc Network, DSDV, NS2, AODV, DSR, Routing Protocols.

I. INTRODUCTION

A form of wireless network where each node communicates with other node using multi-hop links without stationary infrastructure is called Ad-hoc network. According to [1], an Ad hoc network is crew of wireless mobile nodes that creates a network without any assist of centralized administrator. It uses multi-hope point-to-point (P2P) routing as an alternative of stationary network communication to offer network connectivity [2-15]. In such circumstances, due to partial range of mobile host in wireless transmission, each node needs to join up other node in order to communicate with each other and to reach to the destination if located far away.

Routing in ad-hoc networks has been a challenging task ever since the wireless networks came into existence. The major reason for this is the nature of ad-hoc networks where network topologies cannot be static [3]. The non-static nature of Ad-hoc networks raises various performance challenges for routing protocols. The environment in which a MANET is placed has a significant impact on the success of the routing strategy. Therefore, we chose to base our concepts and analysis on the assumption that we must support what is arguably the most demanding MANET environment, a tactical military environment.

In the process of developing our strategy, we examined those techniques that work in a wired network and determined how they can be implemented in a wireless network. We describe these networking techniques in general and point out those that could become the basis for a new protocol design. During assessment of the ns simulations, we discovered startling results regarding these

performance measures irrespective of the routing protocol used. All the while, the VMTS algorithm continued to evolve, particularly as issues arose during the prototype's implementation in ns. However, the results from the simulation of other protocols were so significant that it prompted us to stop further implementation of VMTS for even in its evolved state, VMTS would likely suffer much the same performance maladies (which ultimately was the case).

II. RELATED WORK

In [11] NS2 is used for the performance comparison of AODV, TORA, DSR, and DSDV. They concluded that generally, AODV outperforms TORA and DSR. The performance of simple link state protocols DSR and AODV has been studied in [12-20]. The conclusion of this comparison is that the DSR and AODV perform better when the network load is normal and if the traffic load is heavy the link state outperforms reactive protocol OLSR. In order to study the simulation affects on the performance another author has analyzed the DSDV and DSR [13].

The GloMoSim Simulator is used for the performance evaluation of DSR and On-demand protocol AODV [14]. The conclusion is that AODV outperforms DSR when the source sends data to different destinations and AODV suffers degradation in the average packet delivery rate when the sources send the data to a common destination. They point out the problems that may occur when common gateways are used and provided solutions to minimize this effect. In our project we use different simulation environment to analyzed the similar situation of MANET when nodes send data to a common destination.

1. AD-HOC network

A network is installed without fixed physical layouts, which are generally deployed in emergencies, or battlefield communication on temporary basis. When there is not an infrastructure network available or it is cost effective and devices need to connect for communication, multiple nodes are connected wirelessly. In these devices one or more devices act like nodes as well as routers [16]. Such a network is very easy to deploy and flexible, because devices are not bound to any agreement to stay connected. It can be categorized in following two types

- Static Ad-hoc Networks (SANET)
- Mobile Ad-hoc Networks (MANET)

2. Static Ad-Hoc Network

The wireless network in which nodes are fixed and there is low host mobility or the mobility is disabled. The host communicates with each other by established by predefined links.

3. Mobile Ad-Hoc Networks

The MANET is collection of mobile clients and servers connected by wireless links. In this type of networks there is no fixed and centralized infrastructure. The nodes can freely move without care of topology [7]. As the MANET has limited bandwidth and mobile nodes, it needs to consider the issues of limited bandwidth, unreliable communication, and topology change and energy efficiency of nodes while designing the MANET. The mobile nodes act as both hosts and routers as it can route and accept the traffic from neighbour nodes [17]. The challenges of self-configuration are announced when the network grows and also there are frequent re-associations and connection tearing. The WiMAX technology also play important role in mobile networks [21-22].

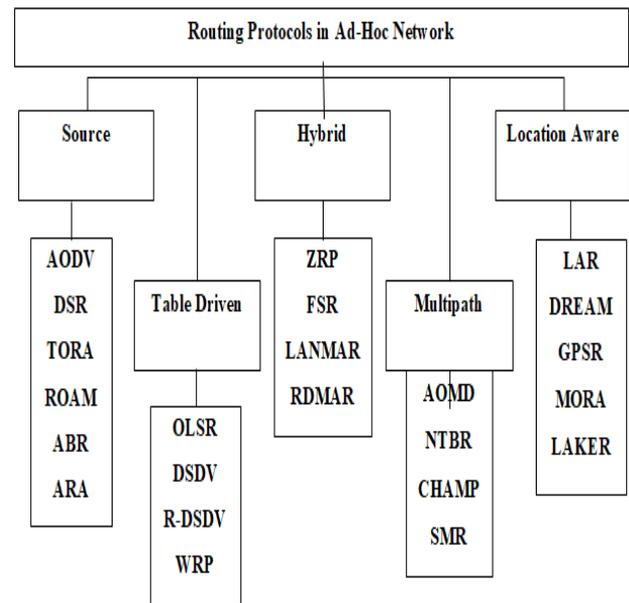
4. Routing Protocols

The function of ad hoc routing protocol is to control the node decisions when routing packets between devices in MANET. When a node joins or tries to join the network, it does not know about the network topology. By announcing its presence or by listening from the neighbor nodes it discovers the topology. In a network route discovery process depends on the routing protocol implementation. For wireless ad hoc networks, several routing protocols have been designed and all these protocols are classified under two major fields of protocols called reactive or proactive. An ad hoc routing protocol with combination of these two is called a hybrid protocol [18].

5. Solution Domain

Performance Evaluation of Routing Protocols with Performance Matrics - In the evaluation of routing protocols different performance metrics are used. They show different characteristics of the whole network performance. In this performance comparison we evaluate the Packet Delivery Ratio, Throughput and End-to-End delay of selected protocols in order to study the effects on

the whole network.



6. Packet Delivery Ratio (PDR)

It is the ratio of actual packet delivered to total packets sent i.e. performance is measured on the major basis of parameters like PDF (packet delivery function). PDF is defined as the total number of packets sending dividing by the total number of packets receiving by TCP sources.

$$PDR = \frac{\text{Total Packet Received By Destination}}{\text{Total Packet sent by Source}} \quad (1)$$

The evaluation of Packet Delivery Ratio (PDR) depends on the received and produced packets as recorded in the trace file. When all is said in done, PDR is characterized as the proportion between the received packets by destination and source. PDR is figured utilizing awk script which forms the trace file record and creates the results.

7. Throughput

Throughput is the ratio of total amounts of data that reaches the receiver from the source to the time taken by the receiver to receive the last packet [27]. It is represented in packets per second or bits per second. In the MANET unreliable communication, limited energy, limited bandwidth and frequent topology change affect throughput [15]. A network requires high throughput and can be represented mathematically by the following equation.

$$\text{Throughput} = \frac{\text{Number of Delivered Packets} * \text{Packets Size} * \text{Bandwidth}}{\text{Total Simulation Period}} \quad (2)$$

8. Demand Routing algorithm (DSR)

DSR is on Demand Routing algorithm and its main feature is to control infinite looping problem by using unique sequence numbers for every packet.

9. Functioning of DSR is in the following algorithm:

1. Initialize Network
2. Procedure link search for all possible destinations
3. Procedure periodic messages broadcast PM(TR)
4. $PM(TR) \leftarrow DEST_ADD, NXT_HOP$
5. At node n PM(TR) process
6. if
7. $PM(TR)_{new} == PM(TR)_{old}$
8. $SEQ_NUM_{old} \leftarrow SEQ_NUM_{new}$ // replace sequence number
9. Elseif
10. $PM(TR) \neq MP(TR)_{old}$
11. $RT \leftarrow PM(TR)_{new}$
12. Flush all PM(TR)_{new}
13. Elseif
14. $PM(TR)_{new} == Null$
15. // Link Fail
16. Flush all TRIGGERED MSG
17. $RT \leftarrow update_TRIGGERED_MSG$
18. // Link Established
19. $BUFFER \leftarrow DATA_PKT$ till LINK_SETTLING_TIME
20. Flush all DATA_PKT
21. // Continue Periodic Messages
22. End Procedures

10. Simulation settings

We use the Network Simulator 2.35 in order to simulate the routing protocols involves in our study. The figure 4.4 shows the setup of one simulation environment of 50 nodes, which are static and the pause time of 100 sec. The details of simulation parameters are given in table 1.

Parameters	Values
No of nodes	30(Intial Phase), 40(Second Phase), 50(Final Phase)
Routing Protocols	AODV, DSDV, DSR
Performance Metrics	Packet Delivery Ratio, Throughput, End-to-End Delay
Simulation Area	2000m*2000m
Packet Size	Random
Pause time	100 Seconds

In initial phase, we use 30 nodes in our scenario and simulate using mobility of the nodes for the performance metrics packet delivery ratio, end to end delay and throughput of routing protocols AODV, DSR and DSDV. DSR choose only one route for the packet delivery. In the 30 static nodes scenario, DSR has the best rated performance as compared to the other routing protocols. The Packet Delivery Ratio for Static Nodes as shown in figure 2.

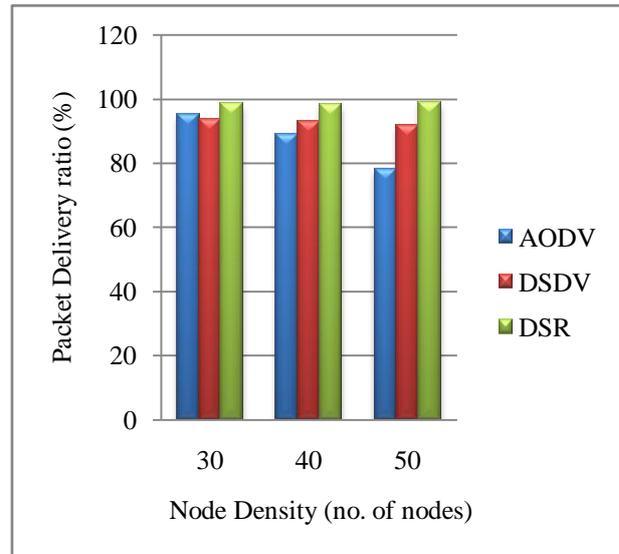


Figure 2: Packet Delivery Ratio for Static Nodes.

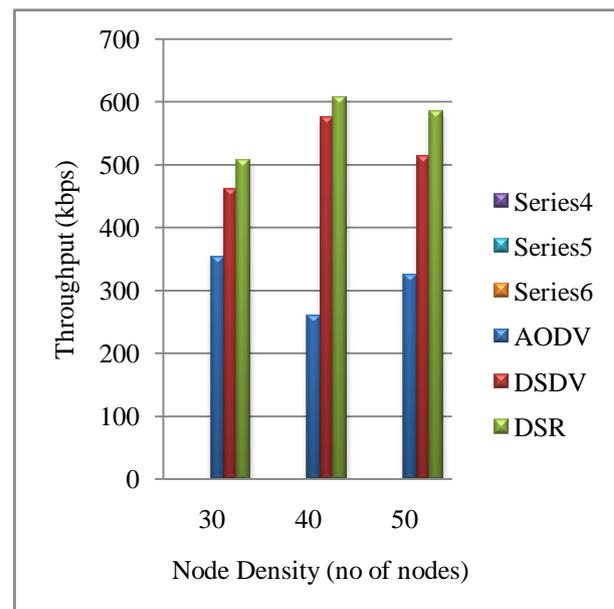


Figure 3: Throughput for Static Nodes.

III. CONCLUSION

Vehicular Ad-hoc Network (VANET) is a part of Mobile Ad-hoc Network (MANET) where the vehicle acts as the mobile nodes within the network exposure with stay on connection; the node should communicate with each other through single hop or multi hop. From section A we have conclude that VANET rural give the best results for packet delivery ratio. VANET urban give the best results for average throughput and MANET rural give the best results for Average end-to-end Delay.

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