Volume 4, No. 5, May 2013
Journal of Global Research in Computer Science
ISSN-2229-371X
REVIEW ARTICLE
Available Online at www.jgrcs.info

AD-HOC ROUTING PROTOCOL "REVIEW PAPER"

Rupali gupta[#1], Dr. Himanshu Aggarwal[*2]
[#] Computer engineering & University college of engineering,
Punjabi university, Patiala , India
[1] er.rupaligupta@gmail.com
[*] Professor, Computer engineering & University college of engineering,
Punjabi university, Patiala,
[2] himanshu.pup@gmail.com

Abstract: A Mobile Ad-Hoc Network (MANET) is a collection of wireless mobile nodes setting up a lasting network without using any centralized access point, infrastructure, or centralized administration. In MANET's Data transmission from one node to another nodes is requires multiple hops as nodes transmission range is limited which does not extend. Mobile ad hoc network is a collection of wireless mobile nodes, in close succession setting up the network topology without the use of any existing network infrastructure or setting up a central administration.

Keywords: MANET, mobile nodes, Ad-Hoc routing protocol, Ad-Hoc Network.

INTRODUCTION

A network is an assemblage of people or systems or organizations who considered together as being related in some way who tend to contribute their information collectively for their business purpose which can be done as wired or wireless. Wireless can be illustrated from wired as no physical connectivity between nodes is required. Wireless mobile ad-hoc networks are described as networks without any physical connections. In wired and wireless networks there is no fixed topology due to the mobility of nodes, interference, multipath propagation and path loss.

Ad-hoc networks are wireless networks where nodes can share their information with each other. Ad-hoc networks form spontaneously without a need of an underlying structure or centered controller. A routing protocol is a protocol that specifies how routers communicate with each other, disseminating information that enables them to select routes between any two nodes on a computer network. Each router has a priori knowledge only of networks attached to it directly. A routing protocol shares this information first among immediate neighbors, and then throughout the network. This way, routers gain knowledge of the topology of the network. An ad hoc routing protocol is a convention, or standard, that controls how nodes decide which way to route packets between computing devices in a network [1].

A Mobile Ad-hoc network (MANET) is a multi hop wireless network designed by a group of mobile node that have Wireless features. MANET is an assemblage of wireless nodes that dynamically create a wireless network among them without any infrastructure. Ad-hoc is an imparted mode that allows computers to directly interchanged information with each other without a router. In Latin, ad-hoc means "for this" meaning "for this special purpose". In ad hoc networks, nodes do not start out familiar with the topology of their networks; instead, they have to discover it [2]. Mobile ad-hoc network also called a Mobile Mesh Network. It is a self configuring N/W of mobile devices connected by wireless links.

Each mechanism in a MANET can independently move in any direction. The idiopathic confrontation in building a MANET is equipping each device to imperceptibly maintain the information required to properly route the traffic. As the network topology is dynamic a routing protocol is required to abutment the proper functionality of the network. There is a main problem with mobile ad-hoc networking that how to send a message from one node to another node without any direct link. For this two approaches are used for routing in ad-hoc networking. The first accession is a proactive approach which is table driven and uses periodic protocols. The second accession is re-active, source-initiated or on demand. There are several advantages of ad-hoc routing protocols that include:

a. On demand setup
b. Fault tolerance
c. Unconstrained connectivity

CATEGORIES OF ROUTING PROTOCOLS IN MANET'S

Classification of routing protocols in MANET‟ s can be done in different ways that Shown in figure 1[3].

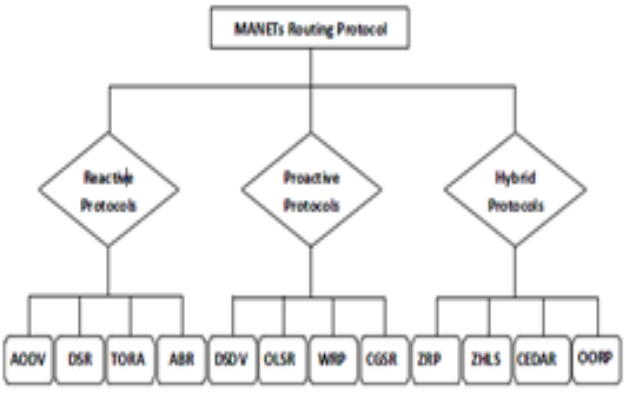

Figure 1. MANET Routing Categories and Protocols

Manets routing protocols are classified in 3 ways that are:

a. On demand/reactive routing protocol
b. Table-driven/pro-active routing protocol

c. Hybrid routing protocol

DESCRIPTION OF ALL ABOVE MENTIONED ROUTING PROTOCOLS

a. On demand/reactive routing protocol: Re-active routing protocols are source-initiated or on demand. It means that every time a message is sent it first has to discover a way by searching the entire network. These routing protocols were accomplished to abate the stress in proactive protocols by maintaining information for active routes only. This means that routes are determined and maintained for nodes that require sending data to a particular destination. Route discovery usually occurs by flooding a route request packets through the network. When a node with a route to the destination (or the destination itself) is reached a route reply is sent back to the source node using link reversal if the route request has traveled through bidirectional links or by piggy-backing the route in a route reply packet via flooding [2]. Main Aspects of this protocol is: finding short path, low-overhead communication, and load-balancing. Reactive protocols can be categorized into two ways: source routing and hop-by-hop routing. In Source routing on-demand routing protocols, every data packets contains the complete source to destination address. Therefore, each In-between node forwards these packets according to the information kept in the header of each packet. This means that the in-between nodes do not need to keep up-to-date routing information for each active route in order to advancing the packet towards the destination. In this nodes do not required to maintain neighbor connectivity through periodically guide messages. Reactive routing protocols have further different categories.

a) Ad-hoc On Demand Distance Vector Routing Protocol (AODV): Ad-hoc on demand distance vector routing protocol: AODV is a very simple, efficient, and effective routing protocol for Mobile Ad-hoc Networks. In AODV there have no fixed topology for mobile ad-hoc networks. It is a loop free routing protocol. It enables multi-hop routing between the participating mobile nodes wishing to establish and maintain an ad-hoc network. This routing protocol is based on the distance vector algorithm. This algorithm uses different messages to discover and maintain links. Whenever a node wants to try and find a route to another node it broadcasts a Route Request (RREQ) to all its neighbors. The RREQ passes through the network until it reaches the destination or the node with a fresh enough route to the destination. Then the route is made available by uncasing a RREP back to the source. The algorithm uses hello messages (a special RREP) that are broadcasted periodically to the immediate neighbors. These hello messages are local advertisements for the continued presence of the node, and neighbors using routes through the broadcasting node will continue to mark the routes as valid. If hello messages stop coming from a particular node, the neighbor can assume that the node has moved away and mark that link to the node as broken and notify the affected set of nodes by sending a link failure notification (a special RREP) to that set of nodes. [4]

The following fields exist in each route table entry of AODV [5]:

(a). Destination IP Address: The IP address of the destination for which a route is supplied

(b). Destination Sequence Number: It is associated to the route.

(c). Next Hop: Either the destination itself or an intermediate node designated to forward packets to the destination

(d). Hop Count: The number of hops from the Originator IP Address to the Destination IP Address

(e). Lifetime: The time in milliseconds for which nodes receiving the RREP consider the route to be valid

(f). Routing Flags: The state of the route; up (valid), down (not valid) or in repair.

b. DSR (dynamic source routing): DSR protocol comes under the category of an on-demand/reactive routing protocol. It is a simple and efficient routing protocol intended specifically for use in multi-hop wireless Ad-hoc networks of mobile nodes. DSR allows the network to be completely self-assembling and self-arrangement, without the need for any existing network infrastructure or administration [2]. This protocol uses explicit source routing which means that every time a data packet is sent, it accommodate the list of nodes it will use to be forwarded [6]. This protocol allows to dynamically discovering a route across multiple network hops to any destination. Source routing means that every packet in its header contains the complete sequential list of nodes through which the packet must pass. Two main mechanisms are used in DSR protocol that are: route discovery and route maintenance. These mechanism works together to allow nodes to discover and maintain routes to random destinations in the ad-hoc network. DSR protocol has many advantages over routing protocols like AODV, TORA, LMR and in small to moderately size networks. DSR protocol performs better than all the above mentioned routing protocols [2]. This allows to dynamically discovering a route across multiple network hops to any destination. Source routing means that each packet in its header carries the fully sequential list of nodes through which the packet must pass. There is no periodic routing of messages in DSR routing protocol, thereby reducing network bandwidth overhead, conservation battery power and avoiding large routing updates throughout the ad-hoc network [4]. In this data packet contains source route in packet header and routes are stored in memory. There is no routing loop in this protocol. If there is any data packet available to send, and it has no route, then route discovery process is initiated. DSR route discovery process is similar to AODV route discovery process.

Every node that receive route request packet, broadcast it, except for destination node or nodes that have route to destination node in their memory. Route through network is built by RREQ packet, and RREP packet is being routed backward to the source. Route that returns RREP packet is cached on the source node for further use. There can be

multiple RREP packets on one RREQ packet [6]. During sending process whenever broken link is detected, RREQ packet has been sent backward to the source node. When RREQ packet has been received source node initiates another route discovery operation. The routes that has contains the broken link should be removed from the route cache.

c. TORA (temporally ordered routing protocol):

TORA protocol comes under the category of reactive routing protocol. TORA is a type of link reversal algorithm. It is highly adaptive, efficient, scalable, best suited for dense networks, protocol and used to establish the "temporal order" of topological change events which is used to structure the reaction to topological changes. This protocol uses a synchronized physical or logical clock and is called as Temporally Ordered Routing Algorithm (TORA) [2]. The protocol is planned to minimize reaction to topological changes. The protocol is distributed in that nodes required only maintain information about adjacent nodes. The protocol is "source initiated" and quickly creates a set of routes to a given destination only when desired. The protocol accomplishes three functions through the use of three distinct control packets such as query (QRY), update (UPD) and clear (CLR). QRY packets are used for both creating and maintaining routes, and CLR packets are used for erasing routes [4]. TORA possesses the following attributes: [2]

i. Loop-free routes
ii. Provide minimal routing functionality
iii. Minimize algorithm reaction
iv. Multipath routing

a) Table-driven/pro-active routing protocol: this routing protocol maintains the routing information even before it is needed. Each and every node in the network asserts routing information to every other node in the network. Routes information is generally kept in the routing tables and is periodically updated as the network topology changes. The proactive protocols are not suitable for larger networks, as they need to maintain node entries for each and every node in the routing table of every node. This causes more overhead in the routing table leading to consumption of more bandwidth [7]. Pro- active routing protocols have further different categories.

(a). Destination-Sequenced Distance Vector (DSDV): DSDV routing protocol comes under the category of proactive routing protocol. This is distance vector routing protocol uses the bellmann-ford algorithm**.** DSDV has the feature of hop by hop distance vector routing protocol in that every node maintains routing table listing the "next hope" and "number of hopes" information for each possible destination. Periodical broadcasts of routing updates attempt to keep the routing table completely update at all times [8].in routing table each entry has sequence number. Whenever a new entry in a routing table has been obtained, then the protocol prefers to select the entry with the largest sequence number. If the entries with same sequence number has obtained then the protocol selects the metric with the lowest value.

Routing information is transmitted by broadcast. Updates have to be transmitted periodically or immediately when any significant topology change is available. Sequence numbers are assigned by destination, means the destination gives a sort of default even sequence number, and the emitter has to send out the next update with this number. Packets are exchanged from the source to destination in the network by using routing table which are stored at the each station of the network. Routing information is advertised by broadcasting or multicasting the packets which are transmitted periodically and incrementally as topological changes are detected - for some time, when stations move within the network. Data is also kept about the length of time between arrival of the first and the arrival of best route for each destination. The entries in the routing table may change fairly dynamically over time [4].

(b). OLSR (optimized link state routing protocol): OLSR is a table driven/proactive routing protocol. In this protocol route information is stored in a route table. OLSR routing protocol acquire the stability of link state algorithm. This protocol is proactive in nature. Due to its proactive nature, it has an advantage of having the routes immediately available when needed. In pure link state protocol, all the links with neighbor nodes are declared and are submerged in the whole network. In OLSR protocol multipoint (MPR) nodes broadcast route packets; other nodes in the network do not broadcast the route packet. Multipoint relay nodes are candidate nodes in OLSR protocol; it is responsible to broadcast packets during flooding process. This technique reduces the overhead of packet transmission compared to flooding mechanism [9]. OLSR protocol performs a hop by hop routing in which every node uses its most recent information to route a packet. So when a node is moving, its packet can be successfully delivered to it, if its speed is such that its movement could be followed in its neighborhood, at least. The protocol thus supports a nodal mobility that can be traced through its local control message, which depends upon the frequency of these messages [10].

(c). Cluster Head Gateway Switch Routing (CHGSR): CHGSR routing protocol comes under the category of proactive routing protocol uses hierarchical network topology in which nodes are organized into small clusters. Each and every cluster is having cluster-head which coordinate the communication among members of each cluster head. Cluster head also handles issues like channel access, bandwidth allocation in the network. The advantage of this protocol is the better bandwidth utilization. The disadvantage of this routing protocol is that frequent cluster head changes can adversely affect routing. This also degrades the performance as the system is busy in cluster head selection rather than data transmission. Another disadvantage is the power consumption, which occurs more at the cluster-head as compared to other nodes [11].

(d). Wireless Routing Protocol (WRP): WRP routing protocol is a table driven/proactive routing protocol. Four tables are used in WRP that are Distance table (DT), Routing table (RT), Link cost table (LCT) and Message Transmission List table (MRL). Each and every node is responsible for maintaining DT, RT, LCT, MRL tables. The distance table contains network

view of the neighbors of a node. Routing table contains the up-to-date view of the network for all known destinations. The link cost table contains the cost of relaying each message through each link. The message transmission list table contains an entry for every update message that is to be retransmitted and maintains a counter for each entry. WRP belongs to class of path finding algorithm. WRP has same advantages as that of DSDV. WRP has faster convergence and involves fewer tables' updates. But as it involves maintaining and processing various tables, it requires larger memory and more processing power at each node [11].

b). Hybrid Routing Protocol (HRP): Hybrid Routing Protocols is the combination feature of the two routing protocols that are proactive and reactive routing protocols. It combines the merits of proactive and reactive routing protocols to overcome their demerits. The protocols that come under the category of HRP are:

(a). ZRP (zone routing protocol): ZRP protocol combines the advantage of both reactive and proactive routing protocol into a protocols into a hybrid scheme, taking advantage of pro-active discovery within a node's local neighborhood, and using a reactive protocol for communication between these neighborhoods, and using a reactive protocol for communication between these neighborhoods. In a MANET, it can safely be assumed that the most communication takes place between nodes close to each other [1]. The main concept is to use a proactive routing scheme within a limited zone in the r-hoop neighborhood of each node, the reactive routing protocol scheme is to use for nodes beyond this zone. In ZRP two different zone routing protocols are used i.e. inter-zone routing protocol (IERP), intra-zone routing protocol (IARP). An Intra-zone routing protocol (IARP*)* is used in the zone where particular node employs proactive routing and limited by the zones radius hops. This protocol is used by a node to communicate with the interior nodes of its zone whereas Inter-zone routing protocol (IERP*)* is used by a node to communicate outside the zone.

CONCLUSION

Day by day, as the applications of the ad hoc networks are increasing, a continuous research and development in required in the field of MANETs. There are various types of design challenges that need to be taken care of. According to the circumstances and scenarios, various types of MANET routing protocols, such that reactive, proactive and hybrid routing protocols are developed by the researchers. But according to the new scenarios and applications, still the developed protocols are under development for improvement and even new protocols are also under development to meet the challenges. There will always a scope of improvement in the working of the protocols and to make the protocols reliable for deployment, again and again intensive simulation based evaluation of the protocols will be required.

REFERENCES

[1]. Shaily Mittal, Prabhjot Kaur," "Performance Comparison of AODV, DSR, and ZRP Routing Protocols in Manets," International Conference on Advances in Computing, Control, and Telecommunication Technologies, IEEE computer society. Pp165-168, 2009.

[2]. Monika Rajput, pallavi khatri, alankar shastri, keshav solanki, "Comparison of Ad-hoc Reactive Routing Protocols using OPNET Modeler," International Conference on Computer Information Systems and Industrial Management Applications (CISIM), Pp 530-534, 2010.

[3]. Ashish Shrestha, Firat Tekiner "On MANET Routing Protocols for Mobility and Scalability." 2009 International Conference on Parallel and Distributed Computing, Applications and Technologies, Pp 451-456, 2011.

[4]. M.K.Jeya Kumar and R.S.Rajesh **"**Performance Analysis of MANET Routing Protocols in Different Mobility Models." IJCSNS International Journal of Computer Science and Network Security, VOL.9 No.2, Pp 22-28, 2009.

[5]. Aditya Goel, Ajaii Sharma, "Performance Analysis of Mobile Ad-hoc Network Using AODV Protocol", International Journal of Computer Science and Security (IJCSS), Volume (3): Issue(5), Page No. 334.

[6]. Sabina Barakovi, Jasmina Barakovi "Comparative Performance Evaluation of Mobile Ad Hoc Routing Protocols", International Convention on Information and Communication Technology, Electronic and Microelectronic(MIPRO 2010) , Pp 24-28, 05.2010.

[7]. Hari Shankar Mewara, Saurabh Porwal "Throughput Performance Comparison of Reactive and Proactive Routing Protocols in Mobile Ad Hoc Networks using OPNET v14.5", IJCA Proceedings on Recent Trends in Information Technology and Computer Science 2012, pp 9-14, February 2013.

[8]. Per Johansson, tony Larsson, nicklas hedman, "Scenario-based Performance Analysis of Routing Protocols for Mobile Ad-hoc Networks", MobiCom '99 Proceedings of the 5th annual ACM/IEEE international conference on Mobile computing and networking, pp 195-206, 1999.

[9]. Harmanpreet kaur, Er. Jaswinder singh**,** "Performance comparison of OLSR, GRP and TORA using OPNET." International Journal of Advanced Research in Computer Science and Software and Engineering, Volume2, Issue 10,October 2010.

[10]. P. Jacquet, P. Miihlethaler, T. Clausen, A. Laouiti, A. Qayyum, L. Viennot "Optimized link state routing protocol for ad-hoc networks" Multi Topic Conference, 2001. IEEE INMIC 2001. Technology for the 21st Century. Proceedings. IEEE International, pp 63-68, 2011.

[11]. Prof. Dr. C. A. Dhote, Prof M.A.Pund, Prof. R.S. Mangrulkar , "Hybrid Routing Protocol with Broadcast Reply for Mobile Ad hoc Network." International Journal of Computer Applications 1(10):pp 108-113,February 2010

