Analysis on Routing Protocol for MANET

Anjali
Research Scholar, Panjab University, Chandigarh 160014, India.

Abstract: In this period of wireless devices, Mobile Ad-hoc Network (MANET) has become an important part for communication for mobile devices. Mobile Ad-Hoc Networks are those networks which don't have any fixed infrastructure. A network consist of dynamic, self- configured and self- organized set of nodes, having no centralized hierarchy is known as MANETs, where nodes itself behave as routers. A number of routing protocols has been proposed in past years for the use of Mobile Ad Hoc Networks in various application areas such as military, govt. etc. In this paper we provide an overview of a wide range of the existing routing protocols with a particular focus on their functionality and their pros and cons. Also, the contrast is provided based on the information and routing methodologies used to make routing decisions.

Key Words: MANET, Comparison in Different Protocols, Routing Protocols.

I. INTRODUCTION

The recent survey and research paper shows that demand of wireless portable devices such as mobile phones, PDAs and laptops is increasing in everyday life. It leads to the possibility of spontaneous or ad hoc wireless communication. Ad hoc networks are autonomous, self-configuring, adaptive which make them applicable in various areas [2]. Wireless network comes up with two variations of - first is network with existing infrastructure and network with Infrastructure less or Ad Hoc wireless network.[3]. Network with existing infrastructure: In this number of mobile nodes are wirelessly connected to a non-mobile Access Point (AP). They communicate to access points to send & receive packets from other nodes [3].Network with Infrastructure less or Ad Hoc wireless network: An ad hoc network is a network composed only of nodes, with no Access Point. Communications possible even between two nodes that are not in direct range with each other, packets are exchanged between the two nodes are forwarded by intermediate nodes, using a routing algorithm. In this network each and every node does participate voluntarily in transit packet from one node to another node [3].

II. MANET

A MANET is a self-organizing collection of wireless mobile nodes that form a temporary network without the help of a fixed networking infrastructure(access point). In it each node can move freely and by node moving topology keeps on changing. Constrained bandwidth and variable capacity links. Limited Physical Security & Frequent routing updates. Reduce infrastructure cost and ease of establishment and fault tolerance as routing is performed individually by nodes using intermediate nodes to forward packets to destination [6]. Nodes may join and leave the network at any time it means it follow dynamic topology.

This paper reviews the key studies of Mobile ad hoc routing protocols introduced by various authors. Firstly, we discuss the application of MANET. Secondly, we introduce classification of routing protocols based on the route discovery and routing information update mechanisms, then we discuss the comparison between them. Further on, we discuss the protocols under the three main routing protocols and their comparison and advantages and disadvantages also the between the routing protocols so that their behavior and performance can be captured under different conditions.

III. APPLICATIONS

In the early time, MANET applications and deployments was only in military oriented. In some of the past years, with rapid advances in mobile ad-hoc networking research, ad-hoc networks have attracted considerable attention and commercialize in almost all fields of life. Few applications of MANET are described below:

1) *Tactical Networks→[16]*
    a) Military communication, operations. [9]
    b) Automated Battlefields

2) Emergency Services→

a) Disaster recovery [9]

b) Search and rescue operations.

c)Supporting doctors and nurses in hospitals.

3) Commercial Environments (business) → *[17]*

a) Used in business dynamic access to customer files stored in a central location on the fly

b) Provide consistent databases for all agents

4) Entertainment→

a) Multi-user games

b) Outdoor Internet access

5) Civil Applications or Education →*[17]*

a) Setup virtual classrooms or conference rooms

b) Setup ad hoc communication during conferences, meetings, or lectures.

6) Sensor Networks→

a) Home applications: smart sensor nodes and actuators can be buried in Appliances to allow end users to manage home devices locally and remotely.

b) Tracking data highly correlated in time and space, e.g., remote sensors for weather, earth activities

7) Location Aware Services →

a) Automatic Call forwarding, advertise location specific services, Location–dependent travel guide [18]

8) Commercial Environments (Vehicular Services)→

a) Transmission of news, road condition, weather, music

b) Local ad hoc network with nearby vehicles for road/accident guidance

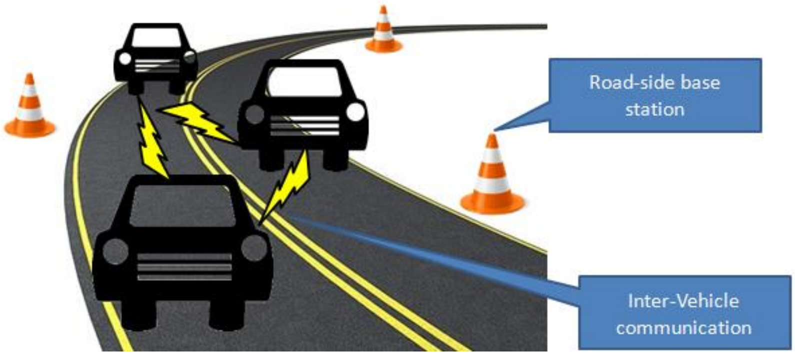

Fig 1: Vehicular Services

IV. CLASSIFICATION OF PROTOCOLS

A routing Protocol is used to transmit a packet from source to destination via number of nodes and for this there is numerous routing protocols have been devised for such kind of activities. Such protocols must handle the limited resources available with these networks, which include high power consumption, low bandwidth and high mobility. Routing protocols tells the way how a message is sent from one node to another.

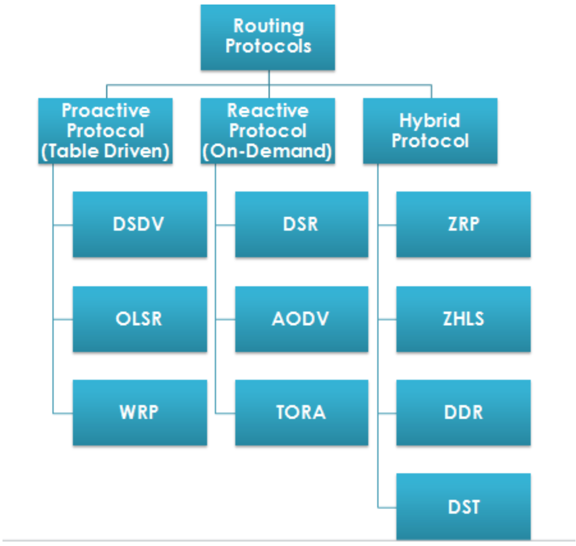

Fig 2: Different type of Routing Protocols

Proactive Protocols: Proactive protocols is also known as distance vector and table driven protocols .In this information is stored in the form of tables in every node and when any type of change occur in network topology then need to update these tables also. Proactive protocols continuously learn the topology of the network by exchanging topological information among the network nodes. Thus, when there is a requirement for a route to a destination, such route information is available immediately. Periodic route updates are exchanged in order to synchronize the tables. Some examples of table driven ad hoc routing protocols are Dynamic Destination Sequenced Distance-Vector Routing Protocol (DSDV), Optimized Link State Routing Protocol (OLSR) and Wireless Routing Protocol (WRP). These protocols differ in the number of routing related tables adhoc changes are broadcasted in the network structure [12]. In this, Slow reaction on restructuring and failures.

A) Reactive Protocols: Reactive protocol is also known as source initiated on demand protocols. In this the route is Discover when needed. The main aim is to minimize the network traffic overhead. These routing protocols are based on some type of "query-reply" dialog. They do not attempt to continuously maintain the up-to-date topology of the network. Rather, when the need arises,[4] a reactive protocol invokes a procedure to find a route to the destination; such a procedure involves some sort of flooding the network with the route query. The source node emits a request message, requesting a route to the destination node. This message is flooded, i.e. relayed by all nodes in the network, until it reaches the destination. The path followed by the request message is recorded in the message, and returned to the sender by the destination, or by intermediate nodes with sufficient topological information, in a reply message. Thus multiple reply messages may result, yielding multiple paths - of which the shortest is to be used. Some examples of source initiated ad hoc routing protocols include the Dynamic Source Routing Protocol (DSR) , Ad Hoc On-Demand Distance Vector Routing Protocol (AODV) , and Temporally-Ordered Routing Algorithm (TORA). No periodic updates are required for these protocols but routing information is only available when needed [12]. High latency time in route finding and also Excessive flooding can lead to network clogging.

B) Hybrid Protocols: A hybrid protocol is consolidation of both protocols proactive protocols and reactive protocols. It reducing the control traffic overhead from proactive systems and decrease the latency caused by route discovery delays of reactive systems, by maintaining some form of routing table Hybrid protocols (Royer, 1999) are designed [10]. Some Hybrid Routing Protocols include CEDAR, ZRP and SRP. The difficulty of all hybrid routing protocols is how to organize the network according to network parameters. The common disadvantage of hybrid routing protocols is that the nodes that have high level topological information maintains more routing information, which leads to more memory and power consumption.

Parameters	Table-Driven (Proactive)	On-Demand (Reactive)	Hybrid
Route Availability	Always Available	Computed as per needed	Depends on Destination
Storage Requirements	Higher	Dependent on no. of routes maintained or needed	Depends on size of zone/cluster
Periodic Route Updates	Required Always	Not Required	Used in each zone
Delay	Low	High	Low for local destinations and high for Interzone
Scalability	100 Nodes	Greater than 100	Greater than 1000
Control Traffic	High	Low	Lower than other two
Routing Information	Keep Stored in table	Doesn't Store	Depends on Requirement
Routing Philosophy	Mostly Flat	Flat	Hierarchal
Comm. Overhead	High	Low	Medium
Mobility Handling	Periodic Update	Route Monitored	Both

Fig 3: Comparison Table of Three Routing Protocols

4.1 Proactive Protocol:

4.1.1) DSDV (Destination-Sequenced Distance-Vector):

DSDV is proposed by Perkins and Bhagwat [11]. It is a table-driven routing scheme for ad hoc mobile networks based on the Bellman–Ford algorithm improvement like loop-free. It's one of the earliest protocols. In this nodes keep on informing the neighbor nodes about the topology changes of network. Each device maintains a routing table containing entries for all the devices in the network. In order to keep the routing table completely updated at all the time each device periodically broadcasts routing message to its neighbor devices. When a neighbor device receives the broadcasted routing message and knows the current link cost to the device, it compares this value and the corresponding value stored in its routing table. If changes were found, it updates the value and re-computes the distance of the route which includes this link in the routing table [10]. Less delay is required in the path set up process. All available wired network protocol can be useful to adhoc wireless networks with less modification. Battery power and a small amount of bandwidth even used when the network is idle for regular updating its routing table. DSDV is not suitable for highly dynamic or large scale networks.

4.1.2) OLSR (Optimized Link State Routing Protocol) :

OLSR is proposed by Clausen and Jacquet [11]. A proactive protocol OLSR is inherited from link state routing and claims to perform better in dense and large net-works In this protocol design each node chooses a group of nodes from its neighbor which act as multipoint relay (MPR) through this less flooding occur. It optimizes the pure link state routing protocol. Optimizations are done in two ways: by reducing the size of the control packets and by reducing the number of links used for forwarding the link state packets. OLSR is based on the following three mechanisms: neighbor sensing, efficient flooding and computation of an optimal route using the shortest-path algorithm. Route immediately available in OLSR but Bigger overhead and need more power.

4.1.3) WRP (Wireless Routing Protocol):

Wireless Routing Protocol proposed by Murthy and Garcia-Luna-Aceves [11], DSDV that inherits the properties of Bellman-Ford Algorithm. It keeps each route information of whole network all the time. Wireless routing protocols (WRP) is a loop free routing protocol. The main goal is maintaining the shortest distance to every destination. Each node in the network uses a set of four tables to maintain more accurate information.

- *Distance Table (DT)* – maintains the network topology view by keeping the distance and address of second last node to any destination informed by neighbor nodes.

- *Routing Table (RT)* – contains information of second last node to the destination, the successor node and a flag that specifies the status of the link.

- *Link Cost Table (LCT)* – reflects from its name that it keeps the cost of links.

- *Message Retransmission List (MRL)* – makes the convergence faster by maintaining the data of update messages which are to be transmitted and retransmitted.

In WRP, eliminates the "Count to Infinity" Problem but it requires larger memory and greater processing power and It is not suitable for highly dynamic and for very large ad hoc wireless network

Parameters	DSDV	WRP	OLSR
Delay	High	Low	Low
Support Multiple Route	No	No	Yes
Unidirectional Link	No	No	Yes
Route Updation	Periodic, Triggered to neighbors	Periodic, Triggered to neighbors	Periodic, Triggered to neighbors
Loop Free	Yes	Yes	Yes
Routing Overhead	High	High	Low
Caching Overhead	Medium	High	High
Throughput	Low	Low	Medium
Routing Tables	2	4	4

Fig 4: Comparison Table of Proactive Protocol

4.2 Reactive Protocol:

4.2.1) AODV(Ad hoc On-demand distance Vector Routing):
AODV proposed by C. E. Perkins and E.M.Royer [12]. It is a combination of both DSR and DSDV.[11] It is basically the improvement on DSDV. AODV minimizes the number of broadcasts by creating routes on-demand as opposed to DSDV that maintains the list of all the routes. [8]To find a path to the destination, the source broadcasts a route request packet. The neighbors in turn broadcast the packet to their neighbors till it reaches an intermediate node that has a recent route information about the destination or till it reaches the destination A node discards a route request packet that it has already seen. The route request packet uses sequence numbers to ensure that the routes are loop free and to make sure that if the intermediate nodes reply to route requests, they reply with the latest information only. [6] When a node forwards a route request packet to its neighbors, it also records in its tables the node from which the first copy of the request came. This information is used to construct the reverse path for the route reply packet. AODV uses only symmetric links because the route reply packet follows the reverse path of route request packet. As the route reply packet traverses back to the source , the nodes along the path enter the forward route into their tables. If the source moves then it can reinitiate route discovery to the destination. If one of the intermediate nodes move then the moved nodes neighbor realizes the link failure and sends a link failure notification to its upstream neighbors and so on till it reaches the source upon which the source can reinitiate route

Discovery if needed [11]. In this, the connection setup delay is lower [1] but the intermediate nodes can lead to inconsistent routes if the source sequence number is very old and the intermediate nodes have a higher but not the latest destination sequence number, thereby having stale entries. Also, multiple Route Reply packets in response to a single Route Request packet can lead to heavy control overhead and unnecessary bandwidth consumption due to periodic beaconing [10].

4.2.2) DSR (Dynamic Source Routing):

DSR Proposed by D. B.Johnson, Maltz and Broch [12] to restrict the bandwidth consumed by control packets in ad hoc wireless networks by eliminating the periodic table update messages required in the proactive routing protocols. It is similar to AODV in that it forms a route on-demand when a transmitting node requests one. However, it uses source routing (also called path addressing, allows a sender of a Packet to partially or completely specify the Route the packet takes through the network) instead of relying on the routing table at each intermediate device. A node maintains route caches containing the source routes that it is aware of. The node updates entries in the route cache as and whenever it has a packet to transmit. DSR performs the process of data transmission in two fragments: Route discovery and Route maintenance

1) Route discovery: When the source node wants to send a packet to a destination, it looks up its route cache to determine if it already contains a route that is unexpired to the destination., then it uses this route to send the packet. But if the node does not have such a route, then it initiates the route discovery process by broadcasting a route request packet. The route request packet contains the address of the source and the destination, and a unique identification number. Each intermediate node checks whether it knows of a route to the destination. If it does not, it appends its address to the route record of the packet and forwards the packet to its neighbors. A route reply is generated when either the destination or an intermediate node with current information about the destination accepts the route request packet [Johnson96]. If the node generating the route reply is an intermediate node then it adjoins its cached route to destination to the route record of route entreaty the packet and puts that into the route respond the packet. To send the route reply packet, the responding node must have a route to the source. The alteration of route record can be used if symmetric links are supported [10].

2) Route maintenance: which is done by keeping the information of each node, in the cache for a specific period of time for future use.[10] It uses two types of packets for route maintenance:- Route Error packet and Acknowledgements. When a node confronts a fatal transmission problem at its data link layer, it generates a Route Error packet. When a node accepts a route error packet, it removes the hop in error from it's route cache. All routes that contain the hop in error are removed at that point. Acknowledgment packets are used to verify the correct operation of the route links. In DSR, the intermediate nodes also utilize the route cache information efficiently to reduce the control overhead but Even though the protocol presents well in static and low-mobility environments, the performance degrades rapidly with increasing mobility. As well, considerable routing overhead is involved due to the source-routing mechanism employed in DSR. This routing overhead is instantly proportional to the path length.

4.2.3) TORA (Temporally Ordered Routing Algorithm):

TORA Proposed by Park and Corson. Temporarily ordered routing algorithm (TORA) is highly adaptive, loop-free, distributed routing algorithm follows the concept of link reversal [11]. In order to achieve this, the TORA does not use a shortest path solution. TORA builds and maintains a Directed Acyclic Graph (DAG) rooted at a destination [20]. The main quality of TORA is to control messages, are localized to a very small set of nodes near the occurrence of a topological change. .Information may flow from nodes with higher heights to nodes with lower heights. Information can therefore be thought of as a fluid that may only flow downhill [5]. To accomplish this, nodes need to stabilized the routing information about adjoining (one hop) nodes. The protocol performs three basic functions:

1) Route Creation: Route Creation is done by QRY and UPD packets. The route creation algorithm begins with the height (propagation ordering parameter in the quintuple) of destination set to 0 and all specific node's height set to NULL (i.e. undefined). The source broadcasts a QRY packet with the destination node's id in it. A node with a non-NULL height reacts with a UPD packet that has its height in it. A node having a UPD packet sets its height to one more than that of the node that generated the UPD. A node with higher height is marked upstream and a node with lower height downstream. In this way a directed acyclic graph is constructed from source to the destination

2) Route maintenance: When a node moves the DAG route is broken, and route maintenance is required to reestablish a DAG for the same destination. When the last downstream link of a node fails, it generates a fresh reference level. This results in the propagation of that reference level by neighboring nodes as shown in figure 7. Links are opposite to reflect the change in adapting to the new reference level. This has the same effect as reversing the direction of one or more links when a node has no downstream links.

3)Route erasure: TORA floods a broadcast clear packet (CLR) throughout the network to erase invalid routes.

TORA provides the supports of link status sensing and neighbor delivery, definitive, in-order control packet delivery and security authentication[20].

Parameters	AODV	DSR	TORA
Periodic Broadcast	Yes	Yes	Yes
Provide Loop free Router	Yes	Yes	Yes
Update Information	Route Error	Route Error	Node's height
Protocol Type	Distance Vector	Source Routing	Directed Acyclic Graph
Route Creation	By Source	By Source	Locally
Periodic Updation	No	No	No
Performance Metrics	Speed	Shortness	Speed
Routing Overhead	High	High	High
Caching Overhead	Low	High	Medium
Throughput	High	Low	Low
Multipath	No	Yes	Yes
Route Updation	Non-Periodic	Non-Periodic	High Routing Overhead

Fig 5: Comparison Table of Reactive Protocol

4.3 Hybrid Protocol:
4.3.1) ZRP (Zone Routing Protocol):

ZRP [19] aims to address excess bandwidth and long route request delay of proactive and reactive routing protocols. ZRP divides the entire network into zones of variable size. Every node in the network has a zone associated to it. The size of a zone is not determined by geographical measurement but is given by a radius of length ρ, where ρ is the number of hops to the perimeter of the zone[7]. ZRP uses proactive approach for routing inside the zone i.e. intra-zone routing protocol (IARP) and reactive approach for routing outside the zone i.e. inter zone routing protocol (IERP).

IARP is used by a node to communicate with in the nodes of its zone and is limited by the zone radius ρ. It maintains routes in zone, each node continuously needs to update the routing information in order to determine the peripheral nodes as well as maintain a map of which nodes can be reached locally[19].

IERP is used to communicate between nodes of different zones. The IERP take help from the IARP. Route discovery is done through a process called Bordercasting that uses a Bordercast Routing Protocol (BRP) to only transmit route requests to peripheral nodes.

BRP is used to direct the route requests initiated by the IERP to the peripheral nodes and also utilizes the topology information provided by IARP to construct a bordercast tree. For route requests away from areas of network, a query control mechanism is employed by BRP.

ZRP uses query control mechanisms by query detection, early termination and random query processing delay to solve this problem. In query detection mechanism, it is possible to detect queries relayed by other nodes in the same zone to prevent them from reappearing in the covered zone. Also, a node can prevent route request from entering already covered regions by using early termination. A random query processing delay can be employed to reduce the probability of receiving the same request from several nodes.[19]

ZRP is best for large networks spanning diverse mobility patterns by providing the benefits of both reactive and pro-active routing but the decision on the zone radius has a significant impact on the performance of the protocol.

4.3.2) ZHLS (Zone Based Hierarchal Link State Routing):

ZHLS based on hierarchical structure in which the network is divided into non-overlapping zones[11]. According to Joa and Lu , each node is designated a zone ID one unique node ID and, which are calculated using geographical information. Therefore the network follows a two-level topology structure: node level and zone level. Respectively, there are two types of link state updates: node level LSP (Link State Packet) and the zone level LSP.

A node level LSP contains the node IDs of its neighbors in the same zone and zone level LSP contains the zone IDs of all other zones. A node periodically broadcasts the node level LSP to all other nodes in the same zone. Therefore, through periodic node level LSP exchanges, each and every nodes in a zone keep similar node level link state information. Before transmission, the source node first checks its intra-zone routing table. If the destination occurs in its zone, the routing information is already present. Otherwise, the source sends a location request to every other zones through gateway nodes, which in turn replies with a location response containing the zone ID of the desired destination. ZHLS has a low routing overhead as compared to AODV and DSR. Also the routing path is adapted to the dynamic topology as only node ID and zone ID are required for routing [7]. The zone level topology is robust and resilient to path breaks due to mobility of nodes but the Additional overhead incurred in the creation of the zone level topology [7].

4.3.3) DDR (Distributed Dynamic Routing):

DDR proposed by Nikaein et al. based on tree-based routing protocol without the need of a root node [11]. The main idea of our proposed distributed dynamic routing (DDR) algorithm is to construct a forest from a network topology (i.e. graph G). Each tree of the constructed forest forms a zone . Then, the network is partitioned into a set of non-overlapping dynamic zones, Z1; Z2; :::; Zn. Each zone Zi contains p mobile nodes, N1; N2; :::; Np [13]. Then, each node calculates its zone ID independently. Each zone is connected via the nodes that are not in the same tree but they are in the direct transmission range of each other. So, the whole network can be seen as a set of connected zones. Thus, each node Nu from zone Zi can communicate with another node Nv from zone Zj[13].

In this strategy tree are constructed using periodic beaconing messages, which are exchanged by neighboring nodes only. These trees within the network form a forest with the created gateway nodes acting as links between the trees in the forest. These gateway nodes are regular nodes belonging to separate trees but within transmission range of each other. A zone naming algorithm is used to assign a specific zone ID to each tree within the network. Hence, the overall network now comprises of a number of overlapping zones The DDR algorithm comprise of the following six phases:

i. preferred neighbor election;
ii. intra-tree clustering;
iii. inter-tree clustering;
iv. forest construction;

v. zone naming;
vi. zone partitioning.

Each of these phases are executed based on information received in the beacon messages. During the initialization phase, each node starts in the preferred neighbour election phase. The preferred neighbour of a node is a node that has the most number of neighbours. After this, a forest is constructed by connecting each node to their preferred neighbour. Next, the intra-tree clustering algorithm is initiated to determine the structure of the zone (or the tree) and to build up the intra-zone routing table. This is then followed by the execution of the inter-tree algorithm to determine the connectivity with the neighboring zones. Each zone is then assigned a name by running the zone naming algorithm and the network is partitioned into a number of non-overlapping zones [14].

DDR does not rely on a static zone map to perform routing but In this networks with high traffic, this may also result in significant reduction in throughput, due to packets being dropped when buffers become full.[14]

4.3.4) DST (Distributed Spanning Tree Based Routing):

In DST the nodes in the network are grouped into a number of trees. Each tree has two types of nodes; route node, and internal node [11].

The root controls the structure of the tree and whether the tree can merge with another tree, and the rest of the nodes within each tree are the regular nodes. Each node can be in one three different states; router, merge and configure depending on the type of task that it trying to perform. To determine a route DST proposes two different routing strategies; hybrid tree-flooding (HFT) and distributed spanning tree shuttling (DST).

In hybrid tree-flooding, control packets are sent to all the neighbours and adjoining bridges in the spanning tree, where each packet is held for a period of time called holding time. The idea behind the holding time is that as connectivity increases, and the network becomes more stable, it might be useful to buffer and route packets when the network connectivity is increased over time [15] .In distributed spanning tree shuttling, the control packets are disseminated from the source are rebroadcasted along the tree edges. When a control reaches down to a leaf node, it is sent up the tree until it reaches a certain height referred to as the shuttling level. When the shuttling level is reached, the control packet can be sent down the tree or to the adjoining bridges.

DDR have Reduced transmission but the holding time used to buffer the packets may introduce extra delays in to the network. It relies on a root node to configure the tree, which creates a single point of failure.

Parameters	ZRP	ZHLS	DST	DDR
Routing Structure	Flat	Hierarchal	Hierarchal	Hierarchal
Multiple Routes	No	Yes	Yes	Yes
Beacons	Yes	No	No	Yes
Route Information Stored In	Intra zone & Inter zone Tables	Intra zone & Inter zone Tables	Route Tables	Intra zone & Inter zone Tables
Route Metric	Shortest Path	Shortest Path	Forwarding Using the tree neighbors	Stable Routing
Advantage	Reduced Transmissions	Low Control Overhead	Reduced Transmission	No Zone Coordinator or Zone Map
Disadvantage	Overlapping zones	Static Zone Map Required	Root Node	Neighbors may become bottlenecks

Fig 6: Comparison Table of Hybrid Protocol

V. CONCLUSION

Wireless mobile ad-hoc network has very enterprising applications in today’s world. we emphasis on a comprehensive analysis about the Mobile Ad Hoc Network (MANET).we define their applications that are used in emergency operations such as search and rescue, policing and firefighting as well as military environments, civil environments, etc. We have focused to describe and review some of routing proto-cols for MANETS. The protocols are divided into three main categories: (i) Source-initiated (reactive or on-demand), (ii) Table-driven (pro-active), (iii) Hybrid protocols. Due to mobility and high diversity of ad-hoc networks, this is quite difficult task to accomplish all the challenges with a single protocol suite. That is why many algorithms and mechanisms are designed for different scenarios. Each routing protocol has unique features. Based on network environments, we have to select the suitable routing protocol. The main differentiating factor between the protocols is the procedure of finding and maintaining the routes between source destination pairs. DSR, AODV and OLSR are preferable for tiny networks while TORA and ZRP are suitable for large networks. This article will help the fresh researchers to get their domain of interest and to identify the areas in which existing protocols are lacking.

REFERENCES

[1] Gurpreet Singh, 1 Atinderpal Singh, Performance Evaluation of Aodv and Dsr Routing Protocols for Vbr Traffic for 150 Nodes in Manets, International Journal Of Computational Engineering Research (ijceronline.com),Vol. 2 Issue. 5-2012.

[2] Anit Kumar, Pardeep Mittal, A Comparative Study of AODV & DSR Routing Protocols in Mobile Ad-Hoc Networks, Volume 3, Issue 5, May 2013,

[3] Amit Shrivastava, Aravinth Raj Shanmogavel, Nitin Chander, Overview of Routing Protocols in MANET’s and Enhancements in Reactive Protocols.

[4] Gurpinder Singh, Jaswinder Singh, MAnet: issues and behavior analysis of Routing Protocols, Volume 2, issue 4, april 2012, ISSN:227128X

[5] Rutvij H. Jhaveri,Ashish D. Patel, Jatin D. Parmar, Bhavin I. Shah, MANET Routing Protocols and Wormhole Attack against AODV, IJCSNS International Journal of Computer Science and Network Security, VOL.10 No.4, April 2010

[6] Alex Hinds, Michael Ngulube, Shaoying Zhu, and Hussain Al-Aqrabi, A Review of Routing Protocols for Mobile Ad-Hoc NETworks (MANET), International Journal of Information and Education Technology, Vol. 3, No. 1, February 2013

[7] Vivek Sharma, Bashir Alam, Unicaste Routing Protocols in Mobile Ad Hoc Networks: A Survey, International Journal of Computer Applications (0975 – 8887),Volume 51– No.14, August 2012

[8] Chintan N. Patel, Prof. Milind S. Shah, Prof. Vyomal N. Pandya, Comparison Of Reactive Routing Protocols For MANET, International Journal of Engineering Research & Technology (IJERT),Vol. 2 Issue 3, March - 2013,ISSN: 2278-0181,www.ijert

[9] Ms. Aastha kohli , Mr. Sukhbir, A Review paper on Routing Protocol Comparison, , (I J R A S E T), Vol. 1 Issue II, September2013, ISSN: 2321-9653

[10] Laraib Abbas1, Muddesar Iqbal, Muhammad Shafiq1, Saqib Rasool , Azeem Irshad,A COMPREHENSIVE REVIEW OF SOME WELL KNOWN ROUTING PROTOCOLS FOR MANETS,ijater,ISSN No: 2250-3536 Volume 3, Issue 6, Nov. 2013.

[11] Anuj K. Gupta, Harsh Sadawarti, and Anil K. Verma, Review of Various Routing Protocols for MANETs, International Journal of Information and Electronics Engineering, Vol. 1, No. 3, November 2011.

[12] Anuj K. Gupta, Harsh Sadawarti, and Anil K. Verma,A Review of Routing Protocols for Mobile Ad Hoc Networks, ISSN: 1109-2742, Issue 11, Volume 10, November 2011

[13]]Navid Nikaein, Houda Labiod and Christian Bonnet, DDR-Distributed Dynamic Routing Algorithm for Mobile Ad hoc Networks

[14] Mehran Abolhasan,Tadeusz Wysocki, Eryk Dutkiewicz, A review of routing protocols for mobile ad hoc networks,University of Wollongong Research Online, 2004.

[15] Sunil Pathak1, Dr. Sonal Jain2, A Survey: On Unicast Routing Protocols for Mobile Ad Hoc Network, International Journal of Emerging Technology and Advanced Engineering, ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 3, Issue 1, January 2013.

[16] Imrich Chlamtac a, Marco Conti b, Jennifer J.-N. Liu, Mobile ad hoc networking: imperatives and challenges, elesvier, 2003

[17] Pravin Ghosekar, Girish Katkar, Dr. Pradip Ghorpade, Mobile Ad Hoc Networking: Imperatives and Challenges ,IJCA Special Issue on “Mobile Ad-hoc Networks” MANETs, 2010

[18] Jeroen Hoebeke, Ingrid Moerman, Bart Dhoedt and Piet Demeester, An Overview of Mobile Ad Hoc Networks: Applications and Challenges

[19] Sweety Goyal, ZONE ROUTING PROTOCOL (ZRP) IN AD-HOC NETWORKS, IJREAS Volume 3, Issue 3 (March 2013) ISSN: 2249-3905.

[20] Tamilarasan-Santhamurthy, A Quantitative Study and Comparison of AODV, OLSR and TORA Routing Protocols in MANET, IJCSI International Journal of Computer Science Issues, Vol. 9, Issue 1, No 1, January 2012.