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Mobile Ad-hoc Network: Working of Routing Protocols and Applications

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ABSTRACT: Mobile Ad-Hoc Network (MANET) is a collectionof two or more devices or nodes or terminals with wireless communications and networking capability that communicate with each other without of any centralized administrator also the wireless that can dynamically form a network to exchange information without using any existing fixed network infrastructure. And it's an autonomous system in which mobile hosts connected by wireless links are free to be dynamically and sometimes acts as a router at the same time. With some restriction of wired communication wireless technology comes into the picture. The emphasis in this paper is concentrated on Mobile Ad-Hoc Networks. They can be set up anywhere without any need for external infrastructure (like wires or base stations). This can be a standard Wi-Fi connection, or another medium, such as a cellular or satellite transmission [1]. This paper includes working of some Proactive, Reactive and Hybrid protocols that make communication possible it also includes its advantages, limitations and applications of MANET. Protocols discussed in this paper are DSR, AODV, TORA, FSR, ZRP, WPR etc.

KEYWORDS: MANET, Routing, Routing Protocol, Ad-HocApplications.

I. INTRODUCTION

In ad hoc networks all nodes are mobile and can be connected dynamically in an arbitrary manner. All nodes of these networks behave as routers and take part in discovery and maintainers of routes to other nodes in the network. The main advantages of ad hoc networks are flexibility, low cost, and robustness. Ad hoc networks can be easily set up where there is no infrastructure and it is too expensive to build it or when local infrastructure is not reliable, as for military operations in the enemy territory. Ad hoc networks are very useful in emergency search-and rescue operations, meetings or conventions in which persons wish to quickly share information, and data acquisition operations in inhospitable terrain. An ad-hoc network is a collection of mobile nodes, which forms a temporary network without the aid of centralized administration or standard support services regularly available on conventional networks. The nodes are free to move randomly and organize themselves arbitrarily; thus the network's wireless topology may change rapidly and unpredictably. Such a network may operate in standalone fashion, or may be connected to the larger internet.

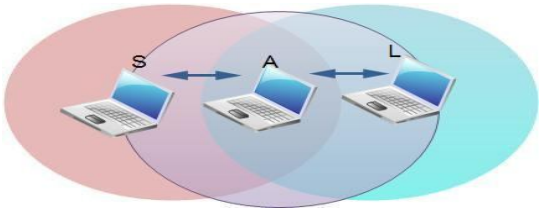

Fig 1 .Infrastructure less networks (Ad Hoc Networks)

II. LITERATURE SURVEY

Chenna Reddy,P [1] had proposed a mobile ad-hoc network (MANET) is a self-configuring infrastructure less network of mobile devices connected by wireless. Each devices a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently.

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Belding-Royer,E.M [2] had proposed primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic Such networks may operate by themselves or may be connected to larger internet. MANET are a kind of wireless ad hoc network that usually has a routable networking environment on top of a Link Layer ad hoc network.

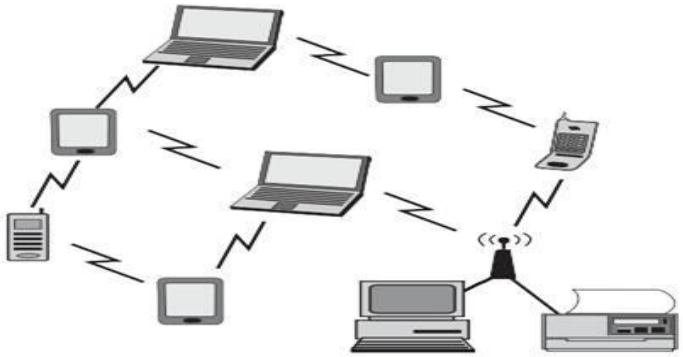

Fig 2.Mobile Ad-hoc Network

Bertsekas, D. [6] had proposed a Mobile Ad Hoc Network (MANET) is a collection of wireless mobile nodes forming temporary/short-lived network without any fixed infrastructure where all nodes are free to move about arbitrarily and where all the nodes configure themselves.

Fig 3.Wireless Ad-hoc Network

Perkins, C.E [3] proposed a Mobile Ad-hoc Network is a collection of independent mobile nodes that can communicate to each other via radio waves. The mobile nodes that are in radio range of each other can directly communicate, whereas others needs the aid of intermediate nodes to route their packets. Each of the node has a wireless interface to communicate with each other. These networks are fully distributed, and can work at any place without the help of any fixed infrastructure as access points or base stations. Figure 2 shows a simple ad-hoc network with 3 nodes. Node 1 and node 3 are not within range of each other, however the node 2 can be used to forward packets between node 1 and node 2. The node 2 will act as a router and these three nodes together form an ad-hoc network.

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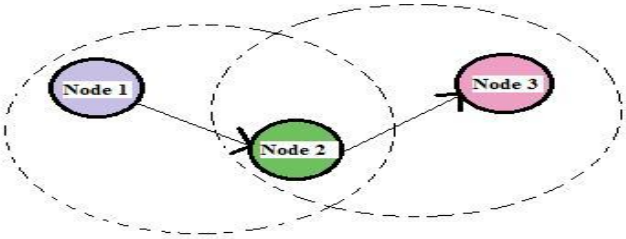

Fig4. Example of Mobile Ad-hoc Network

III. ROUTING IN MANET

Routing protocols may be generally categorized as

- Table driven
- Source Initiated (demand driven)

Table driven protocols maintain consistent and up to date routing information about each node in the network. These protocols require each node to store their routing information and when there is a change in network topology updation has to be made throughout the network. Some of the existing table driven protocols are

The different types of Table driven protocols are:

- Destination Sequenced Distance Vector Routing (DSDV)
- Wireless Routing Protocol (WRP)
- Fisheye State Routing Protocol (FSR)
- Optimized Link State Routing Protocols (OLSR)
- Cluster Gateway Switch Routing Protocol (CGSR)
- Topology Dissemination Based on Reverse Path Forwarding (TBRPF)

To transfer the date between two devices there has to be some mechanism to route that packet on network.

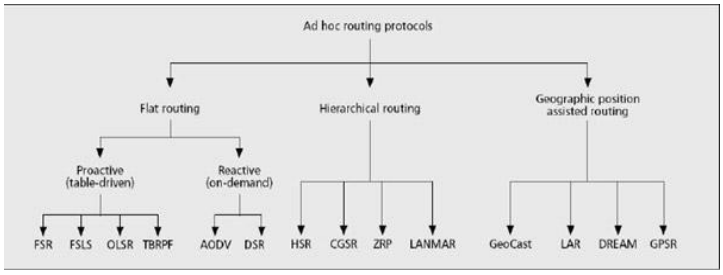

Fig 5.Classification of routing protocols in mobile ad-hoc network

3.1 Proactive (Table-Driven)

Proactive routing protocols maintain routes to all destinations regardless of whether or not these routes are needed. In order to maintain correct route information, a node must send periodically send control messages. Therefore, proactive routing protocols may waste bandwidth since control messages sent out unnecessarily. When there is no data traffic. The main advantage this category of protocols is that hosts can quickly obtain route information and quickly establish a session.Some of the existing pro-active ad hoc routing protocols are: DSDV Host Movement in MANET *(*Destination Sequenced Distance-Vector, 1994), WRP (Wireless Routing Protocol, 1996), CGSR (Cluster head Gateway Switch Routing, 1997), GSR (Global State Routing, 1998), FSR (Fisheye State Routing, 1999), HSR (Hierarchical State Routing, 1999), ZHLS (Zone based Hierarchical Link State, 1999), STAR (Source Tree Adaptive Routing, 2000), DBF, ZRP.

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3.2 Reactive (Source-Initiated On-Demand Driven)

Reactive routing protocols can reduce routing overhead because they do not need to search for and maintain the routes on which there is no data traffic.

Reactive routing protocols can be classified into two categories: source routing and hop-by-hop routing. In source routed on-demand protocols [19, 33], each data packets carry the complete source to destination address. Therefore, each intermediate node forwards these packets according to the information kept in the header of each packet. These means that the intermediate nodes do not maintain up-to date routing for each active route in order to forward the packet towards the destination. Furthermore nodes do not need to maintain neighbor connectivity through periodic beaconing messages. The major drawback with source routing protocols is that in large networks they do not perform well.

These protocols try to eliminate the conventional routing tables and consequently reduce the need for updating these tables to track changes in the network topology. When a source requires to a destination, it has to establish a route by route discovery procedure, maintain it by some form of route maintenance procedure until either the route is no longer desired or it becomes inaccessible, and finally tear down it by route deletion procedure. Some of the existing re-active routing protocols are.DSR (Dynamic Source Routing, 1996), ABR (Associatively Based Routing, 1996), TORA (Temporally-Ordered Routing Algorithm, 1997)[15][16], SSR (Signal Stability Routing, 1997), PAR (Power-Aware Routing,1998), LAR (Location Aided Routing, 1998), CBR (Cluster Based Routing, 1999), AODV (ad hoc On-Demand Distance Vector Routing, 1999). In pro-active routing protocols, routes are always available (regardless of need),with the consumption of signaling traffic and power. Density functions on the last n values of a pixel. The background pixel value at frame n is updated by the running average calculation.

3.3 Hybrid Protocols

Hybrid routing protocols are new generation of protocol, which are both proactive and reactive in nature. These protocols are designed to increase scalability by allowing nodes with close proximity to work together to form some sort of a backbone to reduce the route discovery overheads. This is mostly achieved by proactively routes to nearby nodes and determining routes to far away nodes using a route discovery strategy. Most hybrid protocols proposed to date are zone-based, which means that the network is partitioned or seen as a number of zones by each node.Others group nodes into trees or clusters.

The hybrid approach is an appropriate candidate for routing in a large network. At network layer, routing protocols are used to find route for transmission of packets. The merit of a routing protocol can be analyzed through metrics-both qualitative and quantitative with which to measure its suitability and performance. These metrics should be independent of any given routing protocol. Desirable qualitative properties of MANET are Distributed operation, Loop-freedom, Demand-based operation, Proactive operation, Security, Sleep period operation and unidirectional link support. Some quantitative metrics that can be used to assess the performance of any routing protocol are End-to-end delay, throughput, Route Acquisition Time, Percentage Out-of-Order Delivery and Efficiency. Essential parameters that should be varied include Network size, Network connectivity, Topological rate of change, Link capacity, Fraction of unidirectional links, Traffic patterns, Mobility, Fraction and frequency of sleeping nodes.

IV. REACTIVE ROUTING PROTOCOL

4.1 DSR (Dynamic source routing)

The Dynamic Source Routing is an on-demand routing protocol that is based on the concept of source routing. Mobile nodes are required to maintain route caches that contain the source routes of which the mobile is aware.

Route maintenance is accomplished through the use of route error packets and acknowledgements. Route error packets are generated at a node when the data link layer encounters fatal transmission problem. When a route error packet is

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received, the hop in error is received, the hop in the error is removed from the nodes route cache and all routes containing the hop are truncated at that point. DSR protocol is based on source routing. In the source routing technique, a sender determines the exact sequence of nodes.

- *Benefits and Limitations of DSR:*One of the main benefit of DSR protocol is that there is no need to keep routing table so as to route a given data packet as the entire route is contained in the packet header. The limitations of DSR protocol is that this is not scalable to large networks and even requires significantly more processing resources than most other protocols. Basically, In order to obtain the routing information, each node must spend lot of time to process any control data it receives, even if it is not the intended recipient.

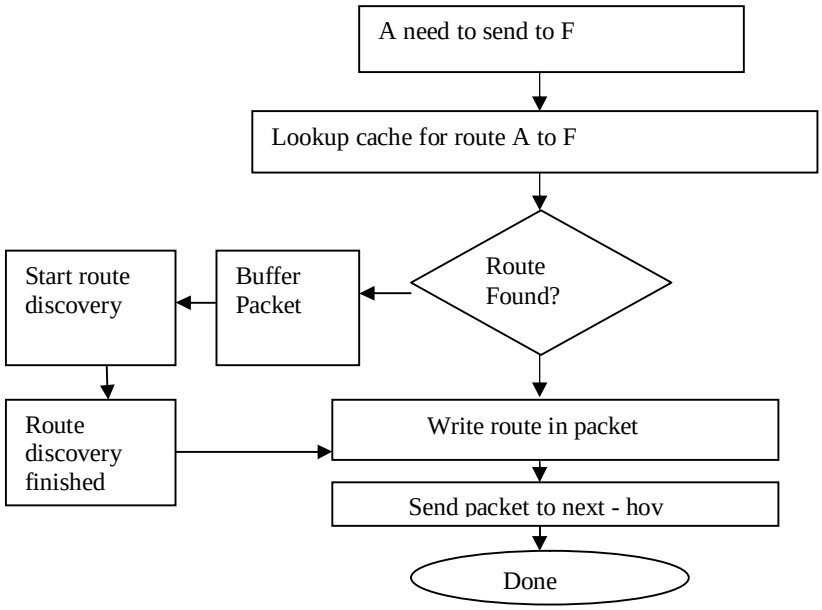

Fig 6. Working of DSR

4.2 AODV (Ad hoc on-demand distance vector)

The Ad Hoc on Demand Distance Vector (AODV) routing protocol builds on the DSDV algorithm and its an improvement of DSDV because it typically minimizes the number of required broadcasts by creating routes on a demand basis, as opposed to maintaining a complete list of routes as in the DSDV algorithm. Since it requires periodic advertisement and global dissemination of connectivity information for correct operation, it leads to frequent system-wide broadcasts. Therefore the size of DSDV ad-hoc networks is strongly limited. While in AODV it tries to minimize the number of required broadcasts. It creates the routes on on-demand basis, as opposed to maintain a complete list of routes for each destination. The steps of the algorithm used by AODV are explained below

4.2.1 Path Discovery Process

When trying to send a message to a destination node without knowing an active route to it, the sending node will initiate a path discovery process. A route request message (RREQ) is broadcasted to all neighbors, which continue to broadcast the message to their neighbors and so on. The forwarding process is continued until the destination node is reached or until an intermediate node knows a route to the destination that is new enough. To ensure loop-free and most recent route information, every node maintains two counters: sequence number and broadcast_id. The broadcast_id and

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the address of the source node uniquely identify a RREQ message. Broadcast_id is incremented for every RREQ the source node initiates. An intermediate node can receive multiple copies of the same route request broadcast from various neighbors. In this case –if a node has already received a RREQ with the same source address and broadcast_id – it will discard the packet without broadcasting it furthermore. When an intermediate node forwards the RREQ message, it records the address of the neighbor from which it received the first copy of the broadcast packet. This way, the reverse path from all nodes back to the source is being built automatically. The RREQ packet contains two sequence numbers: the source sequence number and the last destination sequence number known to the source.

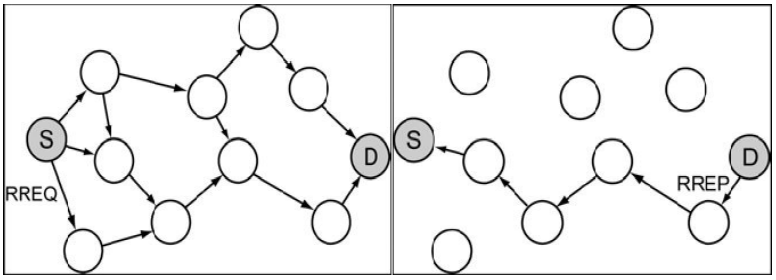

Fig 7 .Explains the AODV path discovery process

4.2.2 Maintaining Routes

If the source node moves, it is able to send a new RREQ packet to find a new route to the destination. If an intermediate node along the forward path moves, its upstream neighbor notices the move and sends a link failure notification message to each of its active upstream neighbors to inform them of the erasure of that part of the route The link failure notification is forwarded as long as the source node is not reached. After having learned about the failure, the source node may reinitiate the route discovery protocol. Optionally a mobile node may perform local connectivity maintenance by periodically broadcasting hello messages.

4.2.3 TORA (Temporally ordered routing protocols)

The Temporally Ordered Routing Algorithm (TORA) is a highly adaptive loop free distributed routing algorithm based on the concept of link reversal.TORA is used to operate in a highly dynamic mobile networking environment. It is initiated and provides multiple routes for any desired source/destination pairs. The key design concept of TORA is the localization of control messages to a very small set of the nodes near the occurrence of a topological change. To accomplish this, nodes need to maintain routing information about adjacent (one-hop) nodes. The protocol performs three basic functions:

V. PROACTIVE ROUTING PROTOCOL

5.1 FSR (Fisheye State Routing)

Fisheye State Routing (FSR) is a link state type protocol which maintains a topology map at each node. To reduce the overhead incurred by control packets, FSR modifies the link state algorithm in the following three ways. First, link state packets are not flooded. Instead, only neighboring nodes exchange the link state information. Second, the link state exchange in only time triggered, not even-triggered. Third, instead of transmitting the entire link state information at the each iteration, FSR uses different exchange Intervals for different entries in the table. To be precise, entries corresponding to nodes that are nearby (within a predefined scope) are propagated to the neighbors more frequently than entries of nodes that are far away. These modifications reduce the control packet size and the frequency of transmission.

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5.2 WRP (Wireless Routing Protocol)

Wireless Routing Protocol makes use of the routing table at each node in the record to complete the routing, and DSDV with CGSR difference is that, WRP require each node to operate a record four tables, namely Distance table, Routing table, Link cost table. Message retransmission table.WRP use the update message between adjacent nodes in each pass is used to determine whether the adjacent nodes to maintain their link relationship, and Message retransmission list (MRL) is used to update records which need to re-transmission, which needs to update needs acknowledgement.WRP use of distance and the second-to-last hop information to find path, such an approach can effectively improve the distance-vector routing possible count-to-infinity problem.

VI. HYBRID ROUTING PROTOCOL

Hybrid routing protocols [5, 14] aggregates a set of nodes into zones in the network topology. Then, the network is partitioned into zones and proactive approach is used within each zone to maintain routing information. To route packets between different zones, the reactive approach is used. Consequently, in hybrid schemes, a route to a destination that is in the same zone is established without delay, while a route discovery and a route maintenance procedure is required for destinations that are in other zones. The zone routing protocol (ZRP) and zone-based hierarchical link state (ZHLS) routing protocol provide a compromise on scalability issue in relation to the frequency of end-to-end connection, the total number of nodes, and the frequency of topology change.

6.1 ZRP (Zone Routing Protocol)

Zone Routing Protocol combines the path to the establishment of two kinds of reactive and proactive way, on the one hand enables the network to keep the record inside a near the node routing information when a node wants to communicate with neighboring nodes in the path when you can get immediate information, but if you want to, and distant nodes links, only allow web of a small number of nodes involving in routing.

VII. MANET APPLICATIONS

With the increase of portable devices as well as progress in wireless communication, ad-hoc networking is gaining importance with the increasing number of widespread applications. Ad-hoc networking can be applied anywhere where there is little or no communication infrastructure or the existing infrastructure is expensive or inconvenient to use. The set of applications for MANET is diverse, ranging from large-scale, mobile, highly dynamic networks, to small, static networks that are constrained by power sources. Besides the legacy applications that move from traditional infra structured environment into the ad hoc context, a great deal of new services can and will be generated for the new environment. Typical applications include.

- *Military Battlefield:* Military equipment nowroutinely contains some sort of computer equipment. Ad- hoc networking would allow the military to take advantage of commonplace network technology to maintain an information network between the soldiers, vehicles, and military information headquarters. The basic techniques of ad hoc network came from this field.
- *Commercial Sector:*Ad hoc can be used inemergency/rescue operations for disaster relief efforts, e.g. in fire, flood, or earthquake. Emergency rescue operations must take place where non-existing or damaged communications infrastructure and rapid deployment of a communication network is needed. Information is relayed from one rescue team member to another over a small hand held. Other commercial scenarios include e.g. ship-to-ship ad hoc mobile communication, law enforcement, etc.
- *Local Level:*Ad hoc networks can autonomouslylink an instant and temporary multimedia network using notebook computers or palmtop computers to spread and share information among participants at e.g. conference or classroom. Another appropriate local level application might be in home networks where devices can communicate directly to exchange information. Similarly in other civilian environments like taxicab, sports stadium, boat and small aircraft, mobile ad hoc communications will have many applications.

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- *Personal Area Network (PAN):*Short-rangeMANET can simplify the intercommunication between various mobile devices (such as a PDA, a laptop, and a cellular phone). Tedious wired cables are replaced with wireless connections. Such an ad hoc network can also extend the access to the Internet or other networks by mechanisms e.g. Wireless LAN (WLAN), GPRS, and UMTS. The PAN is potentially a promising application field of MANET in the future pervasive computing context.
- *MANET-VoVoN:*A MANET enabled version ofJXTA peer-to-peer, modular, open platform is used to support user location and audio streaming over the JXTA virtual overlay network. Using MANE

  JXTA, a client can search asynchronously for a user and a call setup until a path is available to reach the user. The application uses a private signaling protocol based on the exchange of XML messages over MANET-JXTA communication channels.

VIII. CONCLUSION

The Mobile Ad-Hoc Network can be therefore concluded that an effort has been made to concentrate on the working of various Pro-active and Reactive protocols (DSR, AODV, TORA, FSR, ZPR, WPR).In this paper we are focusing on the network size, and from that it can be said that DSR performs very poor in larger networks, as it shows extreme high delays and less packets delivery in a network of 200 nodes. The performance of AODV was very good in all network sizes, even though the routing overhead is higher than in DSR.WRP and FSR, especially, were the main beneficiaries of the group movement model. Unfortunately, we cannot take a conclusion for ZRP due to the missing IERP packets. Those results will need to be validated in a future experiment. In summary, there is no single routing strategy that is best for all network situations. Every protocol has its advantages and disadvantages in different scenarios. The choice of a routing protocol should be made carefully after considering every aspect we provided in this section (and possibly more).

REFERENCES

1. Chenna Reddy, P. Chandrasekhar Reddy,P.,"Mobile Ad-hoc network: Working of routing protocols and applications ", in *Proc. IEEE COMMUNICATIONS LETTERS*, vol. 17 2006, no. 6, pp. 1311-4360.
2. Belding-Royer, E.M. and C.K. Toh, "A review of current routing protocols for ad-hoc mobile wireless networks," in *Proc. 1999 IEEE Personal Communication magazine*, pp. 46-55.
3. Perkins, C.E., Bhagwat P, "Highly dynamic destination sequenced distance vector routing (DSDV) for mobile computers,"*Proceedings of ACM SIGCOMM.*, vol. 94, pp. 34–24., 1994.
4. ijSandipVay, Sharma, S.C., Parmanand, SanthoshKumar, "Research Reviews of IEEE 802.11 Wireless Ad-hoc Networks," *Proceedings of International Journal of Trends inEngineering*, vol. 1, No.2, pp. 234 May 2009.
5. Tsu-WeiChen; Gerla, M.; Global State Routing, "A New Routing Scheme for Ad-hoc Wireless Networks," *Proceedings of International Computing Conference IEEE ICC,* 1998.
6. Bertsekas, D.; Gallager, R , "Data Networks," *PrenticHall Publ., New Jersey. J.*, 2009.
7. Rappaport, T. S., "Wireless Communications," *Principlesand Practice, 2nd Edition, Prentice Hall New Jersey*, 1996.
8. http://www.techterms.com/definition/manet
9. http://w3.antd.nist.gov/wahn_mahn.shtml