"A Review Paper on Introduction to MANET"

Chamkaur Singh[*1], Vikas Gupta [*2], Gurmeet Kaur [*3]

[*] Adesh Institute of Engg. & Technology (Faridkot), PTU Jallandhar,Punjab (INDIA)

[1]M.Tech Student in Electronic and Communication

[2]Asst. Prof. in Electronic and Communicaion Department

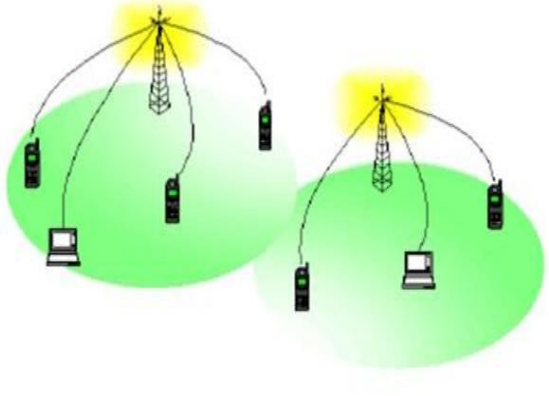
[3]Asst. Prof. in Electronic and Communicaion Department

***Abstract*— Mobile Ad hoc network is network where nodes communicate without any central administration or network structure. They are interconnected through wireless mediums and can use multiple hops to change data with them. Routing protocols are required for communication and synchronization in such Ad hoc networks, where it targets efficient and timely delivery of message. The DSR is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. DSR allows the network without the need for any existing network infrastructure or administration.**

***Keywords*— Manets; DSDV; DSR;**

I. 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 [3]. 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



.

Figure 1.1: Infrastructure based wireless network.

Next generation wireless ad-hoc networks are playing a prominent role in the rapid deployment of independent mobile users, efficient and dynamic communication for emergency/rescue operations, disaster relief efforts, and military networks. Ad-hoc networks do not have fix topologies to cover a large area. These topologies may change dynamically and unpredictably. Traditional routing protocols that are normally used for internet based wireless networks. These can't be applied directly to ad-hoc wireless networks; because some common assumptions are not valid in all cases for such dynamically changing networks and may be not true for mobile nodes. The availability of bandwidth is an important issue of ad-hoc networks. Thus, these network types present a difficult challenge in the design of routing protocols, where each node participates in routing by forwarding data dynamically based on the network connectivity. It improves the scalability of wireless networks compared to infrastructure based wireless networks because of its decentralized nature. In critical situations: natural disasters, military conflicts or any emergency moment, ad-hoc networks are best suited due to minimal configuration and quick operation.

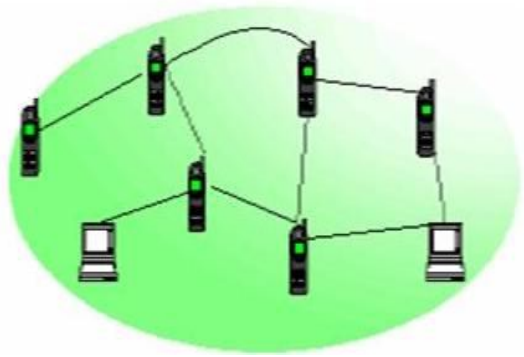


Figure 1.2: Mobile Ad-Hoc Network

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.

II. Mobile Ad Hoc Network (MANET) and Routing Protocols

"A mobile ad-hoc network (MANET) is a self-configuring network of mobile routers (and associated hosts) connected by wireless links." [9]. Mobile Ad-Hoc Networks are autonomous and decentralized wireless systems. MANETs consist of mobile nodes that are free in moving in and out in the network. Nodes are the systems or devices i.e. mobile phone, laptop, personal digital assistance, MP3 player and personal computer that are participating in the network and are mobile. These nodes can act as host/router or both at the same time. They can form arbitrary topologies depending on their connectivity with each other in the network. These nodes have the ability to configure themselves and because of their self configuration ability, they can be deployed urgently without the need of any infrastructure. The application areas of ad hoc networking include students using laptop computers to participate in an interactive lecture, sharing information awareness by military persons in Battlefield, earthquake, business associates sharing information during a meeting. MANET does not use a static network infrastructure. It uses multi-hop routing to provide network connectivity.Internet Engineering Task Force (IETF) has MANET working group (WG) that is devoted for developing IP routing protocols. An easy way to comply with the conference paper formatting requirements is to use this document as a template and simply type your text into it.

MANET aimed is to provide communication capabilities to areas where limited or no predetermined communication infrastructures exist. MANET share several salient characteristics.

1) Dynamic topologies
2) Bandwidth constrained links
3) Energy constrained operation
4) Limited physical security.

Routing protocols is one of the challenging and interesting research areas. The goal of routing protocols are-Find short routes, Decrease routing-related overhead and find stable routes. Many routing protocols have been developed for MANETS, i.e. DSDV, OLSR,AODV, DSR etc. Routing protocols define a set of rules which governs the journey of message packets from source to destination in a network[14]. In MANET, there are different types of routing protocols each of them is applied according to the network circumstances. Figure 2.1 shows the basic classification of the routing protocols in MANET.

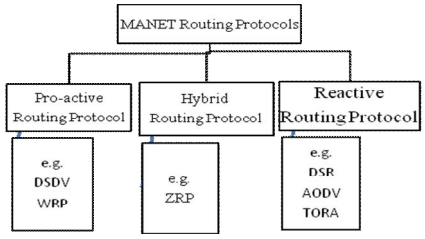


Figure 2.1 classification of routing protocols in MANET

A. *Proactive Routing Protocols-*

Proactive routing protocols are also called as table driven routing protocols. In this each node maintains routing table which contains information about the network topology even without requiring it. Every node in network has one or more routes to any possible destination in its routing table at any given time. The routing tables are updated periodically whenever the network topology changes[12]. Proactive protocols are not appropriate for large networks as they need to maintain node entries for each and every node in the routing table of every node. There are various proactive routing protocols. Example: DSDV, OLSR, WRP etc.

Destination-Sequenced Distance Vector routing (DSDV) Protocol :

Destination Sequence Distance Vector (DSDV) [7] is a proactive routing protocol and is based on the distance vector algorithm. In proactive or table-driven routing protocols, each node continuously maintains up-to-date routes to every other node in the network. Routing information is periodically transmitted throughout the network in order to maintain routing table consistency. The routing table is updated at each node by finding the change in routing information about all the available destinations with the number of nodes to that particular destination. Also, to provide loop freedom DSDV

uses sequence numbers, which is provided, by the destination node. In case, if a route has already existed before traffic arrives, transmission occurs without delay. Otherwise, traffic packets should wait in queue until the node receives routing information corresponding to its destination. However, for highly dynamic network topology, the proactive schemes require a significant amount of resources to keep routing information up-to-date and reliable. In case of failure of a route to the next node, the node immediately updates the sequence number and broadcasts the information to its neighbors. When a node receives routing information then it checks in its routing table. If it does not find such entry into the routing table then updates the routing table with routing information it has found. In case, if the node finds that it has already entry into its routing table then it compares the sequence number of the received information with the routing table entry and updates the information. If it has sequence number that is less than that of the received information then it discards the information with the least sequence number. If the both the sequence numbers are the same then the node keeps the information that has the shortest route or the least number of hops to that destination.

B. *Reactive Routing Protocols-*

Reactive routing protocol is also known as on demand routing protocol. In this type of protocol, route is discoveredwhenever it is needed. Reactive protocols do not maintain up-to-date routes to any destination in the network and do not generally exchange any periodic control messages. Reactive protocol searches for the route in an on-demand manner and set the link in order to send out and accept the packet from a source node to destination node. Route discovery process is used in on demand routing by flooding the route request (RREQ) packets throughout the network.. This routing protocol have two major components:

1) *Route discovery-* In this phase source node initiates route discovery on demand basis. Source nodes consults its route cache for the available route from source to destination otherwise if the route is not present it initiates route discovery. The packet of the source node includes the address of the destination node as well address of the intermediate nodes to the destination.

2) *Route maintenance-* Due to dynamic topology of the network cases of the route failure between the nodes arises due to link breakage etc, so route maintenance is required. Reactive protocols have acknowledgement mechanism due to which route maintenance is possible. There are various reactive routing protocols. Example: DSR, AODV, TORA and LMR.

Dynamic Source Routing (DSR) Protocol:

Dynamic Source Routing DSR [8] is a reactive protocol. This protocol is one of the example of an on-demand routing protocol that is based on the concept of source routing. It is designed for use in multi hop ad hoc networks of mobile nodes. It allows the network to be completely self-organizing and self-configuring and does not need any existing network infrastructure or administration. DSR uses no periodic routing messages like AODV, thereby reduces network bandwidth overhead, conserves battery power and avoids large routing updates. However, it needs support from the MAC layer to identify link failure. The DSR routing protocol discovers routes and maintains information regarding the routes from one node to other by using two main mechanisms:(i) Route discovery – Finds the route between a source and destination and(ii) Route maintenance –In case of route failure, it invokes another route to the destination. DSR has a unique advantage by virtue of source routing. As the route is part of the packet itself, routing loops, either short – lived or long – lived, cannot be formed as they can be immediately detected and eliminated. This property of DSR opens up the protocol to a variety of useful optimizations**.** If the destination alone can respond to route requests and the source node is always the initiator of the route request, the initial route may the shortest. This routing protocol apply the concept of source routing, which means that the source determines the complete path from the source node to the destination. node, that the packets have to traverse, and hence ensures routing to be trivially loop-free in the network. The packet in DSR carries all information pertaining to route in its preamble (header) thus permitting the intermediate nodes to cache the routing information in their route tables for their future use.

In DSR Protocol, Route discovery is the process in which a source, in order to send data to a destination, obtains the route to the destination, even if it does not have a route to the destination. Route maintenance is the mechanism by which the node keeps the record of dynamic changes of the network topology. In other words, source node checks for any link failure between source and destination. If a link failure is found between source and destination, the source node tries to find another route to the destination or invokes Route Discovery; thereby communication between source and destination continues to be established.

C. *Hybrid Routing Protocol-*

This type of protocol is a trade-off between proactive and reactive protocols. Proactive protocols have more overhead and less latency while reactive protocols have less overhead and more latency[14]. Thus a Hybrid protocol is needed to overcome the shortcomings of both proactive and reactive routing protocols. This protocol is a combination of both proactive and reactive routing protocol. It uses the on demand mechanism of reactive protocol and the table maintenance mechanism of proactive protocol so as to avoid latency and overhead problems in the network. Hybrid protocol is appropriate for large networks where large numbers of nodes are present. In this, large network is divided into a set of zones where routing inside the zone is done by using proactive approach and outside the zone routing is

done using reactive approach. There are various hybrid routing protocols for MANET like ZRP, SHRP etc.

Zone Routing Protocol (ZRP):

ZRP [16] is a framework by using it we can take advantage of both table driven and on demand driven protocol according to the application. In this separation of nodes, local neighbourhood from the global topology of the entire network allows for applying different approaches and thus taking advantage of each technique's features for a given situation. These local neighbourhoods are called *zones* (hence the name) each node may be within multiple overlapping zones, and each zone may be of a different size. The "size" of a zone is not determined by geographical measurement, as one might expect, but is given by a radius of length **r** where **r** is the number of hops to the perimeter of the zone.

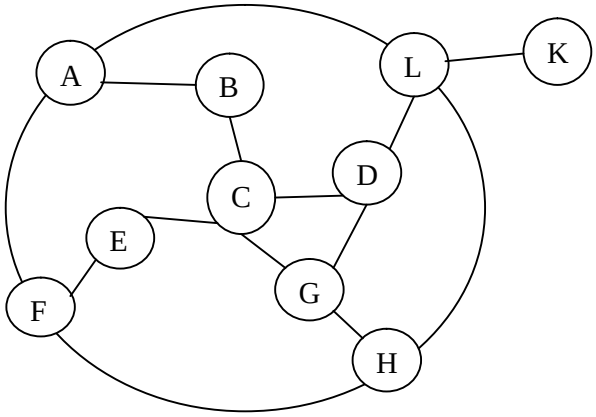


Figure 1 ZRP with Zone radius **r** =2

In the above diagram ZRP, protocol having Zone radius **r** =2 in this inside the zone communication done in proactive way and outside it between such zones in reactive way. B,C,D,E,G are interior node and A,F,L,H are border nodes communication between C and L is done through proactive way and K is located outside the zone. ZRP consist of [17] three parts:
IARP(Intra Zone Routing Protocol) [18] proactive part of it,
IERP(Inter Zone Routing Protocol) [19] reactive part of it and
BRP(Bordercast Resolution Protocol) [20] used with IERP to reduce the query traffic.

III. RELATED WORK

In the paper [1] presents an overview and comparison of existing QoS based revisions done on AODV protocol, thus providing the reader with insight into their differences and allows to highlight trends in protocol design and identify areas for future research. In this article, the review of challenges and concepts behind QoS routing in MANETs based on AODV protocol were presented . The enhancements made to the protocol were analyzed. The protocols were selected in such a way as to highlight many different approaches to QoS routing in MANETs, while simultaneously covering most of the important advances in the field since the last such survey was published. This article summarized the operation, strengths, drawbacks and results of these protocols in order to enunciate the variety of approaches proposed and to expose the trends in designers' thinking. The new protocol should provide high PDR and throughput with short delay, less load and managing the effects of mobility. Enhancements to be done such a way the protocol proves to be best in performing routing in MANETS.

In the paper [2] presented an analytical model for average end-to-end delay that takes into account the packet arrival process, backoff and collision avoidance mechanisms of random access MAC between a pair of source and destination and compares the end-to-end delay experienced by a QoS AODV protocol. The proposed analytical model results closely match with the results obtained from their simulations. They investigated contention delay in a node in MANETs under symmetric conditions. Their analytical model captures a per node delay in MANETs, and the model was validated by simulations.

Jacob (2012) in the paper " Performance Analysis and Enhancement of Routing Protocol in Manet" evaluates the performance of various adhoc routing protocols such as DSDV, AODV, DSR, TORA and AOMDV in terms of energy efficiency and it also proposes a new routing algorithm that modifies AOMDV and it provides better performance compared to all the above protocols. Simulation is done using NS-2(version NS-2.34).

Gill (2012) in the paper "Comparative Analysis of Routing in MANET" presented the impact of comparison of different routing protocol in terms of different parameters. In this paper author discussed classification of routing protocols on the basis of routing information update mechanism, highlighting their characteristics and done comparative analysis for wireless ad hoc networks routing protocols viz. DSDV, CGSR, DSR, AODV and TORA etc. As there are still many challenges facing wireless ad hoc networks, it is not clear that any particular algorithm or class of algorithm is the best for all scenarios, each protocol has their own merits and demerits and is well suited for certain situations. However because of their advantages, wireless ad hoc networks are becoming more and more prevalent in the world.

Arshad (2013) in the paper "Modeling and Simulating Network Connectivity in Routing Protocols for MANETs and VANETs" presents a framework for node distribution with respect to density, network connectivity and communication time. Using NS2, they evaluate and compare performance of three routing protocols; Ad-hoc On-demand Distance Vector (AODV), Dynamic Source Routing (DSR) and Fisheye State Routing (FSR) both in MANETs (IEEE 802.11) and VANETs (IEEE 802.11p). They further enhanced these protocols by changing their routing information exchange intervals; MOD AODV, MOD DSR and MOD FSR. A comprehensive

simulation work is performed for the comparison of these routing protocols for varying motilities and scalabilities of nodes. As a result, they can say that AODV outperforms DSR and FSR both in MANETs and VANETs.

In the paper [3] Mobile Ad hoc network is network where nodes communicate without any central administration or network infrastructure. They are connected via wireless channels and can use multiple hops to exchange data. Routing protocols are needed for communication in such Ad hoc networks, where it targets for efficient and timely delivery of message. There are various performance metrics to compare Ad hoc routing protocols. In this paper, a step by step procedure is stated to compare 3 popular routing protocols, DSR, AODV and DSDV based on performance metrics Packet Delivery Fraction (Pdf), End to end delay and Normalized Routing load while varying the number of nodes, speed and Pause time. It also provides a step by step approach based on assumption on how to carry out such a comparative study, which could be used for future research.

In the paper [4] A Wireless ad hoc network is a collection of autonomous mobile nodes that communicate with each other over wireless links without any fixed infrastructure. The nodes use the service of other nodes in the network to transmit packets to destinations that are out of their range. Such networks are expected to play increasingly important role in future organizations, University, Civilian and Military settings, being useful for providing communication support where no fixed infrastructure exists. Also, in case of disaster or natural calamities, the deployment of a fixed infrastructure is neither feasible nor economically profitable for establishing communication among the rescue members. In order to accomplish this, a number of ad-hoc routing protocols have been proposed and implemented, which include dynamic source routing (DSR) and Destination sequenced Distance Vector (DSDV) routing protocols. In this paper for experimental evaluation purposes, we have considered 500m x 500m, terrain area which illustrates the performance in terms of the packet delivery fraction and throughput for DSR and DSDV routing protocols. Our simulation results using NS-2 shows that DSR performs better in both the case of packet delivery fraction and throughput over DSDV routing protocol.

In the paper [5] The Dynamic Source Routing protocol (DSR) is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. DSR allows the network to be completely self-organizing and self-configuring, without the need for any existing network infrastructure or administration. The protocol is composed of the two mechanisms of Route Discovery and Route Maintenance, which work together to allow nodes to discover and maintain source routes to arbitrary destinations in the ad hoc network. The use of source routing allows packet routing to be trivially loop-free, avoids the need for up-to-date routing information in the intermediate nodes through which packets are forwarded, and allows nodes forwarding or overhearing packets to cache the routing information in them for their own future use. All aspects of the protocol operate entirely on-demand, allowing the routing packet overhead of DSR to scale automatically to only that needed to react to changes in the routes currently in use. We have evaluated the operation of DSR through detailed simulation on a variety of movement and communication patterns, and through implementation and significant experimentation in a physical outdoor ad hoc networking test bed we have constructed in Pittsburgh, and have demonstrated the excellent performance of the protocol. In this chapter, we describe the design of DSR and provide a summary of some of our simulation and testbed implementation results for the protocol.

In the paper [6] The *Dynamic Source Routing* protocol (DSR) is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. DSR allows the network to be completely self-organizing and self-configuring, without the need for any existing network infrastructure or administration. The protocol is composed of the two mechanisms of *Route Discovery* and *Route Maintenance*, which work together to allow nodes to discover and maintain *source routes* to arbitrary destinations in the ad hoc network. The use of source routing allows packet routing to be trivially loop-free, avoids the need for up-to-date routing information in the intermediate nodes through which packets are forwarded, and allows nodes forwarding or overhearing packets to cache the routing information in them for their own future use. All aspects of the protocol operate entirely *on-demand*, allowing the routing packet overhead of DSR to scale *automatically* to only that needed to react to changes in the routes currently in use. We have evaluated the operation of DSR through detailed simulation on a variety of movement and communication patterns, and through implementation and significant experimentation in a physical outdoor ad hoc networking test-bed we have constructed in Pittsburgh, and have demonstrated the excellent performance of the protocol. In this chapter, we describe the design of DSR and provide a summary of some of our simulation and test-bed implementation results for the protocol.

IV. CONCLUSION

A MANET is a collection of mobile nodes. As there are still many challenges facing wireless ad hoc networks, it is not clear that any particular algorithm or class of algorithm is the best for all scenarios, each protocol has their own merits and demerits and is well suited for certain situations. However because of their advantages, wireless ad hoc networks are becoming more and more prevalent in the world. There are some popular ad hoc routing protocols AODV, DSR and DSDV. we have reviewed the comparison of DSR and DSDV protocols with varying number of nodes and speed of nodes in previous papers. DSDV uses the proactive table-driven routing strategy whereas DSR uses the reactive on demand routing strategy with different routing mechanisms. Our goal should be to create an integrated set of protocols that allow mobile computers, and the applications running on them and communicating with them, to seamlessly make the most efficient use of the best available network connections at any time. Further improvements can be done to enhance the performance and efficiency of DSR, for instance to have

scaling to huge networks, and with the addition of new features to the protocol, such as multicast routing.

REFERENCES

[1] S.Sridhar and R.Baskaran, "A Survey on QoS Based Routing Protocols for MANET", International Journal of Computer Applications (0975 – 8887),Volume 8– No.3, October 2010.

[2] Rakesh Kumar, Manoj Misra, and Anil K. Sarje, "A Simplified Analytical Model for End-To-End Delay Analysis in MANET" IJCA Special Issue on "Mobile Ad-hoc Networks" MANETs, 2010.

[3] Amith Khandakar, "Step by Step Procedural Comparison of DSR, AODV and DSDV Routing protocol" 4th International Conference on Computer Engineering and Technology IACSIT Press, Singapore Vol.40, 2012.

[4] Rajeshwar Singh, Dharmendra K Singh and Lalan Kumar, "Performance Evaluation of DSR and DSDV Routing Protocols for Wireless Ad Hoc Networks" Int. J. Advanced Networking and Applications Vol. 02, Issue. 04, Pages: 732-737,2011.

[5] David B. Johnson, "DSR: The Dynamic Source Routing Protocol for Multi-Hop Wireless Ad Hoc Networks" http://www.monarch.cs.rice.edu/monarch-papers/dsr-chapter00.pdf.

[6] D. B. Jagannadha Rao ,Karnam Sreenu, Parsi Kalpana, "A Study on Dynamic Source Routing Protocol for Wireless Ad Hoc Networks" International Journal of Advanced Research in Computer and Communication Engineering Vol.1, Issue.8, October 2012.

[7] The CMU Monarch Project's Wireless and Mobility Extensions to ns,Website: http://www.monarch.cs.cmu.edu/

[8] D. Johnson, D. Maltz and J.Jetcheva, The Dynamic Source Routing Protocol for Mobile Ad hoc networks, *Internet Draft, draft-ietf-manet-dsr-07.txt*, 2002.

[9] Murizah Kassim Ruhani Ab Rahman, Mariamah Ismail Cik Ku Haroswati Che Ku Yahaya," Performance Analysis of Routing Protocol in WiMAX Network," IEEE International Conference on System Engineering andTechnology (ICSET), 2011.

[10] C.E. Perkins and P.Bhagwat,"Highly Dynamic Destination Sequenced Distance-Vector Routing(DSDV) for Mobile Computers,"IGCOMM,London,UK,August 1994

[11] Yuan Xue, Member, IEEE, Baochun Li, Senior Member, IEEE, and Klara Nahrstedt, Member, IEEE," Optimal Resource Allocation in Wireless Ad HocNetworks: A Price-Based Approach,2006.

[12] Narendra Singh Yaday, R.P.Yadav," Performance Comparison and Analysis of Table-Driven and On-Demand Routing Protocols for Mobile Ad-hoc Networks,"Interational Journal of Information and Communication Engineering, 2008.

[13] A.Boukerche,"Performance Evaluation of Routing Protocols for Ad Hoc Networks, "Mobile Networks and Applications,Kluwer Academic Publishers,2004

[14] "The Handbook of Ad-hoc Wireless Network" Edited by Mohammad Ilyas Florida Atlantic University Boca Raton, Florida

[15] Ebrahim Mohammed, Louis Dargin "Routing Protocols Security in Ad Hoc Networks" under Oakland University School of Computer Science and Engineering CSE 681 Information Security

[16] Analysis of the Zone Routing Protocol Jan chaumann December 8, 2002

[17] The Zone Routing Protocol (ZRP) for Ad Hoc Networks<draft-ietf-manet-zone-zrp-02.txt>2002

[18] The Intrazone Routing Protocol (IARP) for Ad Hoc Networks <draft-ietf-manet-zone-iarp-01.txt>.2002

[19] The Interzone Routing Protocol (IERP) for Ad Hoc Networks<draft-ietf-manet-zone-ierp-02.txt>July2002

[20] The Bordercast Resolution Protocol (BRP) for Ad Hoc Networks draft-ietf-manet-zone-brp-02.txt> 2002