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# A Survey on Mobile Ad-hoc Networks

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***Abstract---A Mobile Ad-Hoc Network (MANET) is an aggregation of mobile nodes which communicate with each other via wireless link either directly or relying on other nodes as routers. The operators of MANETs are independent of pre-existing infrastructure or base station. Network nodes in MANETs are authorized to move randomly. As the nodes are mobile in nature, network topology of MANET is prone to dynamic changes without turning to any existing centralized administration. This paper provides focus on the various aspects of MANET like architecture, characteristics, challenges, glimpse of routing protocols used for MANET.***

***Keywords---mobile Ad-hoc network (MANET), routing, proactive routing, reactive routing, UMTS.***

## I. INTRODUCTION

In the last few decades, mobile communication has evolved rapidly. New communication standards have resulted in long lasting batteries, higher bandwidths and smaller devices. Self organizing Ad-hoc networks has gained popularity as well [1]. An ad hoc wireless network comprises of a collection of geographically distributed nodes communicating over wireless links without the aid of any fixed infrastructure or central administration [2].

### 1. Ad-hoc Networks. (Architecture)

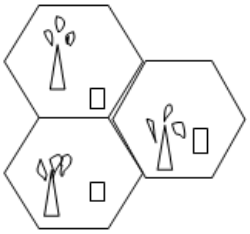
A MANET is a multi-hop ad-hoc wireless network in which nodes can move arbitrary in the topology. The network does not require any given infrastructure and can be set up quickly in any environment. The deployment of this kind of network has grown rapidly in the last years as well. Wireless mobile ad hoc network is a network where each network node not only acts as a host but also acts as a router. Since the nodes are mobile in nature, the environment is highly dynamic [2].

### 1.1 Wireless communication

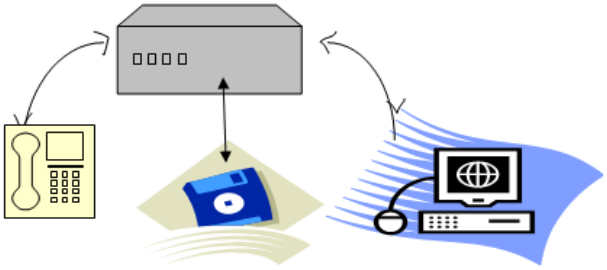
While in wired communication networks some infrastructure has to be setup, wireless communication can occur with or without connecting to special infrastructure [1].

#### 1.1.1 Wireless communication with infrastructure

In wireless communication based upon special infrastructure, such as the GSM or UMTS networks or wireless LANs in infrastructure mode a special dedicated base station or access point is necessary. The nodes participating in the network have to register themselves at this base station or access point. All communication then is realized through these central coordination nodes [1].



Picture 1: Cellular mobile communication with Infrastructure



Picture 2: WLAN in infrastructure mode

### 1.1.2 Wireless communication without infrastructure

In contrast to the communication with infrastructure, the communication in Ad-hoc networks is organized completely decentralized. There is no central entity regulating or controlling network traffic. All nodes can be at the same time nodes originating and receiving network traffic as well as forwarding traffic for other nodes. Therefore, they can act as terminal node and as router simultaneously [1].

### CHARACTERISTICS OF MANETs

The main characteristics of MANET are:

1. Dynamic topologies: The nodes are mobile and can move randomly thus causing the network topology to change rapidly at unpredictable times.
2. Bandwidth constrained: In wireless communications, the links have very low capacity as compared to hard-wired links. In practice, the realized throughput of a wireless network is assumed to be less than radio's maximum transmission rate.
3. Energy constrained operation: The mobile nodes in the network rely on batteries for their operation. Thus, the most important criteria when designing a system for MANET may be energy conservation.
4. Limited physical security: In general, radio networks are more vulnerable to security attack as compared to fixed networks. There is a chance of eavesdropping, spoofing and denial of-service attack. In addition to this, there is no centralized administration in MANET, thus it offers robustness against single point of failure [2].

### CHALLENGES…

The major challenges faced during routing in MANET are listed below:

1. While designing routing algorithm, it is assumed that all nodes have same transmission range, or in other words, symmetric links exist between nodes. But in mobile ad hoc networks, the nodes repeatedly change their location and therefore, the concept of symmetric links does not apply here.
2. As the topology of MANET is highly dynamic, some stale routes are generated in routing table, which adds to the routing overhead of the protocol.
3. The mobile nodes operate on batteries; therefore, to conserve energy, routing protocol should be able to optimize its operations [2].

## II. ROUTING PROTOCOLS

Routing protocol in MANET can be classified in many ways depending on routing algorithm and network organization. Depending on the structure of network, it is classified as flat, hierarchical routing and geographic position assisted, while based on choice of routing strategy, they are divided into table driven or on-demand [2].

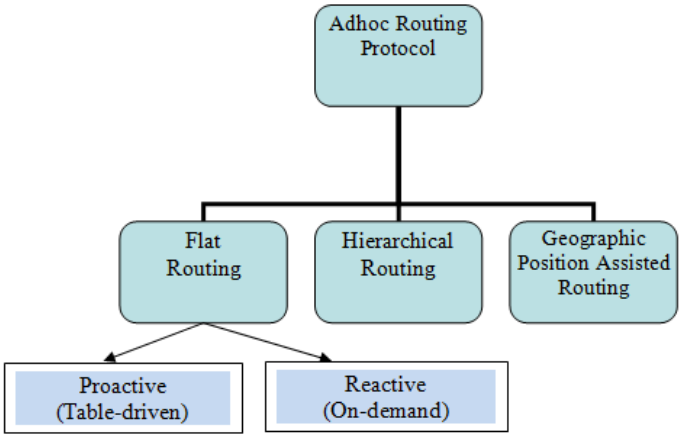



Figure 2.1.Classification of routing protocol in MANET.

The routing protocols are categorized as follows: -

1) Proactive (Table-Driven) Routing Protocol
2) Reactive (On-Demand) Routing Protocol
3) Geographic Routing Protocol
4) Hierarchical Routing Protocol
5) Hybrid Routing Protocol

**Proactive (or Table-driven) routing protocols** maintain routing information about each node in the network. The information is periodically updated throughout the network or when topology changes. Each node stores its routing information [3]. For example, DSDV.

**Pros**

- No Route Discovery is required.
-Exhibit low Latency for real time applications.

**Cons**

- A significant part of the available
Bandwidth is occupied by unused paths [4].

**Reactive or On-demand routing protocols** look for the routes and are created as and when required. The route discovery mechanisms are applied to find the path to the destination [3]. For example: Ad-Hoc On-demand Distance Vector (AODV), Dynamic Source Routing (DSR).

**Pros**

-To update routing table periodic flooding of the network is not required. It is done only when required.
-Beaconless the bandwidth is preserved [4].

**Cons**

- For route finding latency is high.
- Flooding of the network beyond limit causes disruption of nodes communication [4].

**Geographic routing** is a routing that each node knows it's own & neighbor node geographic position by position determining services like GPS. No routing table is maintained or exchanges any link state information with neighbor nodes. Information gathered from GPS device is used for routing decision.

**Pros**

- There is no need for route discovery & management.
-Scalability.
-Support for high node mobility pattern.

**Cons**

-position determining services are required.
-GPS device is unable to work in tunnel because satellite signal is absent there [4].

**Hierarchical routing protocol** Nodes are organized in clusters, Cluster head "controls" cluster, one or multiple levels of hierarchy [3].

**Hybrid routing protocol** It is proactive for neighborhood, Reactive for far away (Zone Routing Protocol), for Proactive for long distance, reactive neighborhood [3].

Table1 Topology based routing types

| TYPE | STRATEGY | STRENGTH | LIMITATION |
|---|---|---|---|
| **Proactive** | Route table maintain in background by regular control packet broadcast | Route is always available on lookup | Takes significant bandwidth by maintaining unnecessary link information |
| **Reactive** | Route discovery by network flooding as communication requested | Less bandwidth requires compares to proactive | Route finding process create delay |
| **Hybrid** | Zone defines by similarities, inside zone proactive and outside reactive | Overcome limitation by above both strategies. | Zone creation and maintenance is complex in VANET |

## III. RELATED STUDY

Joachim Klein et. al.[1] In this paper, the author describes the implementation of the ad-hoc routing protocol "Optimized Link State Routing" (OLSR) within the Click Modular Router framework and the design of a wireless test bed based upon this implementation. The code is divided into modular elements written in C++ combined by the flexible click configuration language.

Tanuja Kumar et. al. [2] This research paper addresses the impact of mobility on the performance of two mobile routing protocols, AODV, which is reactive routing protocol and OLSR, which is proactive routing protocol. A basic framework to analyze the performance of routing protocols is developed. Evaluation of the performance in a static environment where nodes are arranged in static linear topology is made and concluded that OLSR outperformed AODV. To study the mobility, Reference Point Group Mobility model is used that generates real life scenarios.

Aditi Sharma et. al. [3] Mobile Ad hoc Network (MANET) is a collection of mobile nodes that are arbitrarily located so that the interconnections between nodes are dynamically changing. MANET is the special type of wireless network, where mobile nodes are connected through wireless interfaces forming a temporary network. They don't need fixed infrastructure. The mobility and scalability brought by wireless network made it possible in many applications. All the contemporary wireless network, MANET is the most important and unique applications. This research paper make a comparison of OLSR and DSR routing protocol based on the performance metrics**.**

Bijan Paul et. al. [4] VANET (Vehicular Ad-hoc Network) is a new technology which has taken enormous attention in the recent years. Due to rapid topology changing and frequent disconnection makes it difficult to design an efficient routing protocol for routing data among vehicles, called V2V or vehicle to vehicle communication and vehicle to road side infrastructure, called V2I. The existing routing protocols for VANET are not efficient to meet every traffic scenarios. This paper presents the pros and cons of VANET routing protocols for inter vehicle communication.

Chih-Hsun Chou et. al. [5] This paper presents a scheme that decreases the risk of a data packet encountering a dead-end situation as it is forwarded to its destination. The dead-end situation (which is also known as "local maximum") is a fundamental problem when performing geographic forwarding in mobile ad hoc networks. When a packet encounters a dead end, an additional overhead must be paid to route the packet around the dead end. Under the scheme, the mobile nodes periodically broadcast beacon messages to exchange neighboring node information to detect dead ends along their intended transmission paths.

Quanjun Chen et. al. [6] This paper proposes the Adaptive Position Update (APU) strategy for geographic routing, which dynamically adjusts the frequency of position updates based on the mobility dynamics of the nodes and the forwarding patterns in the network. APU is based on two simple principles: (i) nodes whose movements are harder to predict update their positions more frequently (and vice versa), and (ii) nodes closer to forwarding paths update their positions more frequently (and vice versa).

Yugal Kumar et. al. [7] The paper *focuses* on the routing concept for the VANET i.e. principles for routing, decomposition of the routing function and requirement. The data delivery through Vehicular Ad-hoc Networks is challenging since it must efficiently handle rapid topology changes and a fragmented network.

C. Perkins et. al. [8] stated that the Ad hoc On-Demand Distance Vector (AODV) routing protocol was intended for use by mobile in an ad hoc network. It offers quick adaptation to dynamic link conditions, low processing and memory overhead, low network utilization, and determines unicast routes to destinations with the ad hoc network. It uses destination sequence numbers to ensure loop freedom at all times (even in the face of anomalous delivery of routing control messages), avoiding problems (such as "counting to infinity") associated with classical distance vector protocols.

D.B. Johnson et. al. [9] proposed that an ad hoc network is a collection of wireless mobile hosts forming a temporary network without the aid of any established infrastructure or centralized administration. In such an environment, it may be necessary for one mobile host to enlist the aid of other hosts in forwarding a packet to its destination, due to the limited range of each mobile host's wireless transmissions. The paper presents a protocol for routing in ad hoc networks that uses dynamic source routing. The protocol adapts quickly to routing changes when host movement in frequent, yet requires little or no overhead during periods in which hosts move less frequently.

W. Adjie-Winoto et. al. [10] proposed an intentional naming system to address all these considerations. This system is an application level overlay network which integrates name resolution and message routing. The only assumption about the underlying network layer is that it provides IP unicast. The overlay network is comprised of International Name Resolvers (INR's). The INR's self-configure into a spanning tree overlay network topology optimizing the average delay between neighboring INRs. This requires the existence of a rendezvous point which maintains a list of active and candidate INRs. The purpose of the overlay is to exchange service advertisements and route messages towards these services.

## IV. CONCLUSION

This paper compared and analyzed the various routing protocols used in mobile adhoc networks. Mobile Ad hoc Network (MANET) have a dynamic topology due to user's mobility and due to limited radio range are multihop in network. In this paper, the basic fundamentals of MANETs like architecture, character traits, challenges and basic fundamentals of routing and various types of routing MANET is proposed. Performance of routing protocols is evaluated with respect to three performance metrics such as strategy, strength and limitation. Finally, some of the challenges that still need to be addressed in MANETs are security, reliability, enhancement in the routing methods, and others services like internet and entertainment.

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