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MANET's Routing Protocols: Comparative Study

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March 6, 2010

Declaration

I Certify that this thesis submitted for the degree of master of computer science is the result of my own research, except where otherwise acknowledged, and that this thesis (or any part of that) has not been submitted for a higher degree to any other university or institution.

Signed:

Imad Ibraheem M. Abu Sa'da

March 6, 2010

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Abstract

MANET is a mobile ad hoc network and a new paradigm of wireless communication for mobile hosts (nodes) without administration and without infrastructure, Node mobility in MANET causes frequent changes of the network topology.

The main interest in this research will be the routing Protocols and routing protocol approaches of MANETs which must be able to keep up with the high degree of node mobility and unpredictable network topology. These routing protocols including ARPM (adaptive routing protocol) which is now under study, in addition, in this research the process of learning and teaching of routing protocols will be more easily.

However, there are many drawbacks, which mean that it is essential to continue the search for an efficient protocol for MANETs to reduce these drawbacks.

The recent comparison was between ARPM, proactive and reactive routing approaches. This comparison shows that ARPM is more efficient than proactive and reactive routing approaches [5].

This research contains a list for parameters and properties which contain the definitions. The parameters for comparisons were used to detect the best protocol which may be used to reduce the drawbacks of MANETs; the properties were used for establishing a simple reference to the properties of some routing protocols, which will make the knowledge and learning of these routing protocols easier.

The research will gradually search for the more efficient protocol from (DSDV, AODV, SHARP and ARPM) by doing theoretical and experimental comparison. In addition, other available comparisons conducted and published by other researchers, the experimental comparison was reached through simulations for DSDV and AODV using

GloMoSim. The simulation was exploited as bases for completing other comparisons and for reaching final conclusions.

In this study, main work was focused on ARPM and hybrid routing approach (SHARP routing protocol) because these two protocols are relatively new protocols in MANET. Comparisons were illustrated in tables containing parameters, properties and routing protocols, eventually, these tables will form the simple reference (reference guide) that we motivated.

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Chapter One Introduction

1.1 MANET definition and characteristic:

MANET is a mobile ad hoc network and a new paradigm of wireless communication for mobile hosts (nodes) this kind of networks differ traditional networks or wired network it works spontaneously. In the past, the applications of MANET were proposed for military communications and disaster recovery, but now these applications are quickly expanding and spreading to include many applications related to multimedia technology and commercial interest and other civilian applications. These reasons encouraged the interested to make it under scope, so there have been profound and extensive researches since the last decade.

According to [Murphy et al., 1998], an ad hoc network is “a transitory association of mobile nodes which do not depend upon any fixed support infrastructure. Participants at a conference and disaster relief workers may find it necessary to interact with each other in this manner when the static support infrastructure is not available. An ad hoc network can be visualized as a continuously changing graph. Connection and disconnection is controlled by the distance among nodes and by willingness to collaborate in the formation of cohesive, albeit transitory community”.

In an ad hoc network, there is no fixed infrastructure, nodes communicate directly via wireless links without central administrator; frequent changes in network topology and nodes mobility are considered other characteristics of MANET [5].

1.2 Infrastructured and infrastrucureless of mobile network:

According to the infrastructure mobile networks are divided into two types, which enable the nodes to communicate with each other:

1. Infrastructured mobile networks (example: GSM): in this kinds of networks the mobile nodes communicate with access point like base stations connected to the fixed network infrastructure see Figure 1.2.1 [15].
2. Infrastructureless mobile networks: is known as mobile ad hoc network (MANET), in this network, group of nodes which form he network can communicate with each other dynamically without any access point. These nodes can exchange information directly or by an intermediate nodes without configuring a certain infrastructure; this supports the idea of being the nodes in MANET may have high mobility so the recent technology need a simultaneous configuring wireless network or connection between nodes see Figure 1.2.2 [15].

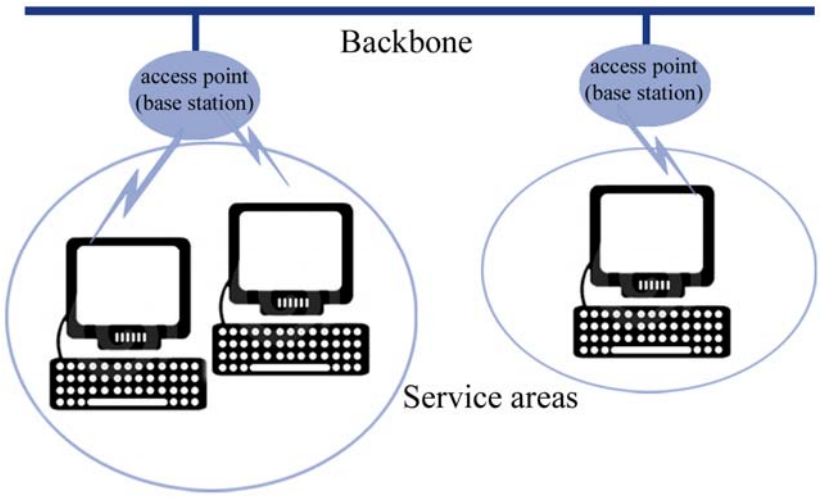

Fig.1.2.1 infrastructured mobile network

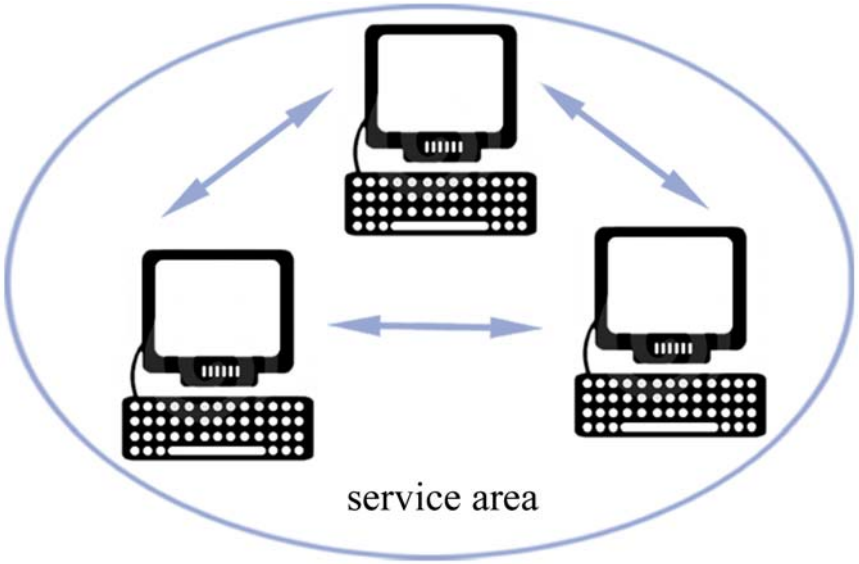

Fig.1.2.2 infrastructureless mobile network

1.3 Challenges of MANET:

MANET has many special features, which make MANET more popular and give it some advantages and facilities. However, at the same time this distinction makes MANET faces several challenges such as:

1- Dynamic topology, each node in MANET can continuously change its location connecting and disconnecting from the network, this makes the issue of routing packet between nodes a challenging task [5].

2- The limited processing and storing capabilities of mobile nodes, MANET nodes need a set of mechanisms to allow autonomous integration and configuration of the nodes to be in network.

3- Security, recent wireless research publications indicate that the wireless MANET presents a larger security compared to conventional wired and wireless networks mainly due to the common vulnerabilities of wireless connection.

4- Quality of Service (QoS): the United Nations Consultative Committee for International Telephony and Telegraphy (CCITT) recommendation has defined QoS as: "The collective effect of service performance which determines the degree of satisfaction of a user of the service" [13].

QoS is considered as an important attribute of routing protocols, during short period QoS becoming an area of interest.

It's a measurement of guarantee of a set of service characteristics, such as jitter and bandwidth. QoS of routing protocols differs and it may be affected by several metrics such as end to end delay and overhead, so the routing protocol with good quality of services will satisfy the user requirements by higher degree and at the same time it will provide better performance.

Due to frequent changing environment of MANET, it is difficult to provide different quality of service level.

5- Internetworking, in addition to the communication inside the MANET there must be cooperation between MANET and traditional network, so to make the routing protocols in the mobile nodes living together is a challenge.

6- The nodes in MANET such as laptops and mobile phones use batteries which have limited life time; this is a challenge which encouraged many researches that focus on power conservation and power consumption [17].

1.4 Problem definition:

Because of mentioned challenges this kind of network has many drawbacks and challenges in routing process, so we have to search a proper protocol that meets the needs of MANET. In addition, some people find learning and educating routing protocols very

difficult because. This is due to the large number of routing protocols proposed. also, determining and distinction the differences, similarities and properties of these routing protocol cause some difficulty so, there is a need for reference which contains a summary of some routing protocols, this reference may be used as educational reference.

1.5 Motivation and Solution:

Several amounts of researches has been proposed on developing skillful protocols specified to minimizing the drawbacks of MANET so, I will do this research which will focus on:

- The comparison of hybrid (SHARP), proactive (DSDV) and reactive (AODV) routing protocols.
- And comparison of ARPM routing protocol with proactive (DSDV) and reactive (AODV) routing protocols.
- Comparison of ARPM with SHARP routing as hybrid routing protocol.

To find the solution as it's clear I will gradually do to conclude the differences between all approaches from the older to the recent protocols and do the comparisons by taking one routing protocol from each routing protocol approaches. These comparisons will help us find the best approach or protocol for MANET by displaying and analyzing some properties and parameters in details, routing protocols include the protocols which are now in the study as an adaptive routing protocol ARPM in comparison with SHARP (hybrid routing protocol). This comparison is considered hot topic in MANET [5], in addition I will do to make the identification of MANET routing protocols more easier by doing simple reference for the properties.

Simply, the motivation of this work is to search and detect an efficient, scalable, and adaptive routing protocol for MANET and to establish simple reference by searching the properties and use them in details, and verifying each piece of information by the analysis of the algorithms, simulation, and some time available information were used with mentioning it's origins as references.

1.6 Thesis organization:

Sections 1.1 and 1.2 of chapter 1 mention and discuss MANET definition and characteristics. Section 1.3 outlines the challenges of MANET. Section 1.4 defines problem of this search and the motivation. Section 1.5 organizes the thesis, and section 1.6 discusses some properties and parameters which are used widely in MANET routing protocol

Chapter two reviews and analyzes some of the existing routing protocol approaches such as proactive routing protocol (DSDV), reactive routing protocol (AODV), hybrid routing protocol (SHARP) and another routing protocol which are now in the study which is called (ARPM).

Chapter three contains the simulation model, simulations environments and simulations results.

Chapter four lists and analyzes some properties and parameters for mentioned routing protocols as an analytical comparison in three tables as follow:

- Comparison and properties in comparative pattern of hybrid (SHARP), proactive (DSDV) and reactive (AODV) routing protocols
- Comparison and properties in comparative pattern of ARPM routing protocol with proactive (DSDV) and reactive (AODV) routing protocols