

## Collation of Mobile Ad-Hoc Network Protocols

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**Abstract.** Mobile ad-hoc network means moving and temporary networks i.e. without any prior infrastructure. So MANET is a network that provides easy way to exchange packet while moving from one state to another. They are deployed in 1990's and after that, they are researched for a long time. Basically, these are a collection of nodes that is connected through a wireless medium forming rapidly changing topologies. To provide efficient end to end communication they demand new strategies to be implemented. As the demand for wireless devices are growing rapidly because of the features that provide flexibility and reliability which includes computed speed, portability of devices etc. MANETS represent complex distributed systems that comprise wireless mobile nodes that can freely self-organise arbitrary and temporary network technologies. These are useful where infrastructure is not possible, where; people and devices are allowed to work seamlessly e.g. Disaster Recovery Environments. Routing in MANET although face challenges due to frequent change in topologies but they can be dealt and provide advantages to us. This paper is an overview of routing protocol, Challenges and protocol comparisons of MANET.

**Keywords:** Mobile ad-hoc network, Routing Protocols comparisons, applications and Challenges.

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### I. INTRODUCTION

The mobile computing and communication devices (e.g., cell phones, laptops, handheld digital devices, personal digital assistants) become a soul part of everyone's life. We are moving from wired structure to more flexible and freedom to use i.e. wireless networks. The wireless network contains many nodes which connect with each other in a random fashion via wireless network devices. Mobile Wireless Networks can be categorized into two types of network structure: Infrastructure and infrastructure-less networks. Infrastructure networks are those required a fixed platform so to connect every node with each other i.e. they require a base station and each node must be in the range of a base station. Each base station provides access to nodes so that they can communicate. Mobile phones and wireless local area network are the best-suited examples for them.

The infrastructure-less network are those don't require any fixed infrastructure but they can be operated via a wireless network and MANET is an example of it. A MANET provides connection to a group of mobile users in slow wireless links via topologies. Topologies can be varied time to time but nodes remain mobile. These can be used as both modes i.e. standalone or with internet i.e. with large interconnected networks. They don't need base stations or infrastructure to work with. MANETs has various characteristics like Bandwidth-constrained, Variable capacity links, Energy constrained Operation, Limited

Physical Security, Dynamic network topology, Frequent routing updates. Routing in ad hoc networks is more complex than compared to traditional one. A mobile ad hoc network with 6 nodes:

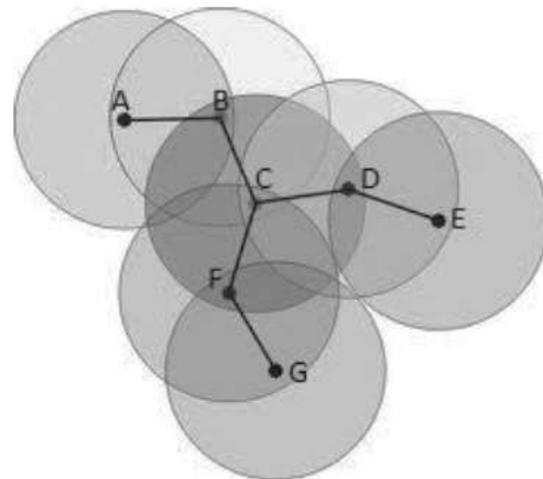


Fig. 1 Mobile ad hoc Network

### II. ROUTING PROTOCOLS

Protocols are set of rules to define the journey of packets that moves through wireless networks. We use different types of protocols in MANET. Fig. 2 shows the classification of MANET:

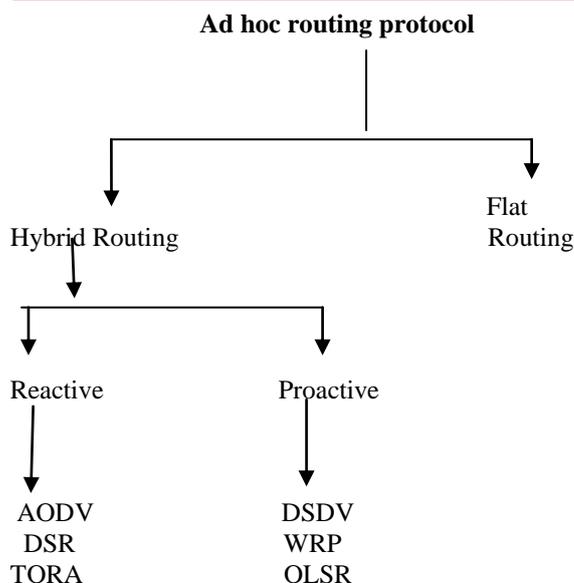


Fig. 2: Classification of MANET

**A. Proactive Routing Protocols:**

Proactive routing protocols are also called as table driven routing protocols. In this, each node has its routing table which contains details about the network topology even if it is not required. As the network topology changes routing tables get updated periodically[3]. Proactive protocols are not advised for large networks as they need to maintain node entries for each and every node in the routing table of every node. There are number proactive routing protocols such as - DSDV, OLSR, WRP etc.

Table 1 shows the comparison of various proactive routing protocols:

Parameters	DSDV	WRP	OLSR
Route updates	Periodic	Periodic	Periodic
Loop-free	High	High	Low
Routing Overhead	Medium	High	High
Caching overhead	Medium	High	High

Table 1: Comparison of Proactive Routing Protocols

**B. Reactive Routing Protocols:**

Reactive routing protocol also called as the on-demand routing protocol. In this protocol, nodes are searched only when they required Route discovery is initiated only when demanded by nodes. A source node acquired a node by the initiation of a route discovery process.

This routing protocol has two major components:

1) Route discovery-

In this phase source node initiates route discovery on demand basis. Source nodes consult its route cache for the available route from source to destination otherwise if the

route is not present it initiates route discovery. The packet of the source node includes the address of the destination node as well address of the intermediate nodes to the destination.

2) Route maintenance-

Due to dynamic topology of the network route failure occurs between the nodes due to link breakage, so maintenance of route is required. Whenever nodes exchange information one node acknowledges the other by sending packets, therefore, node maintenance is possible in it. There are many reactive routing protocols such as DSR, AODV, TORA, and LMR. Table 2 shows the comparison of reactive routing protocols:

Parameter	AODV	DSR	TORA
Route Creation	By source	By source By	Locally
Periodic updating	No	No	No
Performance Matrix	Speed	Shortness	Speed
Routing overhead	High	High	High
Caching overhead	Low	High	Medium
Throughput	High	Low	Low

Table 2: Comparison of Reactive Routing Protocols

**C. Hybrid Routing Protocol:**

This protocol is a trade-off between proactive and reactive protocols. Proactive protocols have more overhead and less latency while reactive protocols have less overhead and more latency [4]. Thus Hybrid routing protocol overcomes the shortcoming of both proactive and reactive routing protocols. This protocol is a combination of both proactive and reactive routing protocol. It uses features of both protocols like it uses table maintenance mechanism, so that history of protocols can be stored, of proactive protocol and demand mechanism of the reactive protocol. These features overcome the latency and overhead problem network

The hybrid protocol is appropriate for large networks where large numbers of nodes are present. In this, a large network is divided into a set of zones where routing inside the zone is done by using a proactive approach and outside the zone, routing is done using reactive approach. There are various hybrid routing protocols for MANET-like ZRP, SHRP etc.

**III. CHARACTERISTICS OF MANET**

- 1) The absence of Infrastructure- ad-hoc network don't have any fixed infrastructure. So they work without any base station.
- 2) Autonomous behavior- In MANET, each node can act like host and router. Therefore each node can send packets and also decide the route for switching of packets. So endpoints and switching are difficult to distinguish.
- 3) Dynamically changing topology- Due to mobile nodes, the change in topology is frequent and dynamic in nature [9]. Therefore

nodes being mobile in nature connects to each other in a random fashion and route also varies as the location associated with node varies.

- 4) Multi-hop transmission- when both source node and destination node exceed the range or out of range then MANET provide them an intermediate path to travel and exchange packets. It provides multi-hop transmission of packets whenever necessary.
- 5) Distributed nature of operation- There is no fixed and central structure here to operate therefore node itself takes the responsibility of all internal security and routing.
- 6) Inferior link capacity- The reliability, scalability, efficiency and capacity of wireless links are often less when compared with wired links. One end to end path can be shared by several sessions. The terminals communicate through which channel is subject to noise, fading, interference and has less bandwidth than a wired network. This shows the fluctuating link bandwidth of wireless links. Symmetric environment- All nodes have identical features with similar responsibilities and capabilities. Every node can function as a router or host and hence it forms completely symmetric environment.
- 7) Lightweight features- MANET nodes are mobile devices that have less CPU processing capability, low power storage, and small memory size.

#### IV. APPLICATIONS OF MANET

##### 1) Military battlefield-

MANET is primarily designed for military as it is not possible to design infrastructure everywhere. So to communicate in between battlefield it is necessary to deploy such devices which can work with temporary environment and infrastructureless bases. MANET helps them to communicate on urgent basis.

##### 2) Commercial sector-

Ad hoc can be used in emergency/rescue operations where fixed infrastructure is not possible but severe need of communication is needed. Natural calamities like flood earthquake where every system collapsed MANET proved very helpful for such operations.

##### 3) Local level-

Ad hoc networks can autonomously link an instant and temporary multimedia network using notebook computers or palmtop computers to spread and share information among participants at a conference. Another appropriate local level application might be in home networks where devices can communicate directly to exchange information.

##### 4) Personal Area Network (PAN)-

Short-range MANET can simplify the intercommunication between various mobile devices (such as a mobile phone, laptops, and wearable computers)[7]. Traditional wired

cables are replaced with wireless connections. MANET can also extend to access the Internet or other networks by mechanisms e.g. Wireless LAN.

#### EFFECTS ON PROTOCOL STACK:

Each layer has its own issues. Since there are central managements and fixed infrastructure our communication protocol stack face different challenges.

At application layer: - new kind of application required due to the network structure, new methods for authentication and encryption required.

For transport layer: - in this layer, there is no central management so issues regarding congestion control, flow control etc needs to be addressed.

At the network layer: -new types of protocols required here.

A new media access techniques will be required.

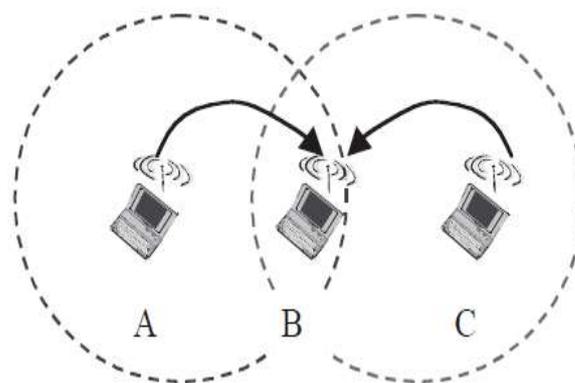
At the physical layer: -different wireless link related issues needs to address for example spectrum usage, allocation of spectrum etc.

#### PROBABILITY OF PACKET COLLISION:-

MANET uses broadcasting and shared media transfer, therefore, chances of packet collision and contention of media are more. The wireless process uses half duplex transmission.

And still node shares the same media, therefore, collision can occur. This is different from the LAN or WLAN. Because here other collision detection system will not work properly. A new type of congestion control protocol required.

When one node try to reach the other node but it doesn't find that some other node is also contacting it because another node is out of range. The collision can possibly occur.

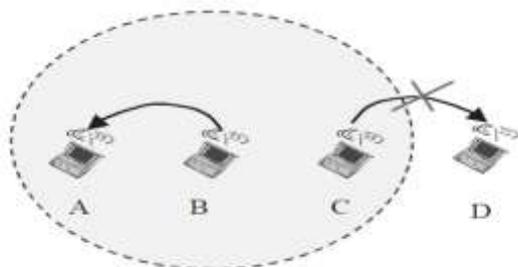


#### PROBLEM OF THROUGHPUT:

The exposed terminal problem occurs when a node wants to transmit a packet to other node but it senses that route is busy due to some intermediate node but actually, it wasn't busy then delayed in packets can happen. which result in the problem of throughput

Fig below depicts a typical scenario in which the exposed terminal problem may occur which affects throughput

Let us assume that terminals A and C can hear transmissions from B, but terminal A cannot hear transmissions from C. Let us also assume that terminal B is transmitting to A, and terminal C has a frame to be transmitted to D. According to the CSMA scheme, C senses the medium and finds it busy because of B's transmission, and, therefore, denies from transmitting to D, although this transmission would not result in a collision at node A. The exposed terminal problem may thus result in loss of throughput.



## V. CONCLUSION:-

In proactive protocols, the topological information is exchanged among all the nodes in a network. In contrast to source initiated routing, table driven routing has extensive precedents in the research done for routing in the wired domain. Also, wired routing protocols have inspired their own classes of protocols table driven ad hoc routing. One of these classes is the distance vector protocols where the nodes maintain only a local topology, and use the distributed Bellman-Ford algorithm to maintain the routing tables, the other class of protocols is the link state routing protocols, where the routers exchange full topology information, and then use a graph-theoretic shortest path

algorithm (Dijkstra's) on the resulting graph. However, these protocols differ in the way routing information is updated and detected, the number of routing tables used, the type of information stored in each table and the changes that are periodically broadcasted in the network. This class of routing protocols has its own advantages and disadvantages. One of its main advantages is that the nodes can easily get routing information and it's easy to establish a session. The disadvantage is too much data stored by the nodes for route maintenance and it is slow to restructure when there is a failure in a particular node link.

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