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Design of a MANET using AODV and AOMDV Routing Protocols

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Abstract: ***Due to emergence of wireless communication the demand for Ad-Hoc mobile communication has increased rapidly over the years. One of the foremost challenges in designing a MANET is construction of robust routing protocols which support data routing between mobile nodes with maximum efficiency. Over the years many routing protocols have been developed and extensively simulated. In this paper we simulate and compare two such protocols on network simulator and evaluate them on five main parameters.***

Keywords: Ad-Hoc, MANET, Network simulator, Routing Protocol, WiMax

1. Introduction

An ad-hoc network or MANET is a collection of mobile nodes sharing a wireless channel without any governing body or central structure. The routers are completely mobile and dynamic. These nodes are either end systems or routers at the same time.

When they act as routers, they discover and maintain routes to other nodes in the network. [1]

The efficiency with which data packets are delivered to the mobile nodes is the main problem in ad-hoc networks as there is no centralised structure. Thus ad-hoc networks are challenging.

To ensure proper routing between these nodes, routing protocols have been developed. These protocols can be broadly classified into two main categories given below;

1) Proactive
2) Reactive
3) Hybrid

Proactive protocols are mainly driven by predefined routing tables. The routing information about each node in the topology is stored and maintained with respect to time. The major drawback of this protocol is the need to store the information about unused path which may take up a large part of available bandwidth.[1]

Reactive protocols generate the routes on demand.

When data packets are transferred between nodes, route discovery mechanisms are used. This eliminates the need for storing unnecessary data.

In this paper we only concern our self with on-demand or reactive protocols. The two routing protocols selected are AODV and AOMDV.

a) Ad hoc on demand vector

AODV is a reactive protocol that discovers routes on an as needed basis using a route discovery mechanism. It uses traditional routing tables with one entry per destination. Without using source routing, AODV relies on its routing table entries to propagate an RREP (Route Reply) back to the source and also to route data packets to the destination. The main advantage of this protocol is that it takes up little memory as it keeps data only for active paths.

But one of the major drawbacks with this type of routing is that it is not very efficient for large networks.[1]

b) Ad hoc on demand multipath vector

AOMDV is an extension of AODV designed for large multipath networks. AOMDV shares several characteristics with AODV. It is based on the distance vector concept and uses hop-by-hop routing approach. Moreover, AOMDV also finds routes on demand using a route discovery procedure. The main difference lies in the number of routes found in each route discovery. In AOMDV, RREQ propagation from the source towards the destination establishes multiple reverse paths both at intermediate nodes as well as the destination. Multiple RREPs traverse these reverse paths back to form multiple forward paths to the destination at the source and intermediate nodes. Note that AOMDV also provides intermediate nodes with alternate paths as they are found to be useful in reducing route discovery frequency.[1]

2. Methodology

Creating an ad hoc wireless network is quite difficult. Therefore we will create the network on a network simulator and compare the protocols on the basis of simulations result. Real life parameters like temperature and humidity are ignored but most of the parameters are covered by the simulator.

The network to be simulated will be a WiMax network as WiMax offers a range up to several kilometres

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A) Network Simulator

We will be using NS2.34 for simulations as it provides a flexible approach for designing a wireless network. NS2.34 requires a c++ compiler, thus it runs on a linux based platform.

Following are the steps to install NS2.34

1. Download the set up file and unzip it in a folder.
2. Install the VMware workstation version 8 or 10.
3. Create a virtual drive on the workstation and assign memory parameters to it.
4. Install the red hat linux 5 on to the virtual machine.
5. Install NS2.34

B) Creating A Network On Ns2

Steps for creating a network on ns2.34[3]

1. Create a simulator object using the below instruction
   Set ns [new simulator]
2. Assign a colour for data flow using the instruction
   $ns color 1 blue or $ns color 2 red
3. Open the NAM trace file using
   Set ns [open filename.nam]
4. $ns nametrace-all $nf
   Creating network (physical layer) using
5. Set n0[$ns node]
   Create link and queue(data link layer) using
6. $ns set duplex-link $n0$ n1 2mb 10ms droptail
   Define routing protocol
7. set opt(adhocRouting) AODV
   Create transport connection (transport layer) using
8. set udp1 [new Agent/UDP]
   $ns_ attach-agent $node_(1) $udp1
9. Create traffic (application layer) using
   $ns_ at 4.0 "$cbr1 start"

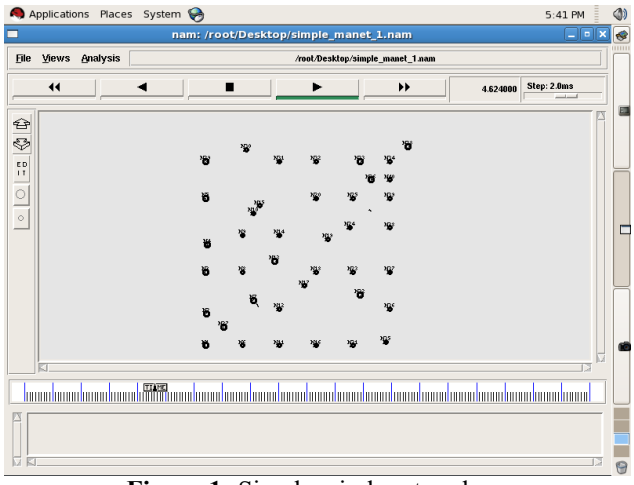

Figure 1: Simple wireless topology

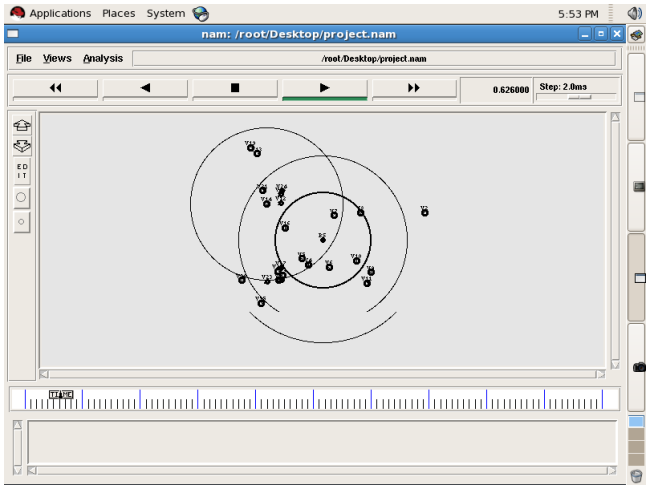

Figure 2: wireless topology using WiMax network

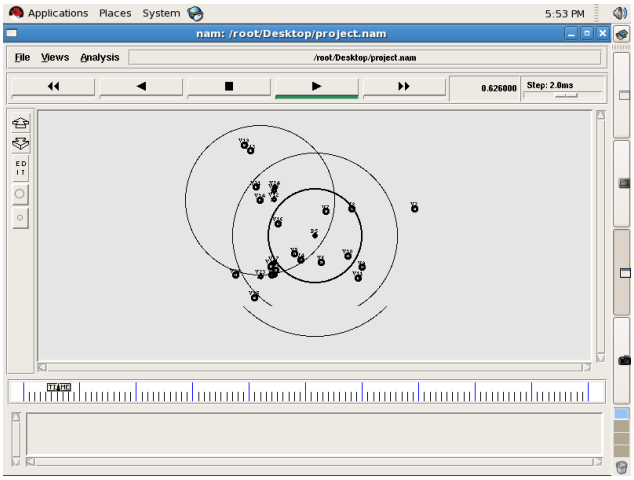

Figure 3: Data transfer between wireless nodes

3. Parameters to be Evaluated

In this paper we evaluate the routing protocols on the basis of five parameters that are given and defined below.

a) Throughput
Throughput can be defined as total packets successfully delivered to the destination in a given unit of time. In general, the longer the path lengths, the higher the probability of a packet drops. Thus, with a lower delivery fraction, samples are usually biased in favour of smaller path lengths and thus have less delay.

b) Delay
Delay represents average end to-end time delay and indicates how long it takes for the packet to travel from one mobile node to another. It includes delays caused by buffering during route discovery latency, transmission delays at the MAC, queuing at interface queue, and propagation and transfer time. It is measured in seconds.

c) Jitter
Packet jitter is the time difference between the receptions of two successive data packets. This metric is highly undesirable in data routing. Thus routing protocols must have low jitter.

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d) Packet delivery ratio

The ratio of data packets delivered to the destinations to those generated by the source. It is highly desired to have a large PDR for successful data routing.

e) Packet lost ratio

PLR is defined as the total packets lost to the total number of packets generated by the source.

It is highly desired to have a low PLR.

4. Simulation Results

Simulation results were obtained by creating an ad hoc network with 25 mobile nodes on a flat grid with one base station. The simulation results in tabulated form are given below.

Parameters	*AODV*	*AOMDV*
Throughput	12882.8062 kbps	13972.5682 kbps
Total packets sent	12874	14713
Total packets received	9980	11988
PDR	77.520584 %	81.478964 %
PLR	22.479416 %	18.521036 %
Average delay	2.0641893	2.57034636

5. Conclusion

The paper compared two reactive routing protocols on the basis of five main parameters (throughput, delay, Jitter, PDR and PLR.

After running the simulations we conclude that AOMDV is better than AODV due to its flexibility in finding new routes when a current link is broken.

Also when the number of mobile nodes increase, AODV becomes inefficient .But the main drawback with AOMDV is that due to its alternate route finding mechanism, it increases the average time delay for packet delivery.

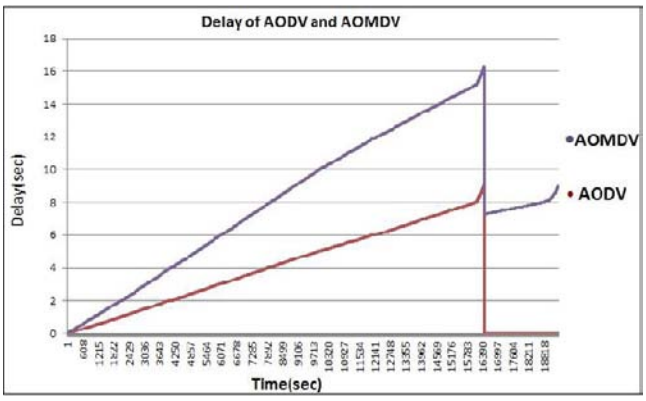

Figure 4: Delay Graph

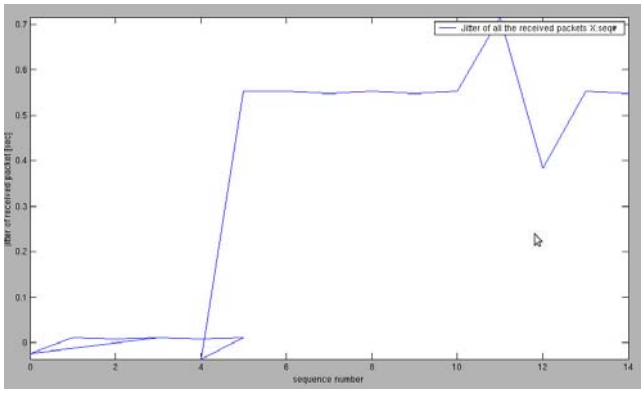

Figure 5: Graph for received packets for aodv

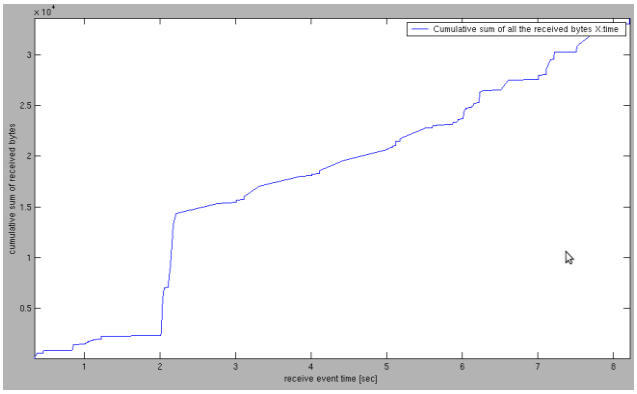

Figure 6: Graph for received packets for amdv

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