

A Survey on Existing Routing Protocols: Mobile Ad Hoc Networks

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Abstract

Mobile Ad Hoc Network (MANET) is a collection of two or more devices or nodes or terminals with wireless communications and networking capability that communicate with each other without the aid of any centralized administrator also the wireless nodes 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 some time act as routers at the same time, and we discuss in this paper the distinct characteristics of traditional wired networks, including network configuration may change at any time, there is no direction or limit the movement and so on, and thus needed a new optional path Agreement (Routing Protocol) to identify nodes for these actions communicate with each other path, An ideal choice way the agreement should not only be able to find the right path, and the Ad Hoc Network must be able to adapt to changing network of this type at any time. and we talk in details in this paper all the information of Mobile Ad Hoc Network which include the History of ad hoc, wireless ad hoc, wireless mobile approaches and types of mobile ad Hoc networks, and then we present more than 13 types of the routing Ad Hoc Networks protocols have been proposed. In this paper, the more representative of routing protocols, analysis of individual characteristics and advantages and disadvantages to collate and compare, and present the all applications or the Possible Service of Ad Hoc Networks.

Keywords: *MANET & Ad Hoc Protocols.*

1. Introduction

With the widespread rapid development of computers and the wireless communication, the mobile computing has already become the field of computer communications in high-profile link. Mobile Ad Hoc Network (MANET) is a completely wireless connectivity through the nodes constructed by the actions of the network, which usually has a dynamic shape and a limited bandwidth and other features, network members may be inside the laptop, Personal Digital Assistant (PDA), mobile phones, MP3 players, and digital cameras and so on. On the Internet, the original Mobility (mobility) is the term used to denote actions hosts roaming in a different domain; they can retain their own fixed IP address, without the need to constantly changing, which is Mobile IP technology.

Mobile IP nodes in the main action is to deal with IP address management, by Home Agent and Foreign Agent to the Mobile Node to packet Tunneling, the Routing and fixed networks are no different from the original; however, Ad Hoc Network to be provided by Mobility is a fully wireless, can be any mobile network infrastructure, without a base station, all the nodes can be any link, each node at the same time take Router work with the Mobile IP completely different levels of Mobility[1,2-5]. Early use of the military on the Mobile Packet Radio Networked in fact can be considered the predecessor of MANET, with the IC technology advances, when the high-tech communication equipment, the size, weight continuously decreases, power consumption is getting low, Personal Communication System (Personal Communication System, PCS) concept evolved, from the past few years the rapid popularization of mobile phones can be seen to communicate with others anytime, anywhere, get the latest information, or exchange the required information is no longer a dream, And we have gradually become an integral part of life. Military purposes, as is often considerable danger in field environment, some of the major basic communication facilities, such as base stations, may not be available, in this case, different units, or if you want to communicate between the forces, we must rely on This cannot MANET network infrastructure limitations. In emergency relief, the mountain search and rescue operations at sea, or even have any infrastructure can not be expected to comply with the topographical constraints and the pressure of time under the pressure, Ad Hoc Network completely wireless and can be any mobile feature is especially suited to disaster relief operations. When personal communication devices and more powerful, some assembly occasions, if you need to exchange large amounts of data, whether the transmission of computer files or applications that display. if we can link into a temporary network structure, then the data transmission will be more efficient without the need for large-scale projection equipment would not have point to point link equipment (such as network line or transmission line)[7,8]. The current wireless LAN technology, Bluetooth is has attracted considerable attention as a development plan. Bluetooth's goal is to

enable wireless devices to contact with each other, if the adding the design of Ad Hoc Network (MANET).

2. Wireless Ad Hoc Networks

MANET is a collection of two or more devices or nodes or terminals with wireless communications and networking capability that communicate with each other without the aid of any centralized administrator also the wireless nodes 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 some time act as routers at the same time. All nodes in a wireless ad hoc network act as a router and host as well as the network topology is in dynamically, because the connectivity between the nodes may vary with time due to some of the node departures and new node arrivals. The special features of Mobile Ad Hoc Network (MANET) bring this technology great opportunity together with severe challenges [8]. All the nodes or devices responsible to organize themselves dynamically the communication between the each other and to provide the necessary network functionality in the absence of fixed infrastructure or we can call it ventral administration, It implies that maintenance, routing and management, etc. have to be done between all the nodes. This case Called Peer level Multi Hopping and that is the main building block for Ad Hoc Network. In the end, conclude that the Ad Hoc Nodes or devices are difficult and more complex than other wireless networks. Therefore, Ad Hoc Networks form sort of clusters to the effective implementation of such a complex process. In the following figure 1 will shows some nodes forming ad hoc networks, and there are some nodes more randomly in different direction and different speeds.

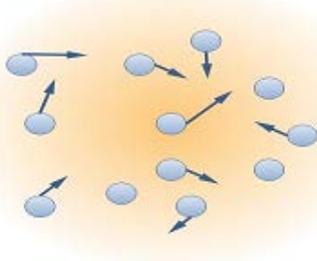


Fig. 1 Ad Hoc Network: Nodes mover randomly in different direction and different speeds.

In the past few years, the people became realized to use all the technology so widely and the people's future

living environments are emerging, based on information resource provided by the connections of different communication networks for clients also we have seen a rapid expansion in the field of Mobile Computing because the proliferation not expensive, widely available wireless devices .A new small devices such as personal communication like cell phones, laptops, Personal Digital Assistants (PDAs),handhelds, and also there's a lot of traditional home appliances such as a digital cameras, cooking ovens, washing machines, refrigerators and thermostats, with computing and communicating powers attached. Expand this area to became a fully pervasive and so widely. With all of this, the technologies must be formed the good and new standard of pervasive computing, that including the new standards, new tools, services, devices, protocols and a new architectures.

As well as the people in this time, or the users of internet users in Ad Hoc network through increase in the use of its advantage is that not involve any connection link and the wiring needed to save space, and building low cost, and improve the use, and can be used in mobile phone, because of these advantage local wireless network architecture readily. And also beads in these advantages the wireless network can be used in the local area network terminal part of the wireless [9].

3. Existing Ad Hoc Protocols

For the Ad Hoc network there are more than 13 kinds of the above routing protocol have been proposed, following the more representative for several separate presentation, and to compare between them, and for more dilates about existing ad hoc network protocols.

3.1 Destination-Sequenced Distance-Vector Routing (DSDV)

Destination-Sequenced Distance-Vector Routing [30] is based on traditional Bellman-Ford routing algorithms were developed by the improvement, and a routing table-based protocol. Each node in an operation must be stored a routing table, which records all the possible links with the nodes in the node and the distance like the number of hops, routing table within each record also contains a sequence number, which is used to determine are there any more old path in order to avoid routing table generation. DSDV is basically on the Internet Distance-Vector Routing the same, but more destination sequence number of the record, makes the Distance-Vector Routing more in line with this dynamic network MANET needs, In addition, when network

topology changes are less frequent when the routing table does not need to exchange all the information, DSDV, within each node, together with a table, is used to record the routing table changes from the last part of the exchange so far, if you change a lot of the conduct of all the information The exchange, known as the full dump packets, if the change very little, it is only for the part of the exchange, known as the incremental packet.

3.2 Global State Routing (GSR)

Global State Routing (GSR) [38] is almost the same as DSDV, because it has the idea of link state routing but it makes a progress by decreasing the flooding of routing messages. In this algorithm, each node maintains a neighbor list, a topology table, a next hop table and a distance table. The neighbor list of a node includes the list of its neighbors (all nodes that can be heard by it). The link state information for each destination is maintained in the topology table together with the timestamp of the information. The next hop table includes the next hop to which the packets for each destination must be dispatched. The distance table contains the shortest distance to each destination node. The routing messages will be created on a link change as in all link state protocols. Whenever it accepts a routing message, the node updates its topology table if the sequence number of the message is later than the sequence number stored in the table and it then reconstructs its routing table and broadcasts the information to its neighbors.

3.3 Cluster head Gateway Switch Routing (CGSR)

Cluster head Gateway Switch Routing [31] is to build from the DSDV above a routing protocol, using a cluster head to manage a group of action nodes, that is, the action is divided into a group of a group of nodes, each elected by a head, the cluster head among through a gateway to connect to each other, into a hierarchical structure. Whether a link between nodes within a cluster, or a link between each cluster head, are based on DSDV routing, so each node also needs a routing table for the record, in addition to DSDV need some information is also necessary to routing table with a record of all the other nodes and the corresponding cluster head.

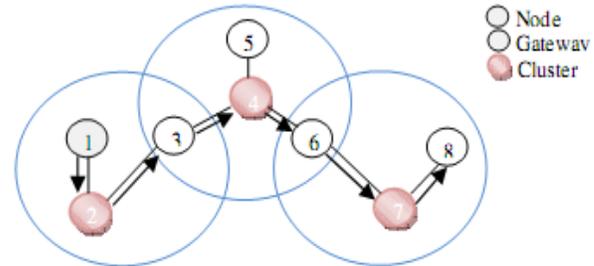


Fig. 2 CGSR: routing from node 1 to node 8.

In the end web of which nodes should be selected as cluster head, and when the cluster head movement and also how to avoid future path changes significantly under to find a new head, all in real CGSR to allow for the more difficult areas.

3.4 Wireless Routing Protocol (WRP)

Wireless Routing Protocol [32] 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 list 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 retransmission, and which update needs acknowledgement. WRP use of distance and the second-to-last hop information to find the path, such an approach can effectively improve the distance-vector routing possible count-to-infinity problem.

3.5 Fisheye State Routing (FSR)

Fisheye State Routing (FSR) [39] is an enhancement of GSR. The large size of update messages in GSR dissipates a substantial amount of network bandwidth. In order to overcome this problem, FSR will use a method where each updated messages would not includes information about all nodes. As an alternative, it swaps information about neighboring nodes regularly than it does about farther nodes, thus reducing the update message size. In this way, each node gets accurate information about near neighbors and accuracy of information decreases as the distance from the node increases. Even though a node does not have accurate information about distant nodes, the packets are routed correctly because the route information becomes more and more accurate as the packet moves closer to the destination.

3.6 Ad Hoc On-Demand Distance Vector Routing (AODV)

Ad Hoc On-Demand Distance Vector Routing using distance-vector concept [33,34,35], but in several different ways and the above is that, AODV does not maintain a routing table, but when a node needs to communicate with another node on demand only to the approach to building routing table. When a node wants to send data to another node in the network, the first to broadcast a Route Request (RREQ) packet [36], RREQ where the record that this is given by which a source is to be used to find which of a destination node. RREQ in the network is a kind of flooding of the transfer mode, destination until they were received, of course, a node can only be processed once on the same RREQ in order to avoid routing loop generation. In theory all the nodes between the source and the destination of the RREQ will be passing a temporary record will be on the last hop of the RREQ via Path of information, when the destination of the RREQ received from different places, choose a shortest path, and to the source sent the direction of Route Reply (RREP).

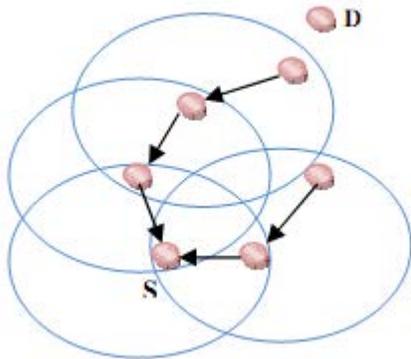


Fig. 3 AODV: reverse path formation.

As the RREP of passing along the nodes on this path will be a record of the relevant information, when the RREP was sent to a sent RREQ the source the beginning, this section of the path from source to destination even been established, and thereafter source can use this route to send packets to the destination.

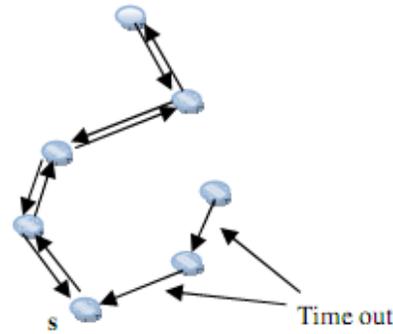


Fig. 4 AODV: forward path formation.

It is noteworthy that, AODV and DSDV routing table inside the same have also recorded a destination sequence number, to avoid routing loop from occurring, but also to ensure the path recorded in the latest expression of the topology.

3.7 Dynamic Source Routing (DSR)

Dynamic Source Routing [37,38,39] As the name suggests is the use of the concept of source routing, the routing information that is directly recorded in the inside of each packet, but to be in the MANET environment, the use of such a special, DSR is needed only when the path to find out the path, that is, on -demand.

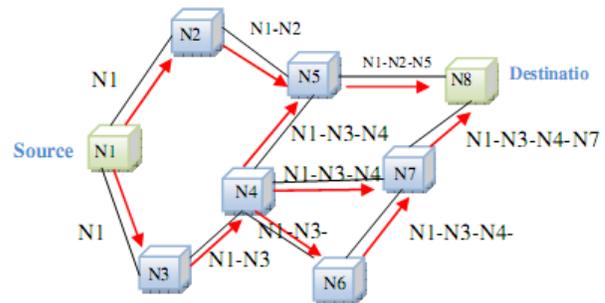


Fig. 5 DSR: route request.

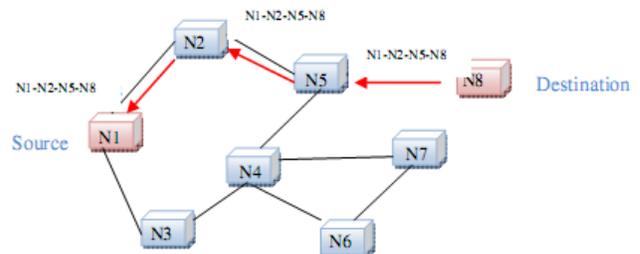


Fig. 6 DSR: route reply

Route Discovery with AODV is similar, but also broadcast from the source client to send a Route Request, the difference is, Route Request after one for each hop, this hop of the ID will be recorded in the Route Request a Route Record, the way, When the Route

Request reaches destination, they will have all the nodes in the path of information, destination in many elected a Request where the best path, according to Route Record to send a Route Reply back to source, source will be recorded in the route reply stored inside the route record in the routing table, then all should be sent to the destination of the packet will have the route record on the inside, only the source path need to have this information, source and destination paths between other nodes in the packet as long as the view inside the route record and then forward you can go out without having to re-select the path.

3.8 Temporally Ordered Routing Algorithm (TORA)

Temporally Ordered Routing Algorithm [20, 21] (TORA). concept of link reversal will be used in MANETS become a kind of decentralized routing algorithms, from the beginning need to route the data sender to the destination number can be used to identify the direction of the path, suitable for highly dynamic environment. TORA is that when there is link the characteristics of the changes, produced by the adjacent node control message is confined to changes occurring at the vicinity of its operation is divided into three steps: Route Creation, Route Maintenance, Route Erasure. In general the process of establishing the route, the network where each node is assigned a "height", and to form a destination as the root of a directed acyclic graph (DAG), the adjacent nodes according to height, all the link will be was designated as upstream or downstream. When network topology changes, DAG was forced to re-establish, when to change the link to the upstream of the upstream node in the direction of height is responsible for the update, until the date back to the source, this update process can source that topology change, while not addressed to destruction of the other route. Topology change from the source to be updated at the beginning to the manner and distance vector routing prone to the same count-to-infinity problems, but this is only a temporary instability.

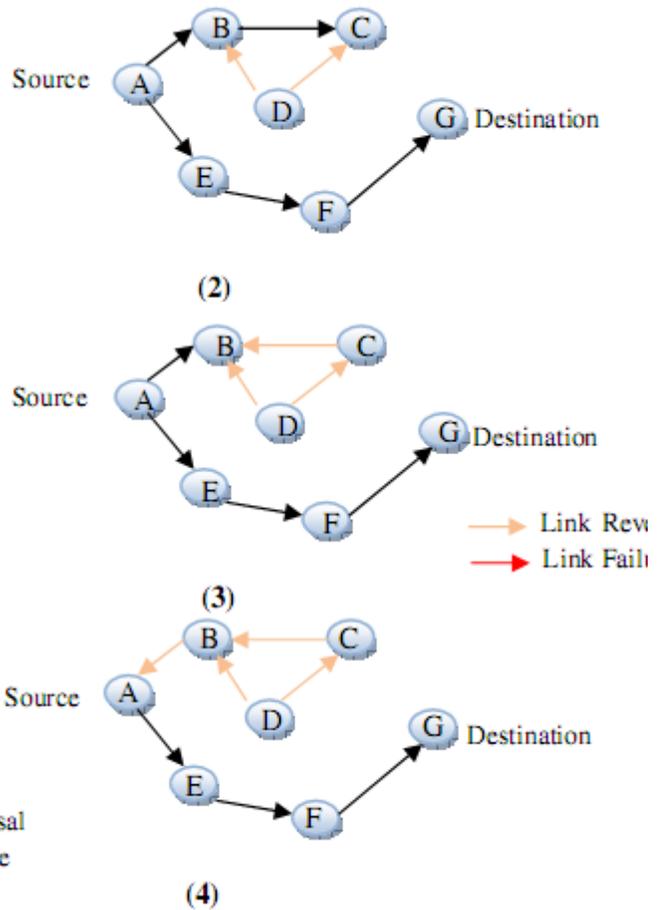
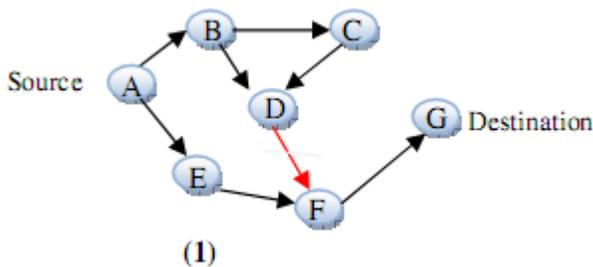


Fig. 7 TORA: route maintenance.

3.9 Cluster Based Routing protocol (CBRP)

In Cluster Based Routing protocol (CBRP) [40], all the nodes are separated into clusters. In order to arrange the cluster, the following algorithm is used. When a node comes up, it will go into the "undecided" state and broadcasts a Hello message. When a cluster-head gets this hello message it will reacts with a triggered hello message immediately. When the undecided node gets this message it changes its state to "member". If the undecided node times out, then it will turn as a cluster-head. If it has a bi-directional link to some neighbour, otherwise it remains in undecided state and repeats the procedure all over again. Cluster-heads are changed as occasionally as possible.

Each node maintains a neighbour table. For each neighbour, the neighbor table of a node contains the status of the link and the state of the neighbour (clusterhead or member). A cluster head maintains information about the members of its cluster and also maintains a cluster adjacency table that contains information about the neighboring clusters. For each

neighbor cluster, the table has entry that contains the gateway through which the cluster can be reached and the information about the cluster head. When a source has to send data to destination, it floods route request packets (but only to the neighboring cluster-heads). While receiving the request, a cluster head will check whether the destination is in its cluster. If yes, then it sends the request directly to the destination or it will send to all its adjacent cluster-heads. The cluster-heads address is documented in the packet. Then a cluster-head will discard a request packet that has been detected. When the destination receives the request packet, it will reply with the route that had been recorded in the request packet. If the source does not receive a reply within a stipulated time period, it will back off exponentially before trying to send out another route request.

In CBRP, routing is done by using the source routing. It also uses the route shortening when receiving a source route packet. The node will attempt to find the farthest node in the route and sends the packet to that node and therefore reducing the route. In the process of transferring the packet, if a node detected a broken link, it will send back an error message to the source and then uses a local repair mechanism. In local repair mechanism, if a node detected that the next hop is inaccessible, it will investigate to see if the next hop can be reached through any of its neighbor. If any one of it works, the packet can be sent out over the repaired path.

3.10 Associativity Based Routing (ABR)

Associativity Based Routing [42, 43, 44] is primarily designed to focus on the MANET where links between nodes, unstable relations, and therefore uses the concept of associativity stability, is used to indicate a node relative to the adjacent node, link stability. ABR adjacent nodes on a regular basis by forming the beacon to indicate its presence, when a node n received from the adjacent nodes coming beacon, n will be updated on the associativity table, in which each adjacent node in the associativity table where the record is called associativity tick, said that the node relative to the n degree of stability. The main objective of ABR is to provide the most stable path between nodes, the path establishment process is as follows: When the node need to go the path of a node, broadcasting a BQ (broadcast query) message, the node will receive the query and its associativity table its own address on its neighboring nodes, together with the associativity ticks along with BQ continues to broadcast out, downstream node d will be its upstream node u where the information recorded in the BQ removed, leaving only, and d the associativity tick, that is, u , d , link stability. BQ way out radio, arrived at destination, it is already recorded on the

path from the source to the destination of all associativity ticks, destination based on these information will be added to the total associativity ticks can be obtained respectively, the stability of each path, destination and so choose the most the appropriate path (most stable), and then along the path to the source terminal send REPLY, along the route through the nodes in its routing table information on the establishment of this path. ABR also designed the path when the link failure, when the reconstruction method. When the source moves, on the re-BQ-REPLY to the above-mentioned steps, if it is a path of nodes within the half-way move, then the mobile node's upstream node u is necessary to undertake Local Query (LQ [H]), is a restricted hop the number of BQ, which is the path to the reconstruction process in order to limit the topology near the approach to change, if one had not received within the time frame REPLY, u should send up Route Notification (RN), requirement of a node sending LQ [H], if not all the way up the success of the reconstruction path (not received from the destination of the REPLY), the midpoint of the path from source to destination is no longer the beginning LQ, but directly tell the source to re-BQ.

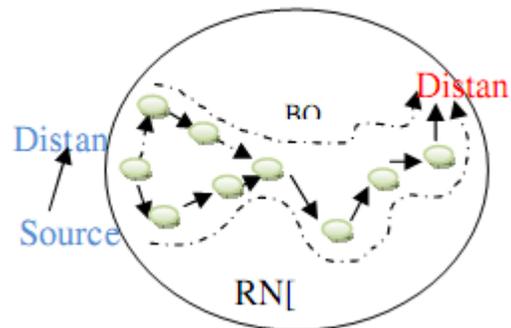


Fig. 8 ABR: route maintenance Route maintenance for a source move.

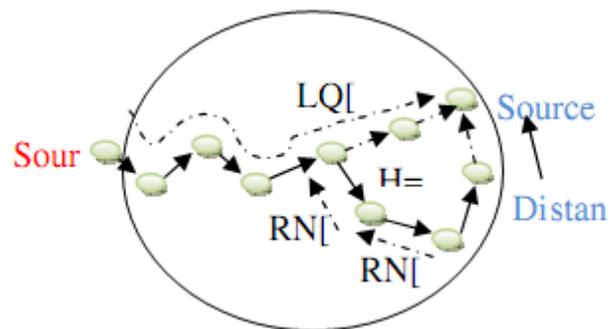


Fig. 9 Router maintenance for a destination move.

3.11 Signal Stability Routing (SSR)

Signal Stability Routing and ABR also added a link to the consideration of stability, is divided into Dynamic Routing Protocol with Static Routing Protocol in two parts. DRP and ABR, as the use of adjacent nodes in each other to define the beacon transmission links are stable, but the DRP only record is strong or weak, that is, a qualitative classification of links, rather than the ABR quantified associatively tick down the value. SRP to use the information obtained by DRP, in the path to the establishment of the process, requires that each downstream node only in the Route request time from the strong link in order to continue broadcasting route request, select the first to reach the final destination of the request, along the source-side reply to establish a path, so SSR can establish a strong link in the shortest possible, and on the best path.

3.12 Core-Extraction Distributed Ad hoc Routing algorithm (CEDAR)

Core-Extraction Distributed Ad hoc Routing algorithm with the above in several different parts of routing protocol is the core use [45]. The original Core is used in the Core Based Tree (CBT), the used to indicate where one or more network nodes are given a special feature may be a relay point for all paths, or the management of certain special features exclusive, In CEDAR, MANET where some of the nodes have been selected for storage of local area link state, and is responsible for calculating the node within the region and select a path.

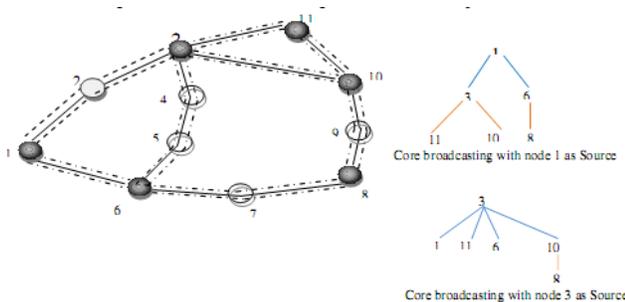


Fig. 10 CEDAR: core broadcast.

When the source (s) with a destination (d) create a link, first send a request to dom (s), that is, s region of the dominator, dom (s) the destination of the message broadcast out to build a dom (s) as the starting point of the core path, when the request sent to dom (d) post, dom (d) will conduct reply, at this time dom (s) to dom (d) the path has been established, while dom (d) also, in its local link state to find the best path to d, so the path from s to d, even if the establishment. CEDAR stressing that by

storing the relevant Quality of service in the link state information, such as bandwidth, making CEDAR become a Quality of service (QoS) routing; In addition, the definition of a group of network core, simplify the routing process, makes the web of the other nodes do not need to participating in a particular path routing.

3.13 Zone Routing Protocol (ZRP)

Zone Routing Protocol combines the path to the establishment of two kinds of reactive and proactive way [46] on the one hand enables the network to keep the record inside a node 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 node links, only allow web of a small number of nodes involved in routing.

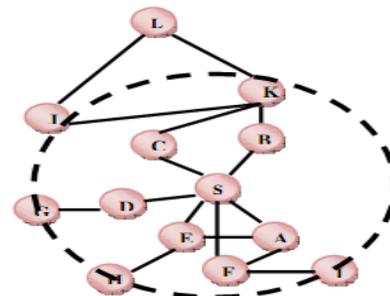


Fig. 11 ZRP: a routing zone with radius = 2 (hops).

ZRP defines a node n of neighbors within a hop distance of all the other nodes, as n, routing zone, since each node has its own different adjacent nodes, so ZRP, the entire Internet is in many overlapping routing zone. In the same zone where the routing is called intrazone routing, mainly using the same zone of nodes exchange distance vector, is a form of distance vector routing, but all the distance vector are limited to the size of the zone.

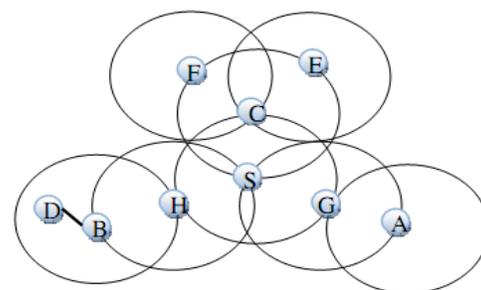


Fig. 12 ZRP: interzone operation.

When a source is not looking for a destination within its routing zone, when, source use Bordercasting, that is, the route query sent to the source of all the nodes within the routing zone, each node checks the query's destination is within its routing zone if not, continues to make Bordercasting, if there is, you can reply, said that it has found the path can be connected to the destination. Such a process across a number of zone, so called interzone routing [33].

4. Comparative Results

And now we will shows the comparison between Table Driven, Demand Driven and Hybrid in Table 1, and then we show in table 2 the Table Driven for three kind of protocols such as WRP, CGSR, DSDV and comparison between them, Demand Driven (On-Demand) with six type of protocols such as TORA, DSR, AODV, ABR, CEDAR and SSR and comparison between them shows in table 3.

TABLE I. COMPARISON BETWEEN TABLE DRIVEN, DEMAND DRIVEN AND HYBRID

	Table Driven (Proactive)	Demand Driven (On-Demand) (Reactive)	Hybrid
Routing Protocols	DSDV,CGSR,WRP	AODV,DSR,TORA,ABR,SSR,CEDAR	ZRP
Route acquisition delay	Lower	Higher	Lower for Intra-zone; Higher for Inter-zone
Control overhead	High	Low	Medium
Power requirement	High	Low	Medium
Bandwidth requirement	High	Low	Medium

TABLE II. SHOWS THE TABLE-DRIVEN FOR THE THREE KINDS OF PROTOCOLS AND COMPARISON BETWEEN THEM

Table Driven	CGSR	WRP	DSDV
Routing philosophy	Hierarchical	Flat	Flat
Loop-free	Yes	Yes, but not instantaneous	Yes
Number of required tables	2	4	2
Frequency of update transmissions	Periodically	Periodically and as needed	Periodically and as needed
Updates transmitted to	Neighbors and cluster head	Neighbors	Neighbors
Utilize hello messages	No	Yes	Yes
Critical nodes	Cluster head	No	No

TABLE III. SHOWS THE DEMAND DRIVEN (ON-DEMAND) WITH SIX TYPES OF PROTOCOLS AND COMPARISON BETWEEN THEM

On-Demand	TORA	DSR	AODV	ABR	CEDAR	SSR
Overall complexity	High	Medium	Medium	High	High	High
Overhead	Medium	Medium	Low	High	High	High
Routing philosophy	Flat	Flat	Flat	Flat	Core-Extracted	Flat
Loop Free	Yes	Yes	Yes	Yes	Yes	Yes
Multicast capability	No*	No	Yes	No	No*	No
Beaconing requirements	No	No	No	Yes	Yes	Yes
Multiple route support	Yes	Yes	No	No	No	No

Routes maintained in	Route table	Route cache	Route table	Route table	Route table	Route table
Route reconfiguration methodology	Link reversal	Erase route; notify source	Erase route; notify source	Localized broadcast query	Dynamic route re-compute; notify source	Erase route; notify source
Routing metric	Shortest path	Shortest path	Freshest & shortest path	Associatively & shortest path & others	Shortest and widest	Associatively & stability

TABLE IV. SHOWS COMPARE THE MAIN CHARACTERISTICS OF EXISTING MULTIPATH ROUTING PROTOCOLS

	AODV	DSR	CBRP	DSDV	WRP	GSR	FSR
Routing Category	Reactive	Reactive	Reactive	Proactive	Proactive	Proactive	Proactive
TTL Limitation	Yes	Yes	Yes	No	No	No	No
Flood Control	No	No	No	Yes	Yes	Yes	Yes
QoS Support	No	No	No	No	No	No	No
Periodic Update	No	No	No	Yes	Yes	Yes	Yes
Power Management	No	No	No	No	No	No	No
Multicast Support	yes	no	No	No	No	No	No
Beaconing	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Security Support	No	No	No	No	No	No	No

4. Conclusion

In this paper we presented an exhaustive survey about the Mobile Ad Hoc Network (MANET) we distinct the characteristics of traditional wired networks, wireless ad hoc networks, wireless mobile approaches and types of ad hoc network as well as all the existing ad hoc protocols, and we comparison between the different papers, most of its conclusions pointed to a phenomenon, not a routing protocol can adapt to all environments, whether it is Table-Driven, On-Demand or a mixture of two kinds, are limited by the network characteristics; even though the same part of the Agreement On-Demand also due to the differences in the mode of operation applicable to different types of network. Also we discussed in this paper the relevant Ad Hoc Network on a multicast (Multicasting), Applications on Ad Hoc Networks, QoS and other topics will be able to see the latest research results, can be expected is that the Ad Hoc Network needs and applications will start to appear in recent years, Ad Hoc Network-related research have become the current Internet trends One of the most anticipated technology.

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