
Ain Shams University
Faculty of Engineering
Electronics and Communications Engineering Department

# Enhanced Route Discovery Mechanism of Ad Hoc on Demand Distance Vector Protocol for MANET

A thesis Submitted in Partial Fulfilment of the Requirements for the Degree of Master of Science in Electronics and Communication Engineering,

***By***

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# STATEMENT

This thesis is submitted as partial fulfillment of the requirements for the degree of Master of Science in Electronics and Communications Engineering, Faculty of Engineering, Ain Shams University.

The Author carried out the work included in this thesis, and no part of it has been submitted for a degree or qualification at any other scientific entity.

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# List of Acronyms:

| | |
|---|---|
| **ACK** | Acknowledgment |
| **AODV** | Ad hoc On demand Distance Vector |
| **AODV-SBA** | AODV with Sufficient Bandwidth Aware Routing Protocol |
| **AODV_MOD** | AODV Modified with non-optimal route suppression |
| **CBR** | Constant Bit Rate |
| **CBRP** | Cluster Based Routing Protocol |
| **DSDV** | Destination sequence distance vector |
| **DSR** | Dynamic source routing |
| **E-to-E delay** | Average end-to-end delay |
| **EPAOMDV** | Enhanced Power Based Multipath Protocol |
| **IEEE** | Institute of Electrical and Electronic Engineer |
| **IETF** | Internet Engineering Task Force |
| **IP** | Internet Protocol |
| **LAN** | Local Area Network |
| **LAR** | Location Aided Routing |
| **LOS** | Line of Site |
| **MAC** | Medium Access Control |
| **MANET** | Mobile Ad hoc Network |
| **NNRR** | Nominated Neighbors Rebroadcast RREQ |
| **NRL** | Normalized Routing Load |
| **NS2** | Network Simulator 2 |
| **OLSR** | Optimized Link State Routing Protocol |
| **OTCL** | Object oriented Tool command language |
| **PDF** | Packet Delivery Fraction |
| **PH-AODV** | Power and Hop based AODV |
| **QoS** | Quality of Service |

| | |
|---|---|
| **RERR** | Route Error |
| **RFC** | Request for comments |
| **RREP** | Route reply |
| **RREQ** | Route request |
| **SHARP** | Sharpe Hybrid Adaptive Routing Protocol |
| **STAR** | Source tree Adaptive Routing |
| **TCL** | Tool command language |
| **ZRP** | Zone routing protocol |

# Abstract

Resources in “Mobile Ad- hoc Network (MANET)” are scarce; therefore it is very important to reduce number of unimportant transmitted data packets and exchanged control packets among nodes, because each transmitted packet exhausts the battery power and needs processing capability at each node along its path. This could be done by diminishing number of control packets and reducing the number of nodes along the route between the originating and target node that reduce the number of transmissions. The control packets and power consumption of reactive protocols are less than proactive ones since routes are created solely when it is needed. As it being reactive protocol, “Ad hoc on Demand distance Vector (AODV)” still try to minimize the control packets at the expense of increased average end-to-end delay. The reasons for the delay to increase are due to the selection of long paths as a route, collision and congestion during path creation procedure.

This thesis revisits the issue of route discovery in “AODV” routing protocol, and forwards a proposal of an algorithm called Enhanced Route discovery Mechanism that suppresses non-optimal routes by identifying cases at which this non-optimal route is to occur during the route discovery process. The modified AODV with enhanced route discovery is called AODV_MOD. The first reason for the formation of non-optimal route is dropping of lately received Route Request (RREQs) by considering as if it has passed more hops than previously arrived. The algorithm, however, processes all RREQs that are received by nodes regardless of their arrival time and responds based on comparisons of their hop count. Besides, an increase in control overhead due to processing the same RREQ more than once is compensated by suppressing the initiation of Route Reply (RREP) which is unimportant and in addition has some contribution for the formation of non- optimal route

even if the RREQ is received for the first time. By using this algorithm, the routing overhead and number of nodes in the source to destination path can be reduced. Ultimately, resulting in the reduction of the average end-to-end delay, number of packet re-transmissions, routing loads and number of data packets drop between the originator and target node. As a result, the performance and efficiency of AODV routing protocol have been improved from point of view of packet delivery fraction, end-to-end delay and normalized routing load.

# Chapter 1

# Introduction

In the last few years, the scene of wireless mobile networking systems has been revised vastly, and modern wireless mobile communication technologies have been progressed innovatively day after day [1]. Wireless networks are networks which use wireless media for communication between the nodes. It allows flexible communication on which mobile nodes can freely move. One of the momentous evolving wireless mobile networking is an infrastructure-less *ad-hoc* network [1]. Due to the rapid increase of technology, it became available various devices with mobility capabilities. Hence Mobile Ad- hoc Networks (MANETs) are being used to carry out some important tasks. Wireless mobile ad hoc network is infrastructure-less and dynamically self- organizing network [2]. MANET consists of a group of wireless mobile nodes, where the communication among them via wireless links with hops style, without any centralized management [3], where each node is capable to forward packets of data in routing, therefore it is a multi-hop communication as shown in Figure 1.1. All the nodes have the same role, where each one of them can operate as a router and a host.

Figure 1.2. Simple Mobile Ad Hoc Network Configuration [4]

MANET has tremendous potential for operating in an on demand style, getting and maintaining routes only when it is needed, i.e. on the fly to start [5]. MANET usage in situation where creating the infrastructure network would be impossible or prohibited by certain reasons [6]. As it is being infrastructure- less, ad hoc network can be used in a certain region and provides firm operation [7]. Example of applications including urgent deliverance teams in locations of natural catastrophes, and for communication in harsh scenarios as battlefields. Even though it has the above important characteristics and applications, there are also challenges that face MANET's such as battery life, buffer space processing capability, security, transmission quality and bandwidth optimization [1]. In addition, problems like maintenance and discovery of routes, where this is due to that the network dynamic topology changes continuously and unpredictably [8].

The mobile nodes in MANET may require a high degree of interaction between them due to their limited capabilities as transmission power [1]. Consequently, in MANET networks, due to nodes mobility, nodes may not be able to communicate with each other directly because they are not in the same area of their transmission range; therefore some intermediate nodes are required for network organization and take care of the data forwarding. Where, nodes can switch from one location to another on a variety of node speed, as a result, the topology of network changes continuously and unpredictably. Only within small interval of time neighboring nodes can lose communication link. Nodes may be willing to enter or leave a MANET at any instant or their battery power have been exhausted at any time especially when the mobility is high [5]. MANET radio transmission range of nodes in wireless networks is optimized, based on their local neighborhood information, to establish desirable network topologies and lower transmission interference. Node can contact directly to all nodes in its transmission range,