

BEHAVIORAL STUDY OF DYNAMIC ROUTING PROTOCOLS FOR MANET

Vijay Kumar

*Department of Computer science
Guru Nanak Khalsa College Karnal, India*

Rakesh Sharma

*Baddi ,Emerging and Science Uni.
Baddi – H.P. – India*

ABSTRACT

An ad hoc network is a dynamic collection of mobile nodes forming a network. It works in infrastructure less environment. As mobile ad hoc network applications are deployed, many issues become vital such as routing stability, end to end delay, security and power. This paper analyses the performance of AODV and DSR routing protocols varying different parameters using random waypoint model. The analyses have been carried out using NS2 as simulator and results are shown graphically for analysis. The objective is to make the protocol robust and standardizing the protocol in general for applications.

Key Words - MANET, AODV, DSR, NS2, Pause Time

I. INTRODUCTION

The history of wireless networks started in the 1970s and the interest has been growing ever since. At present, this sharing of information is difficult, as the users need to perform administrative tasks and set up static, bi-directional links between the computers [1]. This motivates the construction of temporary networks with no wires, no communication infrastructure and no administrative intervention

required. Such interconnection between mobile computers is called an Ad hoc Network. Ad hoc networks are emerging as the next generation of networks and defined as a collection of mobile nodes forming a temporary (spontaneous) network without the aid of any centralized administration or standard support services. In Latin, ad hoc literally means “for this,” further meaning “for this purpose only” and thus usually temporary [1]. An ad hoc network is usually thought of as a network with nodes that are relatively mobile compared to a wired network. Hence the topology of the network is much more dynamic and the changes are often unpredictable oppose to the Internet which is a wired network. This fact creates many challenging research issues, since the objectives of how routing should take place is often unclear because of the different resources like bandwidth, battery power and demands like latency.

MANETs have several salient characteristics: 1) Dynamic topologies 2) Bandwidth constrained, variable capacity links 3) Energy-constrained operation 4) Limited physical security. Therefore the routing protocols used in ordinary wired networks are not well suited for this kind of dynamic environment. Recently more attention has been paid to use specific network parameters when specifying routing metrics. Examples might include delay of the network, link capacity, link stability or identifying low mobility nodes. These schemes are generally based on previous work, which is then enhanced with the new metrics.

Paper Outline

The rest of the paper is organized as follows: Section II presents the mobile ad hoc routing protocols categories. Section III provides an overview and general comparison of the routing protocols used in the study. The simulation environment and performance metrics are described in Section IV and then the results are presented in Section V. Finally Section VI concludes the paper.

II. ROUTING PROTOCOLS

Routing protocols for Mobile ad hoc networks can be broadly classified into two main categories:

- Proactive or table-driven routing protocols
- Reactive or on-demand routing protocols.

A. Table Driven Routing Protocols (Proactive)

In proactive or table-driven routing protocols, each node continuously maintains up-to-date routes to every other node in the network. Routing information is periodically transmitted throughout the

network in order to maintain routing table consistency. Thus, if a route has already existed before traffic arrives, transmission occurs without delay. Otherwise, traffic packets should wait in queue until the node receives routing information corresponding to its destination. However, for highly dynamic network topology, the proactive schemes require a significant amount of resources to keep routing information up-to-date and reliable. Certain proactive routing protocols are Destination- Sequenced Distance Vector (DSDV), Wireless Routing Protocol (WRP), Global State Routing (GSR) and Clusterhead Gateway Switch Routing (CGSR).

B. On-Demand Routing Protocols (Reactive)

In contrast to proactive approach, in reactive or on demand protocols, a node initiates a route discovery

throughout the network, only when it wants to send packets to its destination. For this purpose, a node initiates a route discovery process through the network. This process is completed once a route is determined or all possible permutations have been examined. Once a route has been established, it is maintained by a route maintenance process until either the destination becomes inaccessible along every path from the source or until the route is no longer desired. In reactive schemes, nodes maintain the routes to active destinations. A route search is needed for every unknown destination. Therefore, theoretically the communication overhead is reduced at expense of delay due to route research. Some reactive protocols are Cluster Based Routing Protocol (CBRP), Ad hoc On-Demand Distance Vector (AODV), Dynamic Source Routing (DSR), Temporally Ordered Routing Algorithm (TORA), Associatively-Based Routing (ABR), Signal Stability Routing (SSR) and Location Aided Routing (LAR).

III. OVERVIEW OF AODV and DSR

Every routing protocol has its own merits and demerits, none of them can be claimed as absolutely better than others. We have selected the two reactive routing protocols – AODV, DSR for evaluation [11,18].

A. Ad hoc On-demand Distance Vector Routing (AODV)

Ad-hoc On-demand distance vector (AODV) [4,16] is another variant of classical distance vector routing algorithm, a confluence of both DSDV [5] and DSR [6]. It shares DSR's on-demand

characteristics hence discovers routes whenever it is needed via a similar route discovery process. However, AODV adopts traditional routing tables; one entry per destination which is in contrast to DSR that maintains multiple route cache entries for each destination. The initial design of AODV is undertaken after the experience with DSDV routing algorithm. Like DSDV, AODV provides loop free routes while repairing link breakages but unlike DSDV, it doesn't require global periodic routing advertisements. AODV also has other significant features. Whenever a route is available from source to destination, it does not add any overhead to the packets. However, route discovery process is only initiated when routes are not used and/or they expired and consequently discarded. This strategy reduces the effects of stale routes as well as the need for route maintenance for unused routes. Another distinguishing feature of AODV is the ability to provide unicast, multicast and broadcast communication. AODV uses a broadcast route discovery algorithm and then the unicast route reply message.

B. Dynamic Source Routing (DSR)

The Dynamic Source Routing (DSR) [6] is one of the purest examples of an on-demand routing protocol that is based on the concept of source routing. It is designed specially for use in multihop ad hoc networks of mobile nodes. It allows the network to be completely self organizing and self-configuring and does not need any existing network infrastructure or administration. DSR uses no periodic routing messages like AODV, thereby reduces network bandwidth overhead, conserves battery power and avoids large routing updates. Instead DSR needs support from the MAC layer to identify link failure. DSR is composed of the two mechanisms of Route Discovery and Route Maintenance, which work together to allow nodes to discover and maintain source routes to arbitrary destinations in the network. DSR has a unique advantage by virtue of source routing. As the route is part of the packet itself, routing loops, either short – lived or long – lived, cannot be formed as they can be immediately detected and eliminated. This property opens up the protocol to a variety of useful optimizations. Neither AODV nor DSR guarantees shortest path. If the destination alone can respond to route requests and the source node is always the initiator of the route request, the initial route may be the shortest.

IV. SIMULATION

The simulations were performed using Network Simulator 2 (Ns-2.34) [2], particularly popular in the ad hoc networking community. The traffic sources are CBR (continuous bit –rate). The source-destination pairs are spread randomly over the network. The mobility model uses ‘random waypoint model’ in a rectangular field of 500m x 500m with 25 nodes. During the simulation, each node starts its journey from a random spot to a random chosen destination. Once the destination is reached, the node takes a rest period of time in second and another random destination is chosen after that pause time. This process repeats throughout the simulation, causing continuous changes in the topology of the underlying network. Different network scenario for different number of nodes and pause times are generated. The model parameters that have been used in the following experiments are summarized in Table 1.

TABLE 1 : SIMULATION PARAMETERS

Parameter	Value
Simulator	NS-2.34
Simulation Area	500m X 500m
Mobile Nodes	25
Pause Time	0,10,20,30,40,50,100,150,200,250,300,350,400
Max. Connections	5,10,15,20
Packet Size	512
Routing Protocols	AODV & DSR
Traffic Sources	CBR(UDP)
Simulation Time	100 Sec.

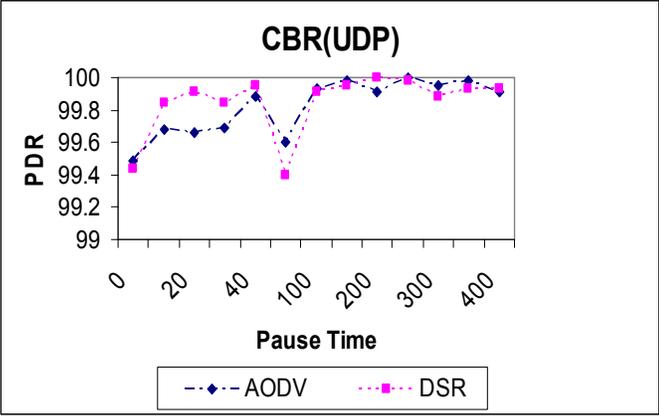


Figure 1 : PDR with Pause time with CBR(UDP)

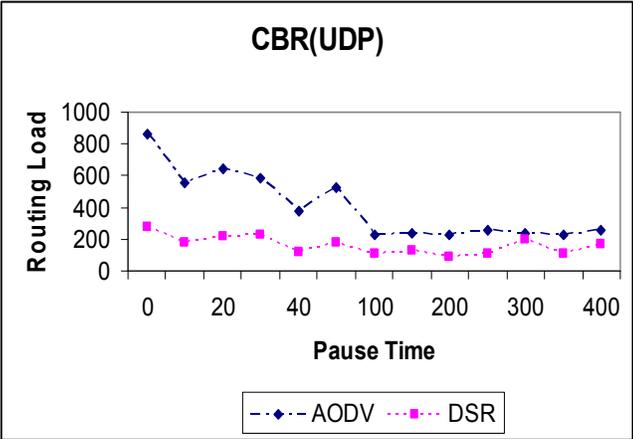


Figure 2 : Routing Load with Pause time using CBR(UDP)

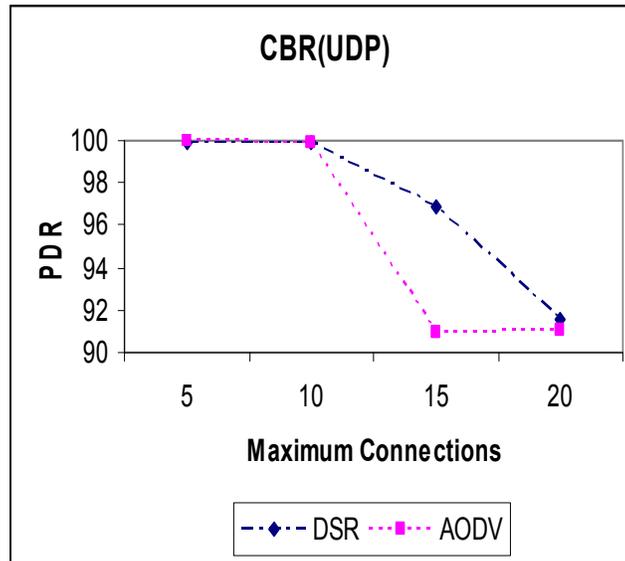


Figure 3 : PDR with Number of Connections with CBR(UDP)

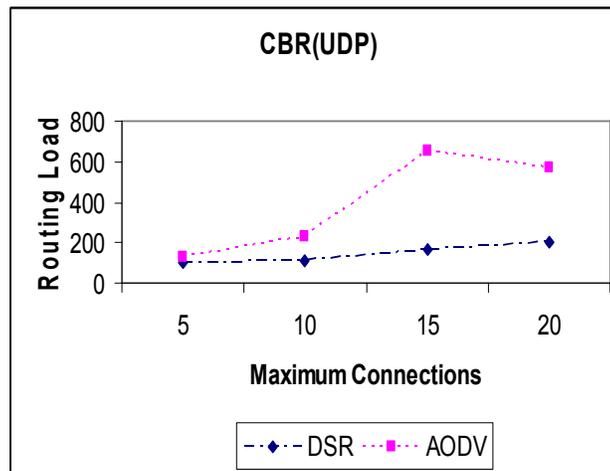


Figure 4 : Routing Load with Connections with CBR(UDP)

VI. SIMULATION RESULTS & OBSERVATIONS

The simulation results are shown in the following section in the form of line graphs. Graphs show comparison between the two protocols by varying different numbers of sources on the basis of the above-mentioned metrics as a function of pause time and Number of maximum Connections.

A. Packet Delivery Ratio(PDR)

Figure 1: shows a comparison between the routing protocols on the basis of packet delivery ratio as a function of pause time and using CBR(UDP) traffic source with both routing protocols AODV and DSR. Throughput describes the loss rate as seen by the transport layer. It reflects the completeness and accuracy of the routing protocols. It shows very that the PDR of AODV is less upto the pause time 50 after that AODV's results are better than DSR. After 100 pause time PDR increased and almost stable in both protocols.

Figure 3: shows the comparison between AODV and DSR using on the basis of PDR as a function basic of Maximum Connections using CBR(UDP) traffic source. In this scenario all the PDR outputs above 99% upto the connection 10 but at the 15 and 20 connections in AODV shows around 91% PDR , But it shows in DSR's PDR better compare to AODV with 15 connections but with 20 connections it almost same like AODV.

B. Routing Load

Figure 2: shows the comparison between AODV and DSR using on the basis of Routing Load as a function basic of pause time using CBR(UDP) traffic source. In this scenario Routing load is high of AODV compare to DSR upto 50 pause time Routing load is very high but after the pause time 100 is almost stable. In DSR Routing load is almost same with a little but vary from starting pause time to end pause time.

Figure 4: shows the comparison between AODV and DSR using on the basis of Routing Load as a function basic of Maximum Connections using CBR (UDP) traffic source. In this scenario all the Routing load is increased with the connections but Routing load is very high of AODV compare to

DSR after the number of connections 10. In DSR protocol routing load is almost slightly increased with of connections.

CONCLUSION

The study has been carried out using the same scenario for both schemes to make it biasfree. Same metrics have been used and results are compared. It has been observed that AODV in the simulation experiment shows overall best performance. It has an improvement of DSR and DSDV and has advantages of both of them. Future work will concentrate on using more metrics and also using different networks for making the study more effective and conclusive. Efforts are on to study the network for more denser and sparse medium as well.

Acknowledgement: Author is especially thankful to Dr. Ashwani Kush, Head, Department of Computer Science, University College, Kurukshetra University Kurukshetra for his valuable suggestions about the topic.

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International Journal of Computing and Business Research
ISSN (Online) : 2229-6166
Volume 2 Issue 2 May 2011

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