1 INTRODUCTION:

Mobile Ad- Hoc Networks (MANETs) have evolved rapidly in the field of wireless networks. These are infrastructure less networks where routers and hosts providing access points are not fixed. In case if a mobile user away from an access point needs to send or receive data packets, this is facilitated by radio transmission and receiving ability of mobile phone with help of other nearby existing nodes creating dynamic networks. In literature MANETs are defined as “an autonomous system of mobile routers (and associated hosts) connected by wireless links – the union of which form an arbitrary graph”

A network can be characterized as wired or wireless. Wireless can be distinguished from wired as no physical connectivity between nodes is needed. Routing is an activity or a function that connects a call from origin to destination in telecommunication networks and also plays an important role in architecture, design and operation of networks. Ad-hoc networks are wireless networks where nodes communicate with each other using multi-hop links. There is no stationary infrastructure or base station for communication. Each node itself acts as a router for forwarding and receiving packets to/from other nodes. Routing in ad-networks has been a challenging task ever since the wireless networks came into existence. The major reason for this is the constant change in network topology because of high degree of node mobility. A number of protocols have been developed for accomplish this task. Some of them are DSDV and AODV routing protocols which are explained in the forthcoming chapters.
We can categorize wireless network in primarily following two categories.

![Diagram of Wireless Network with subcategories: Infrastructure Network and Ad Hoc Networks]

**Fig 1. Mobile Ad-Hoc Networks**

**1.1.1 Infrastructure networks:**

An Access Point (AP) represents a central coordinator for all nodes. Any node can be joining the network through AP. In addition, AP organizes the connection between the Basic Set Services (BSSs) so that the route is ready when it is needed. However, one drawback of using an infrastructure network is the large overhead of maintaining the routing tables. Infrastructure network as shown in Figure 2.

![Diagram of Infrastructure network with nodes connected via Wi-Fi]

**Fig 1.1.1. Infrastructure networks**
1.1.2. Ad Hoc networks: -

Wireless ad hoc network is a decentralized type of wireless network. The network is ad hoc because it does not rely on a preexisting infrastructure, such as routers in wired networks or access points in managed (infrastructure) wireless networks. Ad Hoc networks do not have a certain topology or a central coordination point. Therefore, sending and receiving packets are more complicated than infrastructure networks.

A MANET is a collection of mobile nodes sharing a wireless channel without any centralized control or established communication backbone. MANET has dynamic topology and each mobile node has limited resources such as battery, processing power and on-board memory. This kind of infrastructure-less network is very useful in situation in which ordinary wired networks is not feasible like battlefields, natural disasters etc. The nodes which are in the transmission range of each other communicate directly otherwise communication is done through intermediate nodes which are willing to forward packet hence these networks are also called as multi-hop networks.
1.2 CLASSIFICATION OF ROUTING PROTOCOLS:-

Routing protocols define a set of rules which governs the journey of message packets from source to destination in a network. In MANET, there are different types of routing protocols each of them is applied according to the network circumstances.

Figure as given below shows the basic classification of the routing protocols in MANETs.

![Classification of routing protocol of Manet](image)

Fig.1.2: Classification of routing protocol of Manet.

Routing Protocol of MANET
1.2.1 Proactive Routing Protocols:-

Proactive routing protocols are also called as table driven routing protocols. In this every node maintain routing table which contains information about the network topology even without requiring it. This feature although useful for datagram traffic, incurs substantial signaling traffic and power consumption. The routing tables are updated periodically whenever the network topology changes. Proactive protocols are not suitable for large networks as they need to maintain node entries for each and every node in the routing table of every node. These protocols maintain different number of routing tables varying from protocol to protocol. There are various well known proactive routing protocols. Example: DSDV, OLSR, WRP etc.

i) Dynamic Destination-Sequenced Distance-Vector Routing Protocol (DSDV)
DSDV is developed on the basis of Bellman–Ford routing algorithm with some modifications. In this routing protocol, each mobile node in the network keeps a routing table. Each of the routing table contains the list of all available destinations and the number of hops to each. Each table entry is tagged with a sequence number, which is originated by the destination node. Periodic transmissions of updates of the routing tables help maintaining the topology information of the network. If there is any new significant change for the routing information, the updates are transmitted immediately. So, the routing information updates might either be periodic or event driven. DSDV protocol requires each mobile node in the network to advertise its own routing table to its current neighbors. The advertisement is done either by broadcasting or by multicasting. By the advertisements, the neighboring nodes can know about any change that has occurred in the network due to the movements of nodes. The routing updates could be sent in two ways: one is called a “full dump” and another is incremental. In case of full dump, the entire routing table is sent to the neighbors, whereas in case of incremental update, only the entries that require changes are sent.

ii) Wireless Routing Protocol (WRP):

WRP belongs to the general class of path-finding algorithms, defined as the set of distributed shortest path algorithms that calculate the paths using information regarding the length and second-to-last hop of the shortest path to each destination. WRP reduces the number of cases in which a temporary routing loop can occur. For the purpose of routing, each node maintains four things:

1. A distance table
2. A routing table
3. A link-cost table
4. A message retransmission list (MRL).

WRP uses periodic update message transmissions to the neighbors of a node. The nodes in the response list of update message (which is formed using MRL) should send acknowledgments. If there is no change from the last update, the nodes in the response list should send an idle Hello message to ensure connectivity. A node can
decide whether to update its routing table after receiving an update message from a neighbor and always looks for a better path using the new information. If a node gets a better path, it relays back that information to the original nodes so that they can update their tables. After receiving the acknowledgment, the original node updates its MRL. Thus, each time the consistency of the routing information is checked by each node in this protocol, which helps to eliminate routing loops and always tries to find out the best solution for routing in the network.

(iii) Cluster Gateway Switch Routing Protocol (CGSR):

CGSR considers a clustered mobile wireless network instead of a “flat” network. For structuring the network into separate but interrelated groups, cluster heads are elected using a cluster head selection algorithm. By forming several clusters, this protocol achieves a distributed processing mechanism in the network. However, one drawback of this protocol is that, frequent change or selection of cluster heads might be resource hungry and it might affect the routing performance. CGSR uses DSDV protocol as the underlying routing scheme and, hence, it has the same overhead as DSDV. However, it modifies DSDV by using a hierarchical cluster-head-to-gateway routing approach to route traffic from source to destination. Gateway nodes are nodes that are within the communication ranges of two or more cluster heads. A packet sent by a node is first sent to its cluster head, and then the packet is sent from the cluster head to a gateway to another cluster head, and so on until the cluster head of the destination node is reached. The packet is then transmitted to the destination from its own cluster.

1.2.2 Reactive Routing Protocols:

Reactive routing protocol is also known as on demand routing protocol. In this protocol route is discovered whenever it is needed. Nodes initiate route discovery on demand basis. Source node sees its route cache for the available route from source to destination if the route is not available then it initiates route discovery process. The on-demand routing protocols have two major components.
1.2.3 Hybrid Routing Protocol:

There is a trade-off between proactive and reactive protocols. Proactive protocols have large overhead and less latency while reactive protocols have less overhead and more latency. So a Hybrid protocol is presented to overcome the shortcomings of both proactive and reactive routing protocols. Hybrid routing protocol is combination of both proactive and reactive routing protocol. It uses the route discovery mechanism of reactive protocol and the table maintenance mechanism of proactive protocol so as to avoid latency and overhead problems in the network. Hybrid protocol is suitable for large networks where large numbers of nodes are present. In this large network is divided into set of zones where routing inside the zone is performed by using reactive approach and outside the zone routing is done using reactive approach.