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Survey on a Hybrid Routing Protocol in Ad-Hoc Networks

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Abstract

A Mobile Adhoc Network (MANET) is a system of versatile nodes with no fixed framework or not brought under any centralized organization. In MANET to most extreme every one of the node are mobile, so its topology experiences frequent change and MANET powerfully designs its system. The significant test in MANET is to discover ideal path among source and destination. MANET directing protocols are delegated unicasting and multicasting. Further under unicasting and multicasting Categorization they are delegated proactive, ireactive and hybrid protocols. The khybrid protocols consolidate the positive highlights of both proactive and reactive protocols. One of the effective unicasting hybrid protocols is Zone Routing Protocol (ZRP). ZRP partitions the whole system into routing zones. Directing inside the zone is continued utilizing proactive methodology of Intra Zone Routing Protocol (IARP) and steering outside the zone is continued utilizing responsive methodology of Inter Zone Routing Protocol (IERP). This paper exhibits an outline of adhoc routing executing ZRP. The proposed kprotocol is appropriate for huge dense wireless environments.

Key Words :*Hybrid protocols, Mobile AdHoc Network (MANET), Routing, Zone Routing Protocols.*

I. INTRODUCTION

Wireless mobile networks can be categorized into two based on the presence of infrastructure. The first one is the infrastructured wireless mobile network which depends on the fixed infrastructure like a base station to transmit information. The subsequent classification is the infrastructureless remote portable system with no fixed framework which is usually signified as a Mobile Adhoc Network [1]. A MANET is an assortment of remote nodes that can powerfully shape a system topology to trade data without utilizing any prior fixed system framework. In this system every one of the host goes about as router[13]. Every host inside the system conveys to another host inside the range. To reach the destination node from the source node they communicate through other intermediate nodes. This type of network is called as multihop or store and forward network [2].

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It provides robust communication support during emergencies, like disaster recovery situations and military zones where all other networks are down. MANET applications are mainly implied in PAN, HAN and military environments. Routing plays a major role in networking. Routing can be signified as the way toward choosing a way from source to receiver node in the system traffic, to transmit packets to the destination host while the system host move openly in the system [15].

In MANET different Routing are suitable for different applications. Generally all MANET protocols fall under two categories of unicasting or multicasting. Under every classification they are additionally ordered into proactive, reactive and hybrid protocols. [3].The major problems faced in the Adhoc Networks are limited Band Width and High range Topological change.

II. ZONE ROUTING PROTOCOL

The MANET hybrid protocols combine the features of both table driven and reactive protocols. It implies table driven for the neighborhood and on demand for distant nodes. One of such hybrid protocol is the ZRP Protocol [4]. Two major challenge of Adhoc network is to find a packet route and manage the often changing network topology. ZRP is suitable for large network and as the count of nodes is large, the count of destination is also large and requires frequent exchange and updation of data.

The MANET hybrid protocol ZRP reduce control overhead and decrease latency caused by proactive and reactive protocols. ZRP is a framework of hybrid routing protocol suite containing three modules. The first protocol suite is Intra Zone Routing protocols (IARP), Second protocol suite is inter zone routing protocol (IERP) and third protocol suite is Bordercast resolution protocol (BRP). In ZRP the IARP represents the locally Proactive routing component and the inter zone routing protocol IERP represents the globally reactive routing component. IARP is a family of Proactive link state routing protocols. It conserves routing information for nodes that lies within the routing zone of the node. Similarly IERP is a family of reactive routing protocols that provide route discovery and route maintenance services [5][9].

A. Need for Hybrid ZRP Protocol

Routing protocols are generally categorized as proactive and reactive. Proactive evaluate route and forward packet immediately. Reactive protocol invokes procedure for routing on demand then the search for route is performed. In proactive on requirement of route the delay is less but in case of reactive the delay is significant. Whereas in proactive large portion of the network is utilized for purpose of updating the routing information and the network overhead is high but In case of reactive protocol the network overhead is low. It is not applicable to imply purely on proactive or purely reactive for efficient routing in MANET for large network in the real time communications. Hybrid routing protocols combining the characteristics of table driven and on demand protocols is appropriate for mobile adhoc network which results in reduced delay and limited usage of network capacity [5].

To manage the network efficiently both table driven and on demand protocols can be merged and used as ZRP protocol. From proactive protocol family DSDV, OLSR or WRP can be used and from reactive protocol family DSR, AODV or TORA can be used. For efficient routing the change in the network topology should have only low radii impact. The hybrid protocol ZRP stricts the scope of table driven procedure to the nodes of local neighborhood. The search throughout the network is coordinated perfectly by on demand protocol by querying opted hosts from the network environment in the network. In ZRP the topological change in the network are propagated only to the neighborhood instead distributing information to the whole network.

The high mobility in adhoc networks results in the change

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in topology of the MANET. The change is often due to its high mobility and the nodes connected dynamically in an arbitrary manner. The devices are small with low transmission power and the radio coverage is also less. Here the links are unreliable and characterized by low bandwidth links. As the topology changes are frequent efficient routing protocol is required to manage the routing difficulties in MANET.

B. ZRP ROUTING FRAMEWORK

ZRP networking structure is a hybrid routing framework. ZRP structure is suitable for a wide types of mobile adhoc networks. Efficient routing can be provided for large network spans and diverse mobility pattern simplifying ZRP protocol. It adapts to wide variety of networks by adjusting one parameter the Zone radius at varying levels of node density. The proactive component of ZRP performs route maintenance within zone of each node. The reactive component of ZRP performs route discovery implying technique of bordercasting based on multicasting mechanism for the efficient propagation of route queries. ZRP is suitable for multichannel multi technology routing and network operating under high dense network load.

i. OVERVIEW OF ZONE ROUTING FRAMEWORK

In the ZRP network structure the table driven protocol provides a clear picture of local topology surrounding each node. The services provided within the routing zone are prior route maintenance, unidirectional path construction and monitored message distribution. The global on demand protocol provides efficient service of bordercasting replacing the traditional broadcasting methodology. The bordercasting directs queries around the entire network across overlapping routing zones.

ZRP framework consists of 3 parts IARP the proactive segment, IERP the on demand segment and the BRP utilized by IERP to minimize the dense query flow. IARP routing zone radius shows the scope of the proactive routing protocol. zone provided by the local IARP to build the multicast (bordercast) tree within which the query is directed. In ZRP hybrid framework the BRP is utilized to provide the route information to path request of the entire IERP. BRP implies peculiar query BRP gains information from a map of an extended routing management technique to direct the path request to different segment of the network from that have already been covered by the query. The implication of multicasting and query control mechanism provides the bordercasting more capable of providing better performance and suitable for route discovery compared to that of the flooding process. The BRP is a protocol designed for service of packet delivery and its not a stand - alone protocol. Actually the bordercasting is activated by the local IARP and supports the global IERP [11].

ii. Intrazone Routing Protocol (IARP) and Routing Zones

The Intra zone routing protocol (IARP) maintains routes in prior to destination limited radii of the neighborhood of each node and its defined as the routing zone [6]. The node collection within the routing zone should have less limited distance in hop considering from the particular node, that distance should be less than or equal to the parameter known as the zone radius. Considering the routing zones of individual node, it overlaps with zones of neighbouring nodes.

In routing zone the neighbor host system whose distance from that particular node is equivalent to the zone radius are denoted as the peripheral nodes. Identification of nodes neighbors could be made up with the Media Access Control (MAC) protocols. The neighbors are the nodes, which are in point to point directly connected to the node. Other neighbors of the routing zone are discovered using the Neighbor Discovery Protocol (NDP). The prior existing routing protocol proactive Link state protocol is the base for the IARP Protocol

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iii. INTERZONE ROUTING PROTOCOL (IERP)

IERP is similar to standard route discovery protocol. The IERP route discovery is initiated when the outgoing data packet does not find any route locally to reach the destination. The route query packet generated by the source node is uniquely identified by the source node address and request number. Query is passed on to the neighbors applying the bordercast algorithm. On receiving the query the node checks whether destination is within in its zone, if available a route reply is sent back to the source node. In case if the route is not available then bordercast the query again. Any of the efficient reactive protocol of MANET can be applied for the IERP.

The BRP (Bordercast Resolution Protocol) of ZRP

distinguishes the route Instead of blindly broadcasting the query to all the nodes. The bordercast routing directs the query outward, towards the regions of the network, particularly to the peripheral nodes. Query control mechanism reduces route query traffic. In the multiple channel network a node recognizes only the packet forwarded to it, but in single channel routing the node recognizes all the query packets forwarded to its zone and lies within nodes radio range [7].

Routing zone topology is used by the node when it is invoked to relay a broadcast message. On invoking node first all routing zone members are covered. Then the query is forwarded by the peripheral nodes to neighbors in broadcast tree. Border casting node will forward a query only once.

iv. BORDERCAST ROUTING PROTOCOL (BRP)

Border Casting Protocol supports network querying applications by providing the bordercasting packet delivery service. BRP constructs bordercast trees and directs the query packets. For this it utilizes the directions provided by the extended routing zone which was received from the local IARP. BRP utilizes the routing table and link state table of IARP. In ZRP framework the major role of BRP is to provide guidance to the route request of entire IERP. To route the query request away from already covered nodes the BRP uses a special query control mechanism [14]. Thus BRP is a constructed by combining the multicasting and zone oriented query management mechanism which enables it to provide efficient bordercasting service. It's more suitable for route discovery than flooding method [8]. Border casting is a hybrid protocol because requires local information provided by IARP and global information provided by the IERP. BRP actually provides a service delivering packets and its not a complete self contained protocol. BRP is activated by kIARP and supported by kIERP. On requirement of a path to a receiving node the path finding zone is first checked by the source node for availability of destination node. If the receiving node is available in the limits of path finding area there is no requirement for proceeding with the process of path finding. If node contains the destination node within its routing zone it sends back a route reply to source node providing the route to destination. Otherwise the node the receiving node lies out of the source routing zone the route query is bordercasted to its kperipheral nodes. If any further forwards the query to the peripheral nodes. Process continues until finding route to destination

Bordercasting is more efficient than flooding to provide

global querying. The query is relayed along the bordercast tree. On receiving the bordercast query kpacket the BRP makes note of the interior nodes of the earliersbordercasting nodes as covered by the query bordercasting peripheral nodes. To improve efficiency, the peripheral nodes to which already the query has been passed should be avoided. The BRP terminates the route queries without reaching the peripheral nodes which have already been covered in the previously queried routing zone. The scheme referred as Earlier Termination (ET) is enabled by the IARP which maintains the extended routing zone.

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The packet format of BRP consists of sender nodes IP

address as the sender node query source address that initiates the query and the reciever nodes IP address as the query destination address. The sequence number getting combined with the query source address forms the queryid which distinctivley denotes the BRP query. The query extension denotes whether the query is to be forwarded. Previous bordercast address denoted the IP address of the most latest bordercasting node. Unidirectional links are created between the nodes X and Y, when the node X is capable of communicating with node Y and Y not able to communicate to X. Such links are generated when Y has the transmission range lesser than X.

III. ZRP ARCHITECTURE

The ZRP framework is a modular structure. Here the entire network is considered to be grouped into zones. Routing takes place in the form of intrazone routing and interzone routing. For intrazone routing IARP family of protocols are used and for interzone routing the IERP family of routing protocols are used. BRP is used for bordercasting. A Link state routing protocol like OLSR can be used for IARP and on demand protocol like AODV or DSR can be used for IERP.

In the hybrid Zone Routing Protocol two methodologies are merged together to provide a more efficient routing protocol. In this routing protocol the source node initiates route discovery as a reaction of reply to the route requirement. The adapted proactive routing in the local zone routing topology plays an important role in the activation of the querying process. The size of the routing zone determines the requirement of increase of amount of intrazone control traffic. Bordercasting and query detection termination combining together decrease the amount of inter zone route query traffic by exploiting the routing zone topology.

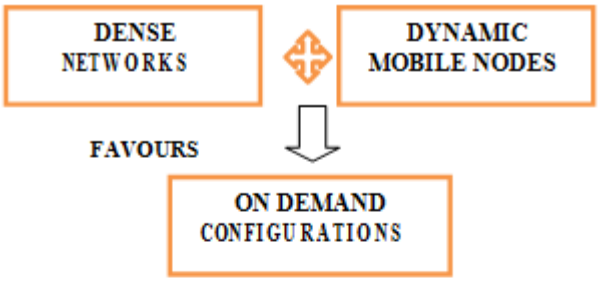

Fig.1 Small Zone Radius suitable for networks with dense fast moving nodes

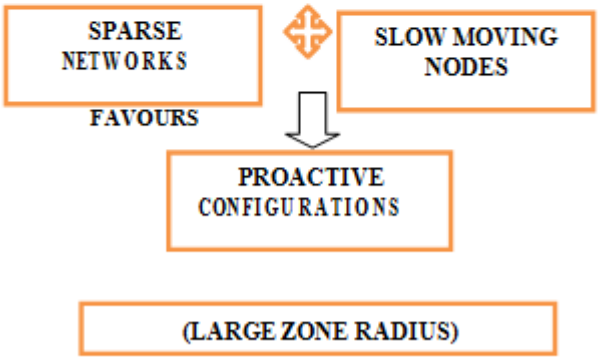

Fig.2 Large Zone Radius suitable for networks with sparse slow moving nodes

This range variation that exist among the costs of proactive and reactive element of ZRP fixes perfectly the optimal zone radius for provided network structure. At the end the total ZRP traffic get raised with node density. The raise in density has more of an impact on the proactive route updates. The output o f these updation shows that the optimal zone radius get reduced with node density.

On summarizing generally, dense networks constructed of minimum number of nodes with speed movement capability supports and prefers on demand (small zone radius) configurations Sparse networks is designed with increased number of slow moving nodes generally supports the on demand (large zone radius) configuration.

In the Paper [11] the author has put forward and assessed two classes of zone radius estimation algorithms. The both attempts are carried on based on the direct measurement of traffic inorder to reduce the amount of ZRP traffic. The first class is

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based on the observation of ZRP behavior and denoted as min searching. Proactive traffic raises with zone radius and reactive traffic reduces with zone radius. Second class is denoted as traffic adaptive for the reason, it adapts the routing zone depending on the current measurements of the ZRP traffic. Conclusively the route estimate proposed implying the estimation techniques along with the simple radius update protocolpermits the ZRP to work and provide a bettr protocol compared to that of other existing traditional routing protocols.

IV. SIZING THE ZONE RADIUS

The ZRP divides the entire network into zones. The structure area of zone is determined by radius and where radius denotes the number of hopes and not the geographical measurement. Every single node may exist within more than one overlapping zones. Performance of ZRP is much influenced by the parameter Zone radius in different node density in local neighborhood called as zones. Routing Zone Radius plays an major role in determining the efficient working of the zone routing protocol. Smaller routing zones are suitable for networks containing dense and fast moving nodes. Larger zone radius is suitable for Networks containing sparse and slow moving nodes.

The network administrator can configure the routing zone radius before deploying the network. By dynamic configuration of zone radius the ZRP can get adjusted with modification that noticed in the in the network behavior. The resizing of the routing zone is achieved by a protocol which conveys the change in zone radius to the members of the routing zone. It's possible to configure optimal zone radius distributed.

V. UNICAST ROUTING PROTOCOL

In Mobile adhoc network many protocols applied for different applications are the unicast routing protocol. In MANET the major operation carried out is carry data from sender node to receiving node. Forwarding process is simple in unicast routing.

The existing different type of MANET routing protocols are suitable for different applications. For the reducednumber of fast moving mobile nodes on MANET the proactive routing protocols are suitable. For Moderate and less topology changes the reactive protocols are suitable and hybrid protocols suitable for balancing between proactive and reactive protocols. Many applications use unicast routing protocol depending on the requirement of the application. The routing protocol implied can be of the type proactive, reactive or hybrid.

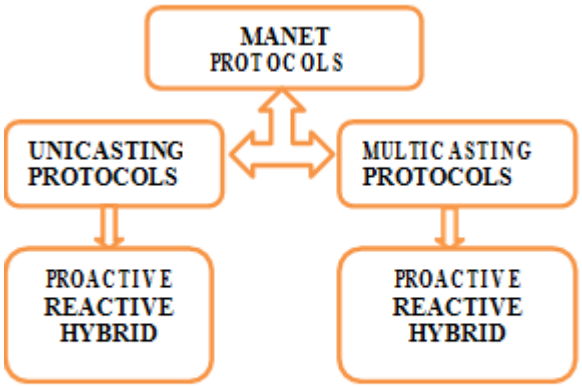

Fig.3 MANET protocols categorized to Unicast and Multicast protocols

The proactive unicast routing protocols are OLSR (Optimised Link State Routing Protocol), FSR (Fish eye State Routing) and TBRPF (Topology broadcast based on Reverse Path Forwarding).In unicast routing every destination have a unique sequence number. The frequent update of the Topology changes in proactive routing consume lots of bandwidth. To minimize the usage of the bandwidth the concept of Reactive protocol is implied. The unicast reactive protocols are DSR (Dynamic Source routing), AODV (Adhoc on demand Distance Vector). Combining the advantages of proactive and reactive protocols forms the hybrid protocols. The unicast ZRP (Zone routing Protocol) is a hybrid protocol. It reduces the overhead of proactive and also the latency of reactive protocol.

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VI. RELATED WORKS

Kamaljit I. Lakhtar in this work, analyses about zone routing protocol in MANET. The paper produces results of various analyses that depicting the influence of the parameter Zone Radius in various node number ranges [10].

The result of the analysis depicts that as the node density increases the throughput of ZRP is better in case of higher zone radius compared to the result obtained with ZRP having smaller zone radius. The results obtained through analysis in this paper states that the ZRP having higher zone radius produce less end to end delay than the ZRP having smaller zone radius in high density node. And when the node density is more the zone size increases the chance of packet transmission from sending node to receiving node at fixed timing breaks is more. And the analysis shows that as the node presence number is higher the packet loss is less in ZRP having maximum zone radius than the ZRP having minimum zone radius.

The paper finally concludes that the node density has impact on the efficiency of the ZRP protocol. As the density changes variation in ZRP attribute Zone radius has to be carried on to obtain efficient performance.

In 2013 SweetyGoyal had given an overview of the ZRP protocol. This paper analyses and states that the reactive routing though adds end to end delay to the network due to route discovery mechanism they reduce the routing overhead generated by the proactive protocol. Concludes that the ZRP protocols reduce the routing overhead in the case of increased end to end delay [11].

In this paper the author states that ZRP is aimed at for bigger networks combining table driven and on demand techniques. Inside routing zone the IARP maintains routing table and outside the routing zone route discovery mechanism is carried on by IERP using route request and route reply and Bordercasting is utilized for route discovery using BRP. The steps proposed in this paper to reduce traffic in route finding are Query management technique, Query identification and Early finishing.

In 1999 the authors of this paper Marc R. Pearlman and Zygmunt J. Haas determines the better structure for the Zone routing protocol. This paper addresses the problem of designing the ZRP to provide the efficient functioning for a specific network at all periods. The ZRP provides a adjustable solution to the issues of finding and managing routes in the RWN (Reconfigurable Wireless Networks) environment [12].

This paper has put forward and analysed two classes of zone radius estimation algorithms. In the two cases also effort is put to reduce the density of ZRP traffic based on Direct Measurement of traffic. The first attempt can be called as min searching and it is based on the observation of ZRP behavior. It's found that the Proactive traffic get raised with zone radius and reactive traffic get reduced with zone radius. The second attempt can be referred as traffic adaptive approach. Because it adapts the routing zone based only on the current measurements of the ZRP traffic. Finally its very clear from the analyses that the proposed route prediction methodologies combining with a simple radius update protocol allow the ZRP to perform specifically in the best manner than traditional preexisting routing protocols.

CONCLUSION

The ZRP is an efficient unicasting hybrid routing protocol combining the features of both proactive and reactive protocol. Its plays a major role in MANET routing. It is highly suitable for large networks with high mobility pattern and resulting frequent changing topology. The kZRP is a framework of IARP, IERP and BRP protocol. IARP refers to a family of proactive protocols, IERP refers to a family of reactive protocols and BRP protocol supports IERP by receiving the extended support from IARP. BRP enables to perform Route requests efficiently without querying all the network nodes.

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Further the performance of the ZRP protocol can be optimized by adjusting the single parameter the zone radius [10]. The adjustment of the zone radius can be achieved implying different techniques [12]. Based on the

review made on the area of MANET routing we conclude that ZRP is an efficient and robust hybrid protocol providing better performance compared to that of the existing proactive and reactive routing protocols.

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