Send Rate Based Evaluation for Various MANET Routing Protocols in NS-2

Nidhi Pouranik[1], Ajay Lala[2], Ashish Chaurasia[3]
[1] Department of Computer Science & Engineering,
Gyan Ganga Institute of Technology & Sciences, Jabalpur, India
[2] Department of Information Technology,
Gyan Ganga Institute of Technology & Sciences, Jabalpur, India
[3] Department of Computer Science & Engineering,
Gyan Ganga Institute of Technology & Sciences, Jabalpur, India

Abstract

The main aim of any ad-hoc network routing protocol is to meet the challenges of the dynamically changing topology and establish a correct and an efficient communication path between any two nodes with minimum routing overhead and bandwidth consumption. Despite the considerable simulation works, still more investigation is required in the performance evaluation of routing protocols for multimedia traffic especially Constant Bit Rate (CBR). In this paper, we will conduct a number of simulations for the performance evaluation of popular routing protocols of MANET, named AODV and DSDV, for CBR traffic by changing the number of nodes and data send rate. We will investigate the performance of AODV and DSDV using three metrics- packet delivery ratio, average end to end delay and throughput.

Keywords: protocols, ad-hoc network, throughput, simulation, data rate

1.Introduction

Routing is a core problem in networks for sending data from one node to another. Wireless Ad Hoc networks are also called Mobile Ad Hoc multi-hop wireless networks is a collection of wireless mobile hosts forming a temporary network without the aid of any established infrastructure or centralized administration [1]. Mobile Ad Hoc Networks (MANETs) are characterized by a dynamic, multi-hop,rapid changing topology. Such networks are aimed to provide communication capabilities to areas where limited or no communication infrastructures exist.

MANET's can also be deployed to allow the communication devices to form a dynamic and temporary network among them. A mobile Ad Hoc network (MANET) is receiving attention due to many potential military and civilian applications. MANETs have several salient characteristics: 1) Dynamic topologies 2) Bandwidth-constrained links 3) Energy constrained operation 4) limited physical security. Therefore the routing protocols for wired networks cannot be directly used for wireless networks. Some examples of the possible uses of ad hoc networking include students using laptop computers to participate in an interactive lecture, business associates sharing information during a meeting, soldiers relaying information for situational awareness on the battlefield and emergency disaster relief personnel coordinating efforts after a hurricane or earthquake. A MANET uses multi-hop routing instead of a static network infrastructure to provide network connectivity. Several routing protocols have been proposed for mobile Ad Hoc networks

In this paper we mainly focus the performance comparison of the AODV and DSDV routing protocols [9]. We need to study the behavior of each every protocol how they performing in different scenarios and which protocol performs better under a particular situation.

MANET [2][3][4] is a kind of wireless ad-hoc network and it is a self-configuring network of mobile routers (and associated hosts) connected by wireless links – the union of which forms an arbitrary topology. The routers, the participating nodes act as router, are free to move randomly and manage themselves arbitrarily; thus, the network's wireless topology may change rapidly and unpredictably. Such a network may operate in a standalone fashion, or may be connected to the larger Internet. Mobile ad hoc network is a collection of independent mobile nodes that can communicate to each other via radio waves. The mobile nodes can directly communicate to those nodes that are in radio range of each other, whereas others nodes need the help of intermediate nodes to route their packets. These networks are fully distributed, and can work at any place without the aid of any infrastructure. This property makes these networks highly robust.

2. Destination Sequenced Distance Vector Routing

This protocol is based on classical Bellman-Ford routing algorithm designed for MANETS. Each node maintains a list of all destinations and number of hops to each destination. Each entry is marked with a sequence number. It uses full dump or incremental update to reduce network traffic generated by rout updates. The broadcast of route updates is delayed by settling time. The only

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improvement made here is avoidance of routing loops in a mobile network of routers. With this improvement, routing information can always be readily available, regardless of whether the source node requires the information or not. DSDV [5] solve the problem of routing loops and count to infinity by associating each route entry with a sequence number indicating its freshness. In DSDV [3][14], a sequence number is linked to a destination node, and usually is originated by that node (the owner). The only case that a non-owner node updates a sequence number of a route is when it detects a link break on that route. An owner node always uses even-numbers as sequence numbers, and a non-owner node always uses odd-numbers. With the addition of sequence numbers, routes for the same destination are selected based on the following rules: 1) a route with a newer sequence number is preferred; 2) in the case that two routes have a same sequence number, the one with a better cost metric is preferred. [4]

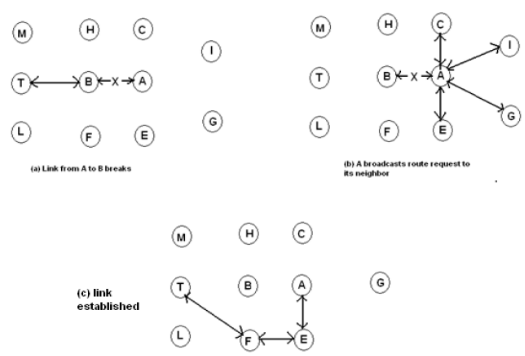

Figure 2.1. Resolving failed link in DSDV

3. AD-HOC on Demand Distance Victor Routig

Ad hoc On-Demand Distance Vector (AODV)[9][10] routing is a routing protocol for MANETs and other wireless ad-hoc networks [3][7][14]. It is jointly developed in Nokia Research Centre of University of California, Santa Barbara and University of Cincinnati by C. Perkins and S. Das. It is an on-demand and distance-vector routing protocol, meaning that a route is established by AODV from a destination only on demand. AODV is capable of both unicast and multicast routing. It keeps these routes as long as they are desirable by the sources. It is loop-free, self-starting, and scales to large numbers of mobile nodes[13]. AODV defines three types of control messages for route maintenance:

RREQ- A route request message is transmitted by a node requiring a route to a node. As an optimization AODV uses an expanding ring technique when flooding these messages.

RREP- A route reply message is unicasted back to the originator of a RREQ if the receiver is either the node usingS the requested address, or it has a valid route to the requested address. The reason one can unicast the message back, is that every route forwarding a RREQ caches a route back to the originator.

RERR- Nodes monitor the link status of next hops in active routes. When a link breakage in an active route is detected, a RERR message is used to notify other nodes of the loss of the link. In order to enable this reporting mechanism, each node keeps a precursor list, containing the IP address for each its neighbors' that are likely to use it as a next hop towards each destination.

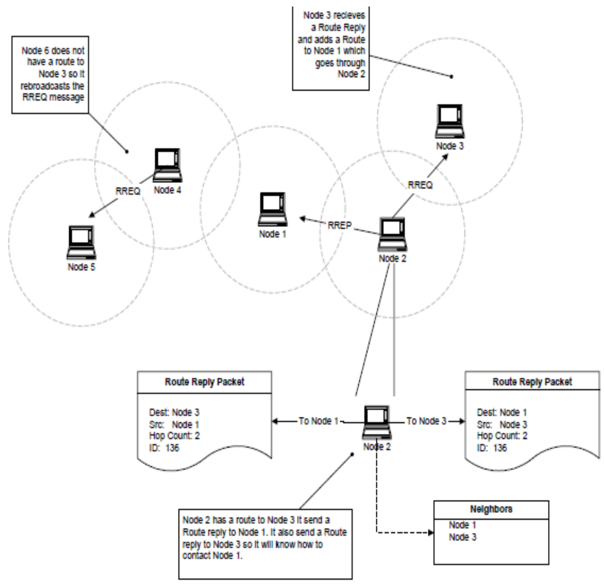

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Figure 3.1.: Working of AODV routing protocol

4. Simulation and Result

4.1 Performance Metrics

Some important performance metrics can be evaluated:-

4.1.1 **Throughput** — The ratio of the number of data packets sent and the number of data packets received.

4.1.2 **Packet delivery Ratio (PDR)** — It is the ratio of all the received data packets at

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the destination to the number of data packets sent by all the sources. It is calculated by dividing the number of packet received by destination through the number of packet originated from the source.

PDR = (Pr / Ps) * 100 Where, Pr is total packet received and Ps is total packet sent.

4.1.3 **End to End Delay** — This includes all possible delays caused by buffering during route discovery, latency, and retransmission by intermediate nodes, processing delay and propagation delay.

It is calculated as D = (Tr - Ts) Where, Tr is receive time and Ts is sent time of the packet.

4.2 Simulation Parameters

As already outlined we have taken routing protocols, namely AODV and DSDV. For all the simulations, simulation time was set to 100 sec for 800X800 area and send data rate was varies from 64 kb to 256kb.

Scenario 1

Parameter	Value
Number of nodes	10 & 30
Simulation Time	100 sec
Pause Time	2m/s
Environment Size	800x800
Transmission Range	250 m
Traffic Size	CBR
Packet Size	1000 bytes
Packet Rate	5 packets/s
Send Data Rate	64 Kb
Simulator	NS-2.35

Table 4.1: Scenario 1 for implementation of AODV and DSDV

Scenario 2

Parameter	Value
Number of nodes	10 & 30
Simulation Time	100 sec
Pause Time	2m/s
Environment Size	800x800
Transmission Range	250 m
Traffic Size	CBR
Packet Size	1000 bytes
Packet Rate	5 packets/s
Send Data Rate	128 Kb
Simulator	NS-2.35

Table 4.2: Scenario 1 for implementation of AODV and DSDV

Scenario 3

Parameter	Value
Number of nodes	10 & 30
Simulation Time	100 sec
Pause Time	2ms
Environment Size	800x800
Transmission Range	250 m
Traffic Size	CBR
Packet Size	1000 bytes
Packet Rate	5 packets/s
Send Data Rate	256 Kb
Simulator	NS-2.35

Table 4.3 Scenario 3 for implementation of AODV and DSDV

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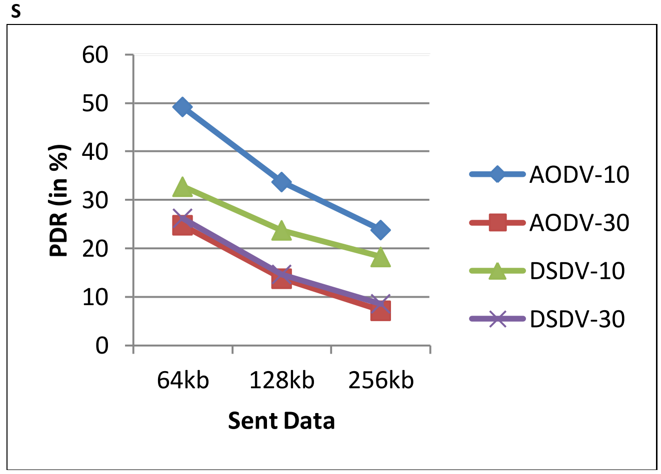

Figure 4.1 Packet Delivery Ratio for Scenario 1,2 and 3

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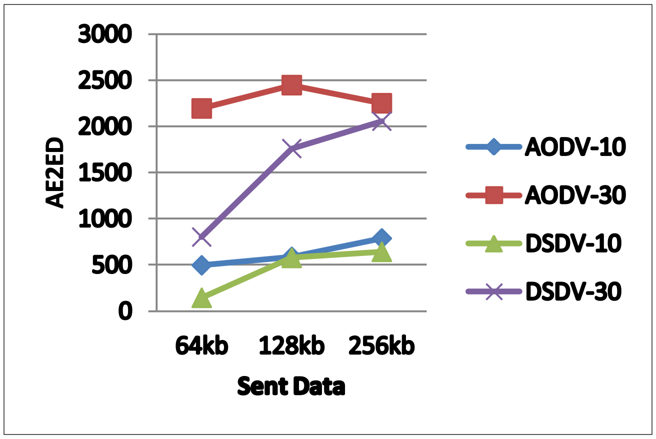

Figure 4.2 Average End 2 End Delay for Scenario 1,2 and 3

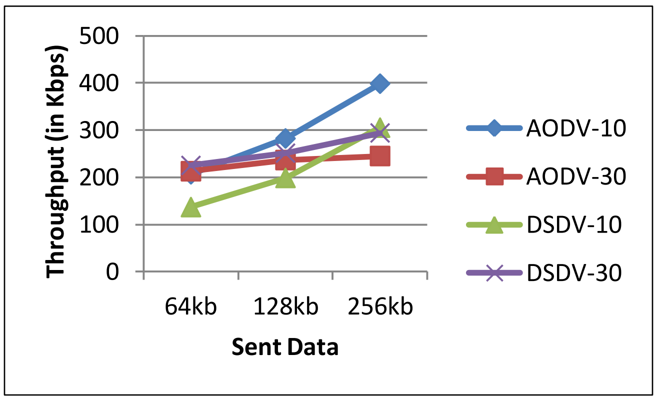

Figure 4.3 Throughput for Scenario 1,2 and 3

In figure 4.1 initially for 10 nodes the PDR of AODV is highest and DSDV is lowest for 64kbps but as the sent data rate increases the PDR decreases gradually for 128 Kbps and 256 Kbps. For 30 nodes the PDR are almost same for AODv and DSDV.

In figure 4.2 initially for 10 nodes the average end to end delay of DSDV is lower as compared to AODV and as the send rate increases to 128 and 256 kbps the AE2ED od DSDV is lower as compared to DSDV. For 30 nodes initially the AE2ED of DSDV is very low as compared to AODV but as the send rate increases The delay of DSDV increases but still low as compared to AODV.

In figure 4.3 initially for 10 nodes the throughput of DSDV is low as compared to AODV and as the send rate increases to 128 and 256 kbps the throughput also increases. For 30 nodes initially the throughput of AODV is high as compared to DSDV but as the send rate increases the throughput of AODV decreases and that of DSDV increases and for 256 kbps send rate the throughput of AODV decreases and of DSDV increases.

5. Conclusions

Three different simulation scenarios are generated, In all the scenarios the no of nodes taken are 10 and 30. The send rate taken was 64, 128 and 256 kbps. Initially the AODV gives better result as compared to DSDV for 64 kbps send rate but as the send rate increase the result of DSDV improves as compared to AODV.

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