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Performance Based Comparativeanalysis of AODV & AOMDV Protocols Under Energy Constrain

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Abstract - A Mobile Ad hoc NETwork (MANET) is a kind of wireless ad-hoc network, and is a self configuring network of mobile routers (and associated hosts) connected by wireless link. The routers are free to move randomly and organize themselves arbitrarily, thus the network's wireless topology may change rapidly and unpredictably. There are various routing protocols available for MANETs. The most popular ones are DSR, AODV and DSDV. However, these protocols typically suffer from a number of shortcomings, such as high routing overhead and limited scalability. With extent the mobile node also comes with limited source of power. The Node energy is mainly consumes in the process of receiving, transmitting, sensing and routing out of which routing load can be varied with efficient mechanism. More recently, it has been shown that multi-path ad-hoc routing protocols have a number of advantages over their single-path counterparts, including reduced overhead and increased reliability. This paper is an attempt has been made to compare the performance of AODV with its variation of Multipath version AOMDV. The comparison has been done under two protocols namely UDP and TCP. The tools used for the simulation are NS2 which is the main simulator, NAM (Network Animator) and Trace graph which is used for preparing the graphs from the trace files. The results presented in this dissertation work clearly indicate that the performance of AOMDV is better than AODV with respect to throughput and energy consumption.

Keywords: **MANET, AODV, AOMDV and NS2-Simulation.**

I. INTRODUCTION

A mobile ad hoc network (MANET) is a self-configuring less infrastructure network of mobile devices connected by wireless links. Ad-hoc is Latin and means "for this purpose". Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Each must forward traffic unrelated to its own use, and therefore be a router. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic and provide continous battery power to each node for breakless operation. Mobile ad hoc network is a wireless network that transmits from computer to computer. Instead of using a central base station (access point) to which all computers must communicate, this peer-to-peer mode of operation can greatly extend the distance of the wireless network.[2]

Mobile ad-hoc networks where there is no infrastructure support as is the case with wireless networks, and since a destination node might be out of range of a source node transmitting packets a routing procedure is always needed to find a path so as to forward the packets appropriately between the source and the destination. Within a cell, a base station can reach all mobile nodes without routing via broadcast in common wireless networks. In the case of ad-hoc networks, each node must be able to forward data for other nodes. This creates additional problems along with the problems of dynamic topology, which is unpredictable connectivity changes [3].

II. MEDIUM ACCESS CONTROL PROTOCOL

In these networks, the Medium Access Control (MAC) protocols are responsible for coordinating the access from active nodes. The IEEE 802.11 MAC protocol is the standard for wireless LANs, it is widely used in test beds and simulations for wireless multi-hop ad-hoc networks [4]. These protocols are of significant importance since the wireless communi-cation channel is inherently prone to errors and unique problems such as the hidden-terminal problem, the exposed-terminal problem, and signal fading effects. Although a lot of research has been conducted on MAC protocols, the various issues involved have mostly been presented in isolation of each other [5].

The popular Carrier Sense Multiple Access (CSMA) MAC scheme and its variations such as CSMA with Collision Detection (CSMA/CD) developed for wired networks, cannot be used directly in the wireless networks. In CSMA-based schemes, the transmitting node first senses the medium to check whether it is idle or busy. The node defers its own transmission to prevent a collision with the existing signal, if the medium is busy. Otherwise, the node begins to transmit its data while continuing to sense the medium. However, collisions occur at receiving nodes [8]. Since, signal strength in the wireless medium fades in proportion to the square of distance from the transmitter, the presence of a signal at the receiver node may not be clearly detected at other sending terminals, if they are out of range.

III. ROUTING CONSIDERATIONS

Since several hops may be needed for a packet to reach its destination, routing protocols are needed. There are two main functions of the routing protocols. First is finding the routes from the source to the destination and the second one is to deliver the messages or data packets from the source to the destination. The second process is more complicated as it also requires some control mechanism to assure the proper delivery of data packets so that the packets are not lost in the way. Apart these routing mechanism faces challenges in the form of followings:

Asymmetric links: Most of the wired networks rely on the symmetric links, which are always fixed. But this is not a case with ad-hoc networks as the nodes are mobile and constantly changing their position within network [6].

Routing Overhead: In wireless ad-hoc networks, nodes often change their location within network. So, some stale routes are generated in the routing table, which leads to unnecessary routing overhead.

Interference: This is the major problem with mobile ad-hoc networks as links come and go depending on the transmission characteristics, one transmission might interfere with another one and node might overhear transmissions of other nodes and can corrupt the total transmission.

Dynamic Topology: This is also the major problem with ad-hoc routing since the topology is not constant. The mobile node might move or medium characteristics might change. [6].

IV. ROUTING PROTOCOL

Ad-hoc On-Demand Distance Vector Routing (AODV)

AODV is a reactive protocol that discovers routeson 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. AODV uses sequence numbers maintained at each destination to determine freshness of routing information and to prevent routing loops [7]. All routing packets carry these sequence numbers. AODV maintains timer-based states in each node, for utilization of individual routing table entries, whereby older unused entries are removed from the table. Predecessor node sets are maintained for each routing table entry, indicating the neighboring nodes sets which use that entry to route packets. These nodes are notified with RERR (Route Error) packets when the next-hop link breaks. Each predecessor node forwards this packet to its predecessors, effectively erasing all routes using the broken link. Route error propagation in AODV can be visualized conceptually as a tree whose root is the node at the point of failure and all sources using the failed link as the leaves [7]. The advantages of AODV are that less memory space is required as information of only active routes are maintained, in turn increasing the performance, while the disadvantage is that this protocol is not scalable and in large networks it does not perform well and does not support asymmetric links.

Ad-hoc On-demand Multipath Distance Vector Routing (AOMDV)

Ad-hoc On-demand Multipath Distance Vector Routing (AOMDV) [3] protocol is an extension to the AODV protocol for computing multiple loop-free and link disjoint paths [7]. The routing entries for each destination contain a list of the next-hops along with the corresponding hop counts. All the next hops have the same sequence number. This helps in keeping track of a route. For each destination, a node maintains the advertised hop count, which is defined as the maximum hop count for all the paths, which is used for sending route advertisements of the destination. Each duplicate route advertisement received by a node defines an alternate path to the destination. Loop freedom is assured for a node by accepting alternate paths to destination if it has a less hop count than the advertised hop count for that destination. Because the maximum hop count is used, the advertised hop count therefore does not change for the same sequence number [7]. When a route advertisement is received for a destination with a greater sequence number, the next-hop list and the advertised hop count are reinitialized. AOMDV can be used to find node-disjoint or link-disjoint routes. To find node-disjoint routes, each node does not immediately reject duplicate RREQs. Each RREQs arriving via a different neighbor of the source defines a node-disjoint path. This is because nodes cannot be broadcast duplicate RREQs, so any two RREQs arriving at an intermediate node via a different neighbor of the source could not have traversed the same node. In an attempt to get multiple link-disjoint routes, the destination replies to duplicate RREQs, the destination only replies to RREQs arriving via unique neighbors. After the first hop, the RREPs follow the reverse paths, which are node disjoint and thus link-disjoint. The trajectories of each RREP may intersect at an intermediate node, but each takes a different reverse path to the source to ensure link disjointness [7]. The advantage of using AOMDV is that it allows intermediate nodes to reply to RREQs, while still selecting disjoint paths. But, AOMDV has more message overheads during route discovery due to increased flooding and since it is a multipath routing protocol, the destination replies to the multiple RREQs those results are in longer overhead.

V. IMPLEMENTATION

The entire simulations were carried out using ns 2.31 network simulator which is a discrete event driven simulator developed at UC Berkeley as a part of the VINT project [4]. The goal of NS2 is to support research and education in networking. It is suitable for designing new protocols, comparing different protocols and traffic evaluations. NS2 is developed as a collaborative environment. *NS -2* is an object oriented simulator, written in C++, with an OTcl interpreter as a frontend. The simulator supports a class hierarchy in C++ (also called the compiled hierarchy in this document), and a similar class hierarchy within the OTcl interpreter (also called the interpreted hierarchy in this document). The root of hierarchy is the class Tcl Object. Users create new simulator objects through the interpreter these objects are instantiated within the interpreter, and are closely mirrored by a corresponding object in the compiled hierarchy. [4]

Proposed simulation used network simultor-2, and use inbuilt package nam as TCL, Tk, Otcl, NS-2 etc. NS-2 use various different package like routing, MAC, TCP etc and invoke through TCL script.

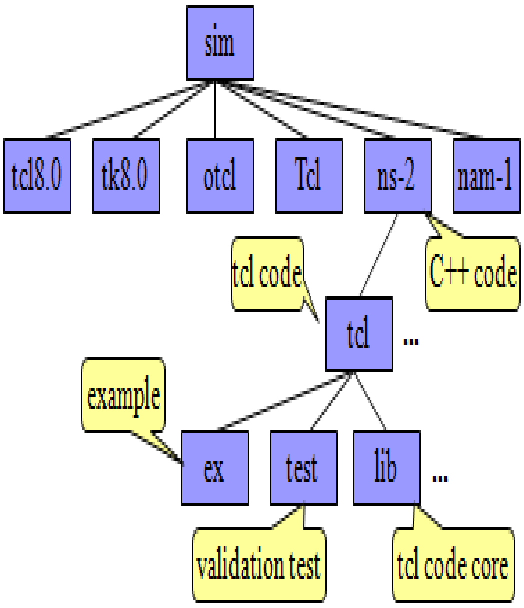

Fig 1: Directory Structure of NS-2

Following parameter selected for the simulation and analysis for the environment. According to below table 1.

Table 1: Simulation parameter

Parameter	Value
Number of nodes	50
Dimension of simulated area	800×600
Routing Protocol	AODV, AOMDV
Simulation time (seconds)	100
Antenna Type	Omni directional
Mac Layer Standard	802.11
Transport Layer	TCP,UDP
TCP Access Mechanism	Newreno, Updated Newreno
Traffic type	CBR, FTP
Packet size (bytes)	Random
Number of traffic connections	6
Maximum Speed (m/s)	Random

VI . RESULTS

Energy Utilization Graph in AODV Time

This graph shows energy discharge analysis in case of AODV routing mechanism working, here X-axis represent simulation time in second and Y-Axis shows energy value of particular node.

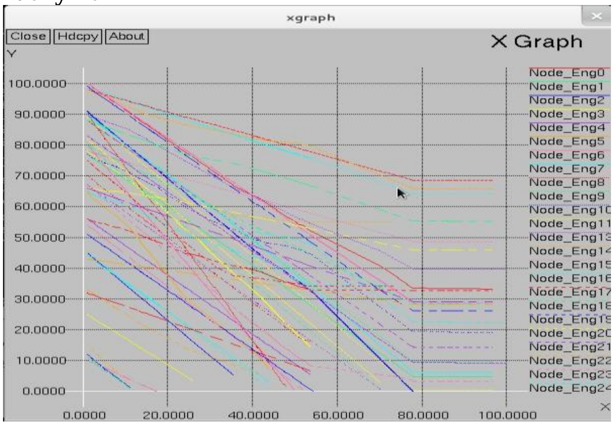

Fig 2: Energy Utilization Graph in AODV Time

Energy Utilization Graph in AOMDV Time

Graph shows energy depletion for AOMDV time that time till the end data can be transmitted and gives better data delivery ratio as compare to AODV routing, because AOMDV gives multiple path to route the packets to destination and that conclude node energy utilize by the actual data transmission.

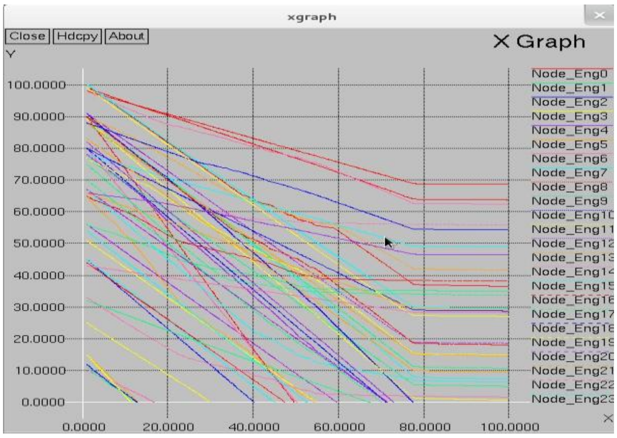

Fig 3: Energy Utilization Graph in AOMDV Time

UDP Packet Received Analysis for AODV and AOMDV

The graph shows result between AODV and AOMDV packet receive. X-axis shows simulation time in seconds and Y-axis shows total UDP packets received. As shown in graph it is observed that AOMDV protocol is better than AODV protocol in terms of UDP connection transmission.

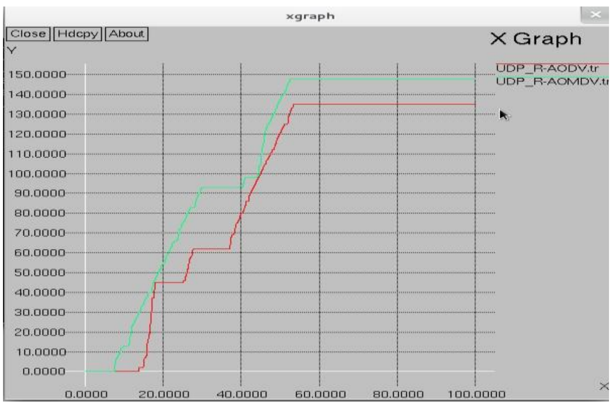

Fig 4: UDP Packets Receive Analysis For AODV and AOMDV

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UDP Packets Lost Analysis for AODV and AOMDV

The graph shows result between AODV and AOMDV packet lost. As shown in graph it is observed that AOMDV protocol is better than AODV protocol in terms of UDP connection transmission.

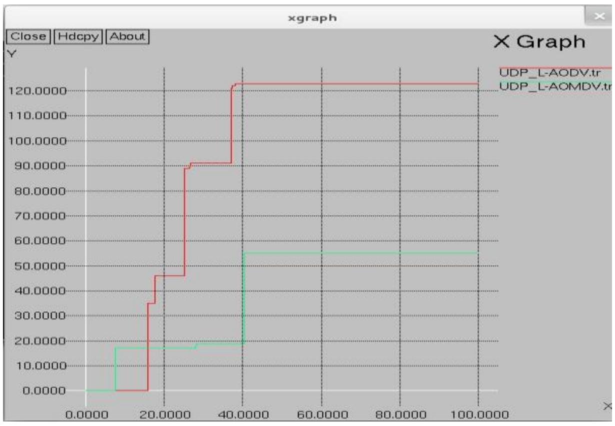

Fig 5: UDP Packets Loss Analysis for AODV and AOMDV

TCP Packet Analysis for AODV and AOMDV:

Result concludesAOMDV gives better TCP performance as compare to AODV routing protocol.

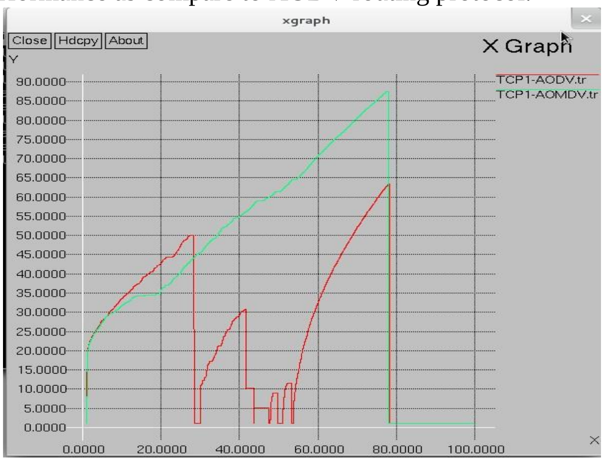

Fig 6: TCP Connection Analysis for AODV and AOMDV

OVERALL SUMMARY RESULT

This is the summary table in case of fifty nodes. All the below result conclude that proposed AOMDV protocol is efficient in Mobile Ad-hoc network.

Table 2: Result Analysis

Overall Analysis:		
PARAMETER	**AODV**	**AOMDV**
SEND	6332	5773
RECV	6159	5658
ROUTINGPKTS	13625	11826
PDF	97.27	98.01
NRL	2.21	1.98
Average E-E delay (ms)	285.74	267.76
No. of dropped data (packets)	173	115
No. of dropped data (bytes)	154500	108980

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