A Survey on Unicast Routing Protocols in Mobile Ad-Hoc Networks

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Abstract- MANET is a self-organized and self-configured network in which mobile nodes are freely move and the structure of network changed dynamically. In order to perform the communication among the entire network the routing is required, so the routing is challenging issue in MANET. In this paper we will discuss unicast routing protocols with their advantages and disadvantages.

Keywords: MANET, Routing Protocols, Proactive, Reactive and Hybrid.

I. INTRODUCTION

There are two types of network- wired and wireless network. The wired networks are generally connected with the help of wires and cables. In this the connection is establish with the help of physical devices like switches and hubs. In case of wireless network the radio frequencies are used to transmit and receive the packets. The wired networks are more efficient, less expensive and much faster than the wireless network. In wired network the connection speed is 100Mbps to 1000Mbps.

Ad-hoc networks are wireless network in which nodes communicate with each other through multi-hop links. In this no fixed base station and infrastructure present for communication. For sending and receiving packets from other node the nodes itself acts as router or transferring packets. Ad hoc radio networks have various application areas. Some areas are mentioned as military, emergency, conferencing and sensor applications [3].

II. ROUTING IN MANET

The process of finding the path from source to destination in the network is called routing. The main requirements for designing ad-hoc routing protocols are-low overhead, adaptiveness and resilience to loss. There are two activities associated with routing-determine optimal routing paths and transferring the packets through an internetwork.
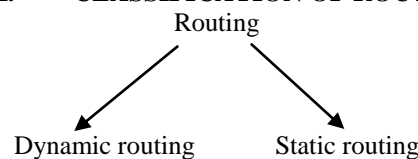
III. CLASSIFICATION OF ROUTING

Routing

Dynamic routing   Static routing

Fig.1 Types of routing

Dynamic routing- This type of routing depends on the state of the network, means in this routing tables are affected by the activeness of the destination [1].

Static routing- Static routing maintain routing tables which is maintain by network administrator.

TYPE CAST ROUTING

Another type of classification can be done via, type caste property [6]. That are-
- UniCast
- GeoCast
- MultiCast

i) UniCast- UniCast means one to one.
ii) GeoCast- Geocast is to deliver the data to a group of nodes which are situated inside a specified geographical area [6].
iii) MultiCast- Muticast means one to many.

Routing protocols

Routing protocols has several metric which is used to find the best path for sending/transmit the packets to its destination.

IV. CLASSIFICATION OF ROUTING PROTOCOLS IN MANET

Routing protocols define a set of rules which governs the journey of message packets from source to destination in a network [8].
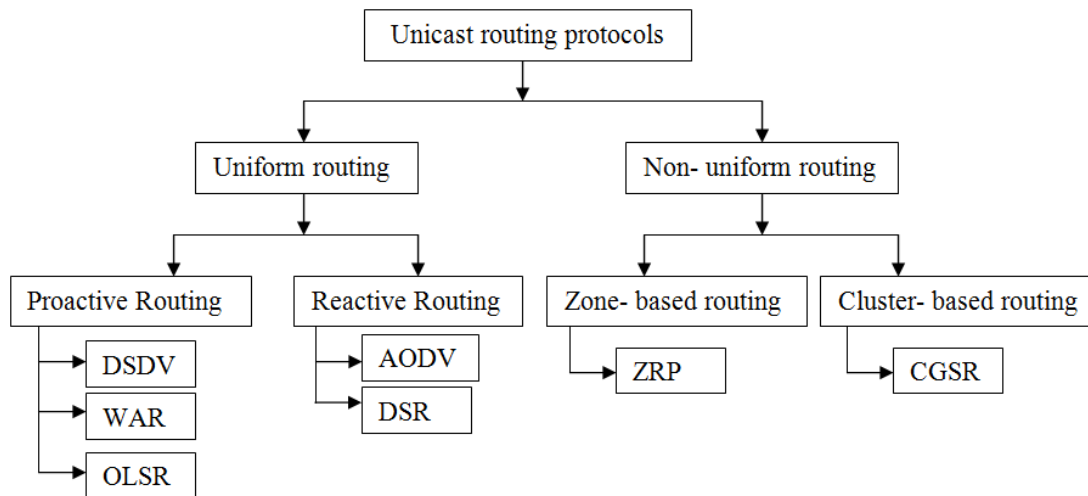

Fig.2 Classification of unicast Routing protocols

Proactive Routing protocols- Proactive Routing protocols are also known as table-drive routing. In this each node maintain the network topology information in the form of tables. These tables are periodically exchange to get up to date view of network. Example of proactive routing protocols are- DSDV, WAR and OLSR.

Reactive Routing protocols- Reactive Routing protocols are also known as on-demand routing protocols. In this the route is establish on the basis of demand means when the route is required then it is establish. Example of routing protocols are- AODV, DSR etc.

Hybrid Routing protocols- Hybrid Routing protocols are the combination of both these protocols proactive and reactive routing protocols. This routing protocol takes the advantages of both these protocols. For example ZRP.

Advantages- Proactive Routing protocols vs Reactive Routing protocols

In proactive the route is available all the time to send the packets to any other mobile node. In reactive the route is established on the basis of demand and they are bandwidth efficient protocols. In this less communication overhead [4] .

Disadvantages- Proactive Routing protocols vs Reactive Routing protocols

In proactive the resource consumption is more to maintain the up to date view of network. In reactive the response time is very high.

1. **Proactive Routing protocols**
i. **DSDV (Destination Sequenced Distance Vector) Routing Protocol-** DSDV is a table driven routing protocol in which each node maintain a table that contain the shortest distance. DSDV is the first routing protocol in ad-hoc which is proposed by Bell-man Ford algorithm. In DSDV table updates with increasing sequence number. Sequence number is used to avoid the formation of loops, this sequence number generated by the source node. There are two ways to update tables- incremental update and full-dump. In incremental update it takes single network data packet unit (NDPU). In full-dump it takes multiple network data packet units (NDPU). The objective of this protocol is to find optimum routes.
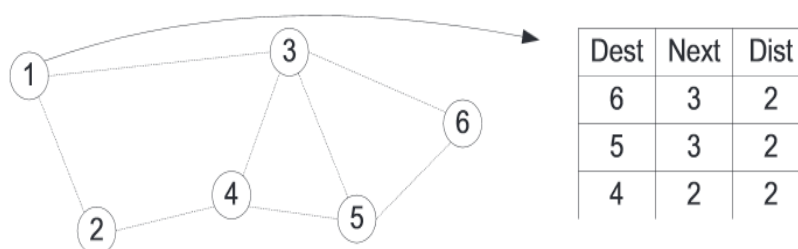

Fig.3: Example of routing table in DSDV

Advantages- 1.minimum delay 2. Route is available for all the nodes 3. Up to date view of network 4. Adaptable with the ad-hoc 5. Provide loop free path.

Disadvantages- 1.lot of control overhead 2.not scalable 3.count to infinity problem 4.convergence of routing protocols is slow 4.doesnot support multipath routing.

ii. **WARP (Wireless Ad-hoc Routing Protocol)- Wire**less routing protocol is the extension of DSDV. It inherits the properties of distributed Bellman-Ford algorithm. This routing protocol is designed to remove count to infinity problem. Like DSDV, WAR also provide the up-to-date view of network. WAR uses a set of tables to maintain more accurate information. These tables are- Distance table, Routing table, message passing retransmission table and link cost table. Distance table contain the network view of the neighbors of a node. Routing table provide up-to date view of the network for all known destination. It also keeps the shortest distance, predecessor node, successor node and a flag which indicate the status of the path. Link cost table contain the cost. The cost of broken links is infinity. Message retransmission list maintain the information of all messages.

Advantages- 1.solve count to infinity problem 2.faster convergence
Disadvantages- 1.Lot of memory required 2. Not suitable for large mobile ad-hoc network

iii. **OLSR (Optimized Link State Routing) -** OLSR is a proactive protocol. OLSR routing protocol is divided into three main modules that are- neighbor sensing, optimized flooding, link state messaging and route calculation. In neighbor/link sensing the links and neighbors are detected by hello messages. All the nodes transmit hello messages at a regular interval. The optimized flooding and multipoint relaying is used to reduce the number of duplicate retransmission while forwarding a broadcast packet. In link state messaging all nodes floods the network with link state information.
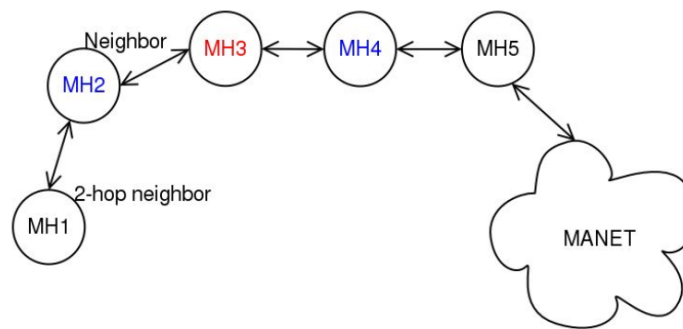

Fig.4 OLSR (neighborhood)

Advantages -1.Reduce size of control message 2. Minimize flooding 3. Supports nodes mobility 4. routes already known

2. **Reactive Routing protocols**

i) **AODV (Ad-hoc On-demand Distance Vector) Routing Protocol- A**ODV is based on Bellman-Ford Distance algorithm. It is on-demand routing protocol. In this route is route is find from source to destination only on demand basis. AODV is beacon-full routing protocol means exchanging of hello message to make the relationship with the neighbors. There are different phases- route discovery phase, route maintenance phase, route table management and local connectivity management [1]. In route discovery phase the source node communicate with the destination node through the intermediate nodes. The route request (RREQ) send by the source node. This RREQ contain source address, destination address, source sequence number, destination sequence number, broadcast-id and TTL. The sequence number is used to avoid the loops. The source sequence number and destination sequence number are used to maintain the latest information of nodes. The (Source address and broadcast-id) pair is used to identify the RREQ uniquely.
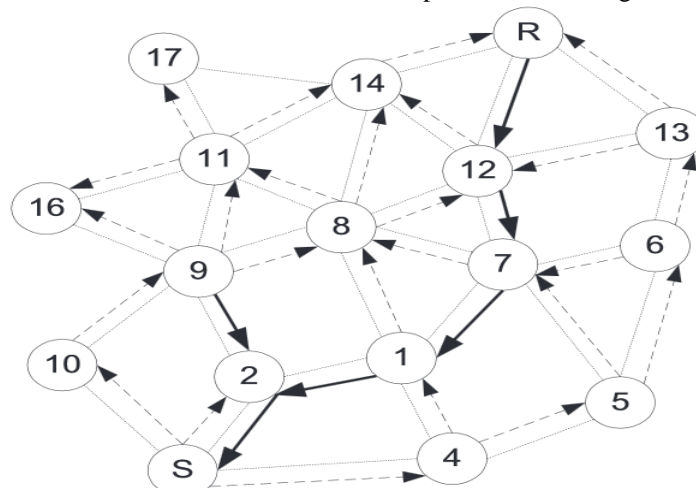When a node discover link break then it broadcasts route error packet to its   neighbors [2].
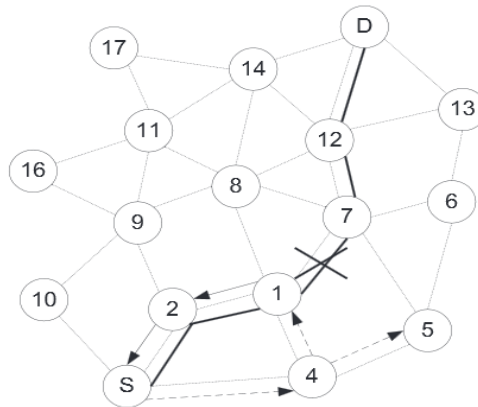

Fig. 5 Route establishment in AODV

Fig. 5 Route maintenance in AODV

Advantages- 1.route is establish on the basis of demand. 2. Connection setup delay is less. 3.used for both unicast and multicast.

Disadvantages- 1.uneccessary bandwidth consumption 2.Stale cache 3.intermediate node not have latest information. 4. no reuse of routing information.

ii) **DSR (Dynamic Source Routing) Protocol**- DSR is an on-demand routing protocol means route is establish when it is required. It is beaconless routing protocol (no hello packets are exchanged). These hello packets are used to inform its neighbors of its presence. Initially source node does not have the route to send the first packet to the destination. DSR has two functions- route discovery and route maintenance. When a source node wants to send a packet to the destination then first it check in its route cache if it has valid route then it send the packet, but if there is no route available then source node initiate the route discovery process by sending the RREQ packets to all neighbor nodes.
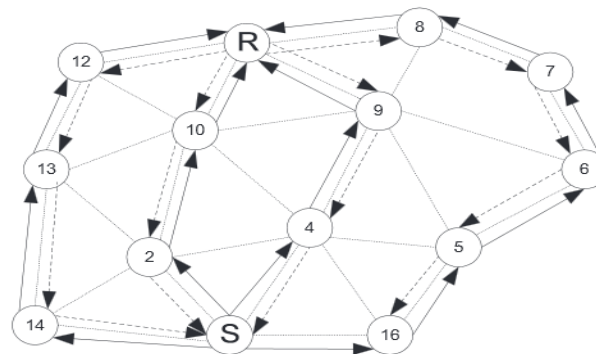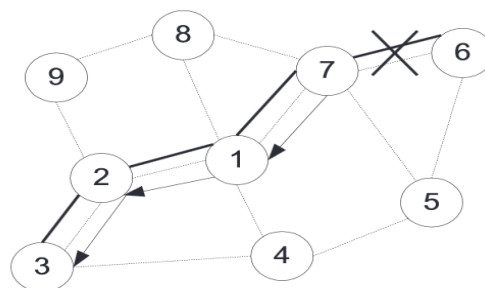

Fig. 6 Route establishment in DSR

Fig.7 Route failure notification in DSR

Advantages- 1.route is establish when required 2.no more tables used
Disadvantages- 1.header size increases 2.suitable for small network.

3. **Hybrid Routing protocols**
i) **ZRP (Zone Based Routing Protocol)-** Zone Based Routing Protocol is the hybrid routing protocol, which is combination of best feature or proactive and reactive protocols. ZRP uses proactive protocols for finding zone neighbors and use reactive protocol for routing purpose [5]. In ZRP the nodes have routing zone which define a range in terms of hop that each node is required to maintain network connectivity [7]. The routing processes inside the zone are performed by the Intrazone routing protocol (IARP) and to communicate with different zone is performed by Interzone routing protocol (IERP). To optimize the routing process between perimeter nodes is done by Bordercast Resolution Protocol (BRP) [5] also used to control traffic between zones.
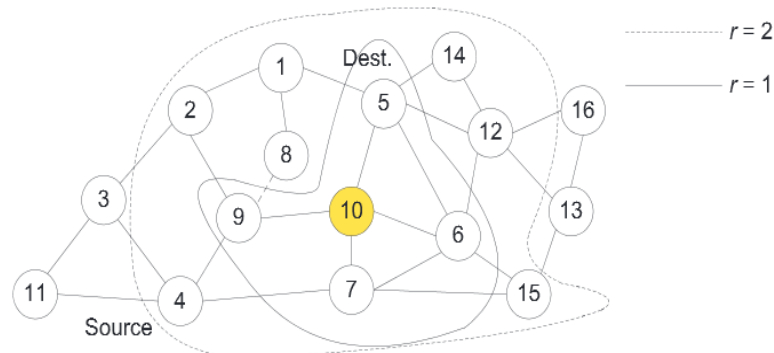
For r = 2: 5, 6, 7, 9 are interior nodes 14, 12, 15, 4, 2, 8, 1 are peripheral nodes

Fig. 8 Zones in ZRP for node 10

ii) CGSR (Cluster-head Gateway Switched Routing) Protocol- CGSR is hierarchical network topology. It is table driven routing protocol that employ flat topology. GGSR organize the nodes into cluster form. The members of cluster choose the cluster head. The election of cluster head is done on the basis of least cluster count (LCC) algorithm. According to this algorithm three parameters are used- 1.lower ID 2.Less mobility 3.higher connectivity.

Generally the nodes which are one hop away make cluster. In LLC if the tie is occur between nodes then the head is elected in the basis of lower ID. The node which is common in both clusters is called gateway. The communications between to clusters are done through the gateway. In CGSR two tables are maintain- 1.member table 2.routing table. The member table maintains the list of all nodes of cluster and the routing table maintains the route information.
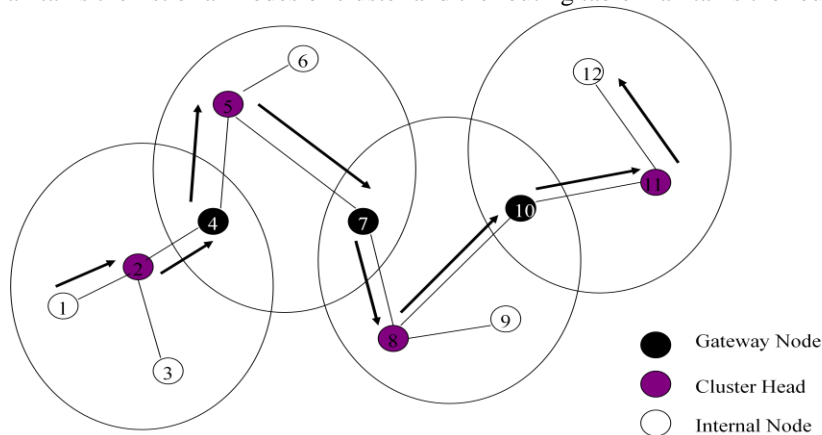

Fig.9 CGSR: routing from node 1 to node 8

Advantages -1.better bandwidth utilization 2.scalable at low mobility environment.
Disadvantages - 1.increase path length.

V. CONCLUSION

In this paper, we have described unicast routing protocols for mobile ad-hoc networks (focusing on proactive, reactive and hybrid protocols.

Table 1 compression of three routing protocols

Parameters	Proactive Protocols	Reactive Protocols	Hybrid Protocols
Routing Scheme	Table-driven	On-demand	Combination of both
Routing overhead	High	low	medium
Storage capacity	High	low	Depend on the size of zone
Periodic update	Yes	Not needed as the route is available on demand	Yes needed inside the zone
latency	Low	high	Inside the zone is low, and outside is high

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