An Improvement on Ad-Hoc Wireless Network Routing Based on AODV

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Abstract— **Ad-hoc networks are characterized by multi-hop wireless connectivity, frequently changing network topology and the need for efficient dynamic routing protocols plays an important role. In which Modified AODV routing protocols gives better performance than AODV. This paper presents the simulation results in order to choose the best routing protocol to give the highest performance when implement the routing protocols in the target mobile application. The simulations comparing two ad-hoc routing protocols named AODV (ad-hoc on demand distance vector) and MAODV (modified ad-hoc on demand distance vector) with different parameters Throughput, Jitter, PDR and Average end-to-end delay. The performance differentials analyzed using varying simulation CBR. These simulations are carried out using the QualNet simulator version 4.5.**

Keywords— **Protocol: AODV, MAODV, QualNet simulator version 4.5.**

1. INTRODUCTION

Wireless networks are playing a major role in the area of communication. Now we are using wireless networks in military applications, industrial applications and even in personal area networks. Previously, the main difference between wireless and wired networks was only in communication channel. There exist physical medium in wired networks, while on the other side physical medium doesn't exist on the wireless networks. Wireless networks became very popular in different applications considering the following factors: ease of installation, reliability, cost, bandwidth, total required power, security and performance of network. All networks were however based on fixed infrastructures. Most common infrastructure based wireless networks are cordless telephone, cellular networks, Wi-Fi, Microwave communication, Wi-MAX, Satellite communication and RADAR etc.

II. ADHOC NETWORKS

A wireless mobile ad-hoc network (MANET) is a network consisting of two or more mobile nodes equipped with wireless communication and networking capabilities, but lacking any pre-existing network infrastructure. Each node in the network acts both as a mobile host and a router, offering to forward traffic on behalf of other nodes within the network. For this traffic forwarding functionality, a routing protocol is needed.

Ad-hoc networks can be classified in three categories based on applications; Mobile Ad-hoc Networks (MANETs), Wireless Mesh Networks (WMNs), Wireless Sensor Networks (WSN). A MANET is an autonomous collection of mobile nodes. A network is decentralized when the network organization and message delivery are executed by mobile nodes. The routing functionality is furthermore integrated into the mobile nodes. Nodes are struggling with the effects of radio communication, including multi-user interferences, multipath fading, and shadowing. The design issue of network protocols for MANET environment is highly complex. These networks need efficient distributed algorithms which are used to determine the connectivity of network organizations, link scheduling, and routing. The efficiency of routing algorithms in networks depends on the route computation. The shortest path based on network metrics from a source to a destination is usually the optimal route in static networks, this idea is not easily extended to MANETs. Many factors: extended power, quality of wireless links, path losses, fading, interference, and topological changes have to be considered in order to determine a new route. The networks should adaptively change routing paths to improve any of these effects. In Mobile Ad-hoc Networks, the lack to consider any of these requirements may degrade the performance and reliability of the network. There are three categories of MANET routing protocols such as table driven, on-demand and hybrid. In table driven approach, each router may contain one or more routing table though routing tables are absent in on-demand routing protocols. In on-demand, route request starts to establish a route on the basis of demand. A route request establishes a route on an on-demand basis for on-demand routing protocol.

III. ROUTING PROTOCOL

Routing is the act of moving information from a source to a destination in an internet work. At least one intermediate node within the internet work is encountered during the transfer of information. Basically two activities are involved in this concept. Determining optimal routing paths and transferring the packets through an internet work. The transferring of packets through an internetwork is called as packet switching which is straight forward, and the path determination could be very complex. Routing protocols use several metrics as a standard measurement to calculate the best path for routing the packets to its destination that could be number of hops, which are used by the routing algorithm to determine the optimal path for the packet to its destination. The process of path determination is that, routing algorithms find out and maintain routing tables, which contain the total route information for the packet. The information of route varies from one routing algorithm to another. The routing tables are filled with entries in the

routing table are IP-address prefix and the next hop. Destination/next hop associations of routing table tell the router that a particular destination can be reached optimally by sending the packet to a router representing the address prefix specifies a set of destinations for which the routing entry is valid.

IV. MAODV AND AODV ROUTING PROTOCOL

The Modified Ad-Hoc On-Demand (MAODV) Routing Protocol is the proposed routing protocol gives better performance than the Ad-hoc On-Demand Distance Vector (AODV) Routing Protocol. Before MAODV necessary to describe AODV Routing protocol in detail.

The Ad-hoc On-Demand Distance Vector (AODV) routing protocol is designed for use in ad-hoc mobile networks. AODV is a reactive protocol: the routes are created only when they are needed. In case of a route is broken the neighbors can be noticed. The following control packets are used: routing request message (RREQ) is broadcasted by a node requiring a route to another node, routing reply message (RREP) is unicasted back to the source of RREQ, and route error message (RERR) is sent to notify other nodes of the loss of the link. HELLO messages are used for detecting and monitoring links to neighbors. AODV is a relative of the Bellmann-Ford distant vector Algorithm, but is adapted to work in a mobile environment. AODV determines a route to a destination only when a node wants to send a packet to that destination. Routes are maintained as long as they are needed by the source. Sequence numbers ensure the freshness of routes and guarantee the loop-free routing.

The Modified AODV (MAODV) Routing Protocol is the change in the parameter values of AODV. The parameter values of MAODV is selected as follows: Active Route Time-out 4s, My Route Time-out 7s, RREQ Retries 4, TTL-Start 2 ,TTL-Increment 4, TTL-Threshold 6, Active Route Time-out: is the lifetime of an active route.

My Route Time-out: Receipt of a RREP a mobile node sets the lifetime of the route. RREQ Retries: A mobile node has to wait MAX_RREQ_TIMEOUTseconds after doing network-wide search RREQ_RETRIES times. TTL-START, TTL-INCREMENT, AND TTL-THRESHOLD: When searching for a route to the destination node, the source node uses the expanding ring search technique to prevent unnecessary network-wide dissemination of RREQs. This is done by controlling the value of the time to live (TTL) field in the IP header. The first RREQ message sent by the Source has TTL=TTL_START. The value of TTL defines the maximal number of hops a RREQ can move through the mobile ad hoc network, i.e. it decides how far the RREQ is broadcasted. In other words, it implies that the RREQ which is broadcasted by the source is received only by mobile nodes TTL hops away from the source (and of course all mobile nodes less than TTL hop away from the source). Apart from setting the TTL, the timeout for receiving a RREP is also set. If the RREQ times out without reception of a corresponding RREP, the source broadcasts the RREQ again. This time TTL is incremented by TTL_INCREMENT, i.e. the TTL of the second RREQ message is TTL_START + TTL_INCREMENT. This continues until a RREP is received or until TTL reaches TTL_THRESHOLD. If TTL reaches TTL_THRESHOLD a RREQ is sent with TTL=NET_DIAMETER, which disseminate the RREQ widely, throughout the MANET. Broadcasting a RREQ with TTL=NET_DIAMETER is referred to as a network-wide search.

V. QUALNET SIMULATOR

The simulator used in this thesis is QualNet 4.5, which is developed by Scalable Network Technologies. QualNet is a discrete event simulator of scalable network technologies. The simulation is running based on an event scheduler. That means the simulation is not performed in a constant time flow, but at specific points of time when events occur. QualNet is a predictive high-fidelity modeling tool for wireless and wired networks of tens of thousands of nodes. It makes good use of computational resources and models large-scale networks with heavy traffic load and mobility in reasonable simulation times.

VI. SIMULATION

The simulated network has 50 nodes randomly placed initially on a 1000m*1000m field. Each node moves in the region according to a given mobility model .a wireless channel has 2 Mb/s bandwidth and a circular radio range with 250m radius. No multiple-access contention or interference is modeled and each link uses the entire channel bandwidth while transmitting packets. The routing protocol is modeled as an independent routing module; one at each node. Link layer protocol is used to detect link failures. Since no link layer details are modeled, a link layer event is generated automatically whenever a link fails or reappears. Nodes are constantly moving according to a model similar to Brownian model. In this model node changes their speed and direction at discrete time intervals. The parameter used in our implementation of this model are Vmax = 20m/s and the movement interval duration=0.1 s. the simulation traffic is constant bit rate(CBR) with 10-50 connection .In each connection ,the source sends 128 byte data packets at an average rate of 2pkts/sec. The parameter values for MAODV are selected as follows: Active Route Time-out = 4s , My Route Time-out = 7s , RREQ Retries = 4 , TTL-Start = 2 TTL-Increment = 4 , TTL-Threshold = 6 , Simulation time = 100s.

VII. RESULT

Figure 1 shows the average end-to-end delay with different CBR values 10, 15, 20, 25 and constant pause time 30sec, node value 50, speed 20m/sec. Comparative analysis for AODV and MAODV, the MAODV gives better performance than AODV.

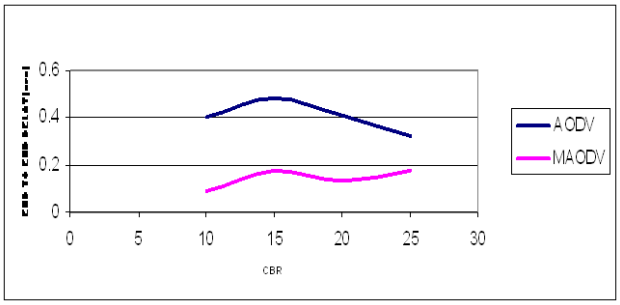

Figure 1. End-to-End delays Vs CBR

Figure 2 shows the Jitter with different CBR values 10,15,20,25 and constant pause time 30sec, speed 20m/sec, node value 50.

Comparative analysis for AODV and MAODV, the MAODV gives better performance than AODV.

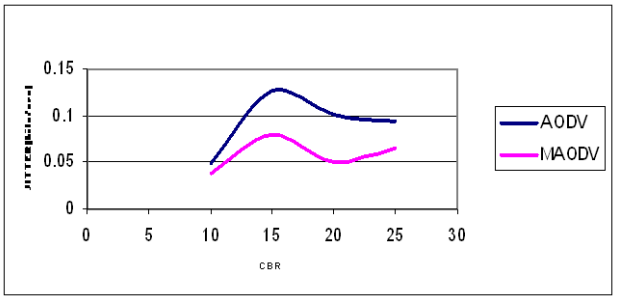

Figure 2. Jitter Vs CBR

Figure 3 shows the PDR with different CBR values 10,15,20,25 and constant pause time 30sec, speed 20m/sec, node value 50.

Comparative analysis for AODV and MAODV, the node value 10 to 20 MAODV gives better performance than AODV but for high values of CBR AODV gives better performance. The MAODV gives better performance for CBR low values and for high values AODV gives better performance.

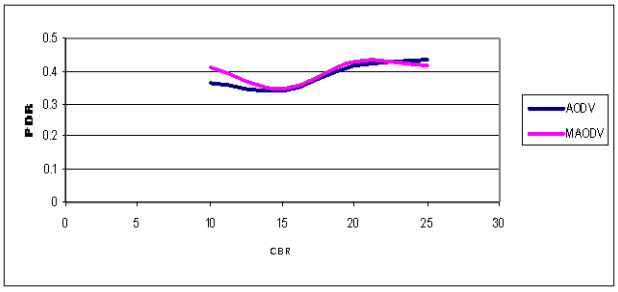

Figure 3. PDR Vs CBR

Figure 4 shows the Throughput with different CBR values 10,15,20,25 and constant pause time 30sec, speed 20m/sec, node value 50. Comparative analysis for AODV and MAODV, CBR value 10 to 15 the MAODV gives better performance than AODV and 15 to 20 AODV better but again 20 to 25 MAODV better than AODV. The MAODV gives better performance but CBR value 15 to 20 AODV gives better performance.

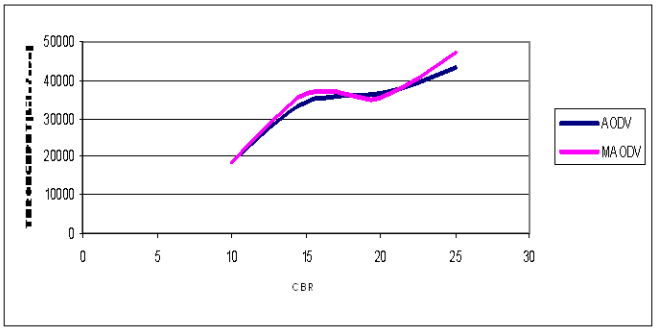

Figure 4. Throughput Vs CBR

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