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## **Routing Protocol in Mobile Ad-hoc Network: Survey & Discussions**

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**Abstract:** *Mobile Ad-hoc Networks (MANETs) are a form of a network where the mobility of nodes is relatively high, making them ideal for mobile applications. In MANETs, nodes can move about quite a bit, which is why they're referred to as "moving networks". There is no set infrastructure in MANETs. Thus, nodes can come and go as they want. In theory, the computing power of each node should be equal. For a network to function correctly, mobile devices must work together to find and maintain routes for packets as they travel between them and their intended destinations. With mobile nodes, routes are constantly changing and need to be updated. This necessitates complicated routing algorithms. Since MANETs are dynamic, maintaining routes is challenging. When it comes to routing, it's all about finding the best way for data packets to go across a network. Routing information is critical to network communication's throughput, reliability, and congestion characteristics. In this paper, present the literature works for wireless communication using routing protocol for reactive routing techniques.*

**Keywords:** - MANET, VANET, Routing Protocol, Wireless Communication, Local Area Network.

### **Introduction**

Mobile ad hoc network (MANET) is the collection of wireless communication devices that are connected in wireless environment and have a self-organizing and self-configuration capability. This is an example of infrastructure less network where the devices can send, and receive the messages via radio waves. These devices can also forward the messages of other devices such as routers. In MANETs, all devices can move together from one place to another place and due to its ad hoc nature of network, therefore, the network can also move along with the devices. MANETs is infrastructure-less network, therefore, it is broadly used in a great variety of scenarios, such as in video conferencing, disaster recovery, and battlefield communications, where audio/video data are most likely to be transmitted. With the development of IoT, smart devices as network nodes are further promoting the applications of MANET. Due to lack of fixed infrastructure, MANET is suffering from many issues such as device limited battery power, limited bandwidth, scalability. Further, the node storage capacity is limited and the network has no center, which makes the data access complicated. In MANETs routing is required to communicate with the other nodes in the network; therefore, the routes need to be established between the participating nodes by routing protocols. MANET routing protocols have primarily two operations. First is to discover the best route and second is to transfer the data packets from source node to destination node. Therefore, routing plays a crucial role in wireless communication. In general, MANET has a variety of routing protocols at present. Based on network nature, these routing protocols can be categorized as proactive protocols, reactive protocols and hybrid protocols.



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Likewise, based on the number of paths established among communicated nodes, protocols can be categorized as single path and multipath routing protocols. Multipath routing protocols can reduce network congestion by transferring traffic to other paths, if the primary path fails under some network circumstances. In that way improving network utilization and balancing network load. In order to overcome MANET issues, many routing protocols have been proposed.

An ad hoc network is a group of communications devices or nodes that communicate with each other without fixed topology (infrastructure) and without pre-determined organization. Hence one can define the ad hoc network as dynamic network. Individual nodes have capacity to communicate directly with other nodes. An ad hoc network can be created by using wireless technologies such as Bluetooth, Wi-Fi etc. such a network is called wireless ad hoc network. Under emergency situation these type of network is very useful to communicate with the service centers [17]. An Adhoc network is a continuously and dynamically self-configuring network without any pre-existing infrastructure containing devices called nodes that are connected to each other forming a temporary network. Adhoc networking describes a mode of connecting electronic devices to one another without the use of a central device that conducts the flow of communications. The devices that are connected to an adhoc network (called nodes) forward data to other nodes that are within its reach. An adhoc network is a local area network (LAN) that requires minimal configuration and can be deployed quickly for specific or temporary needs. An ad hoc network is a collection of wireless mobile hosts that form a temporary network without the aid of any centralized administration or standard support services, where all the mobile nodes communicate with each other by wireless channels. A physical medium that can sustain data communication between two nodes is called a link. A link may be asymmetric between two nodes. The transmission characteristics of a link depend upon the relative position or design characteristics of the transmitter and the receiver on the link. Due to the property of asymmetric links, a node may receive a message from another node but its transmitting message cannot reach the one that was transmitting. Additionally, a link may be symmetric, in which case the nodes can communicate with each other by local broadcast. If there is a symmetric link between two nodes, they will be referred to as neighbors of each other. When there is an asymmetric link between two nodes, these will be called semi-neighbors. Since there are two types of links in ad hoc networks, it is assumed that each node in the network must be detect their nodes of neighbors, and semi-neighbors that are transmitting by local broadcast. Each node will broadcast a beacon control signal within a given time period so that it can detect the state of a link either connected or disconnected. The control signal may communicate over the dedicated control channels. In ad hoc networks, the message is routed along the links in the multi-hop style. All the mobile nodes act as routers [11].

If all nodes communicate with each other within the same ad hoc network then it is called isolated ad hoc network. The isolated ad hoc network has no link with any infrastructure-based communication network, such as the global Internet. A large scale isolated ad hoc network may consist of thousands of nodes. It is not suited to transmit huge quantity of data because these types of networks that causes higher security problems, high network architecture costs and very low level traffic performance. Small size ad hoc networks may have elevated commercial uses in smart home environments, business meeting places, hotspots, and also in some private areas. The promising wireless LAN technologies that enable the small size ad hoc networks are IEEE 802.11, HiperLAN2, Bluetooth. In Integrated adhoc network, using internet, a smart phone can able to provide highly secured or open internet to other devices such as phone, PC etc [7].



Figure 1: Isolated ad hoc network.

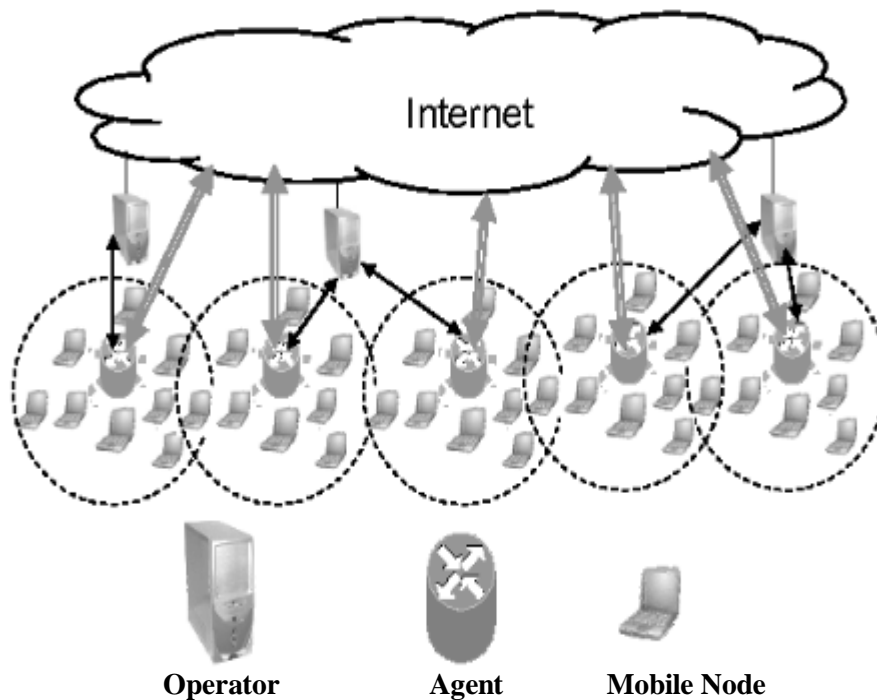


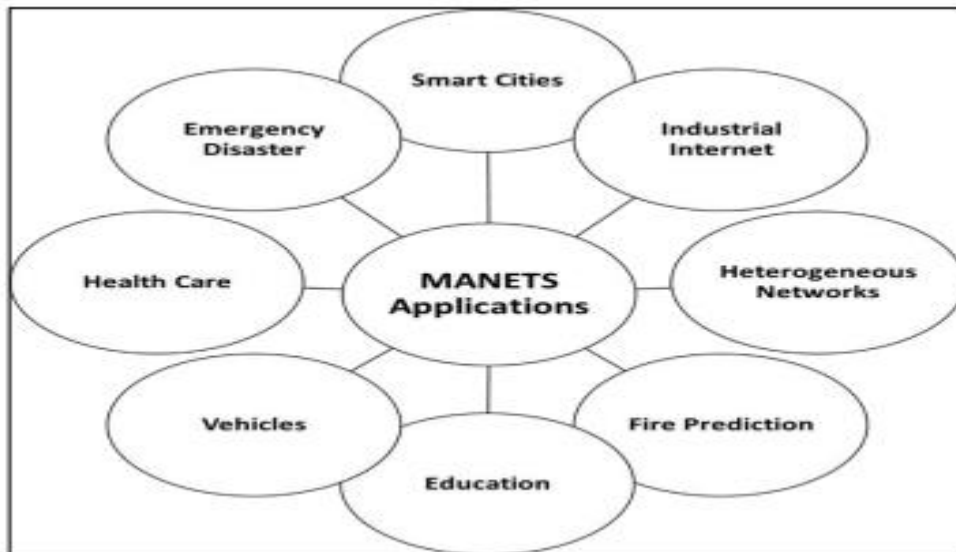
Figure 2: Integrated ad hoc network.



## **II. Application of MANET**

Some of the typical applications include [13]:

- Collaborative work: For some business environments, the need for collaborative computing might be more important outside office environments than inside and where people do need to have outside meetings to cooperate and exchange information on a given project.
- Military battlefield: Ad-Hoc networking would allow the military to take advantage of commonplace network technology to maintain an information network between the soldiers, vehicles, and military information head quarter.
- Local level: Ad-Hoc networks can autonomously link an instant and temporary multimedia network using notebook computers to spread and share information among participants at e.g. conference or classroom. Another appropriate local level application might be in home networks where devices can communicate directly to exchange information.
- Personal area network and Bluetooth : A personal area network is a short range, localized network where nodes are usually associated with a given person. Short-range MANET such as Bluetooth can simplify the inter communication between various mobile devices such as a laptop, and a mobile phone.
- Commercial Sector: Ad hoc can be used in emergency/rescue operations for disaster relief efforts, e.g. in fire, flood, or earthquake [13].



**Figure 3:** Applications of MANET.

## **III. Literature Review**

Mobile Ad-Hoc Networks (MANETs) are gaining the importance in the field of wireless communication. The promising feature of MANET is that it can be deployed immediately in demanding situations. MANETs are the communication networks which do not require the infrastructure or any centralized structures as compared to traditional wired and wireless networks. The majority of the mobile ad hoc network (MANET) community uses simulation as their primary research method. They allow for a large



number of nodes and repeatable environmental variables. Two kinds of MANET protocols are dominantly used: proactive, reactive protocols, and hybrid routing protocols.

[1] Mobile ad-hoc wireless networks give us the high probability and high properties to create networks, without any central management or infrastructure, independent and temporary network, that is means wide ubiquitous networks. The intermediate nodes should be able to communicate between them to send and receive the data with ability using at anytime and anywhere, the mobility of the intermediate node between the source and destination gives us unstable topology maybe the connection between the nodes will be break often. Therefore, the strategies to design any wireless depend on path routing and protocol selection. In this paper they study and evaluate the effect of mobility on the routing protocols DSDV, AODV and DSR in two different scenarios, the density of nodes and different area in NS2.35 simulation by using three performance metrics in the evaluating the routing protocols are Average Throughput, Packet Delivery Ratio and Average End-to-End Delay.

[2] Mobile Ad Hoc Network (MANET) is a group of wireless mobile nodes that can connect with each other over a number of hops without the need for centralized management or pre-existing infrastructure. MANET has been used in several commercial areas such as intelligent shipping systems, ad hoc gaming, and clever agriculture, and non-commercial areas such as army applications, disaster rescue, and wildlife observing domains. One of the main challenges in MANET is routing mobility management which affects the performance of MANET seriously. The routing protocols have been functionally classified into proactive routing protocols, reactive routing protocols, and hybrid routing protocols. The objective of this paper is to create observations about the advantages and disadvantages of these protocols. Thus, the aim of this paper is to conduct a comparative analysis of the three groups of MANET routing protocols by comparing their features and methods in terms of routing overhead, scalability, delay, and other factors. It was shown that the proactive protocols guarantee the availability of the routes. However, it suffers from scalability and overhead. Whereas, reactive protocols initiate route discovery only when data needs to be sent. However, reactive protocols introduce an undesirable delay due to route establishment, which affects the network performance.

[3] This research paper aims to analyze and evaluate the performance of the OLSR protocol concerning various random and group mobility models. Two simulation scenarios were conducted over four mobility models, specifically the Random Waypoint (RWP), Random Direction (RD), Nomadic Community (NC), and the Reference Point Group Model (RPGM) consider a low as well as high random range mobility of the nodes. Moreover, Bonn Motion Software and Network simulator NS-3 used to implement the simulation scenarios. Further, the performance of the OLSR protocol analyzed and evaluated based on latency, routing overhead, and packet loss ratio metrics. According to the results, the OLSR protocol provides the best performance over the RWP model in a low mobility environment, whereas the Nomadic mobility model is suitable for OLSR protocol in a high mobility environment.

[4] In this paper, different routing protocols for Ad hoc networks were reviewed and tested to show the unique features of each one. Results have shown that that the proactive routing protocols are faster in terms of responsiveness. This is because they have all the routing information already ahead of transmission, as nodes collect all the information on a fixed interval whether or not they use it on the instance. However, this comes at the cost of overheads needed to collect the information all the time. On the other hand, the reactive routing protocols are higher in terms of performance. However, they are less responsive. Every time



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transmission starts, there is a latency required ahead of transmission to collect the required information. For the future, we plan to compare the performance of the three different protocols using bigger network and more nodes and also in the presence and absence of attacks.

[5] This paper talks about three most widely used MANET routing protocols and compared the performance of these protocols by running those protocols over 5 Km X 5 Km fixed sized network with varying number of mobile nodes from 25 to 100. These simulation experiments are performed on OPNET modeler 14.5. The simulation result shows that for increasing number of mobile nodes OLSR offers better throughput than AODV and GRP routing protocols. Also, OLSR protocol offers minimum delay than AODV and GRP routing protocols. Hence, this paper concludes that OLSR gives better performance than AODV and GRP for varying number of mobile nodes on fixed sized MANET.

[6] Today, MANET is strongly applied in many fields such as healthcare, military, smart agriculture, and disaster prevention. In the transportation area, in order to meet the unique characteristics of the vehicle network, such as movement pattern, high mobility with the support of RSUs, MANET has evolved into Vehicle Ad-hoc Networks, also called VANET. Due to the mobility of the nodes, like MANET, the performance of VANET is relatively low and depends on the communication technologies. Designing more flexible, reliable, and smarter routing protocols to improve VANET performance for smart urban is a significant challenge. In this study, we conduct a survey of communication solutions for VANET in recent years. The results indicated a common framework for designing VANET communication solutions based on three main approaches: multi-metric, UAV/ Cloud/Internet, and Intelligent. Moreover, with each proposed solution, we also analyse to show the focus of the research and the results achieved. Finally, we discuss and point out possible future research directions. We hope that the research results in this work will be important guidelines for future research in the communication area for VANET.

[7] Several aspects are evolving while exploring an underwater environment, such as monitoring underwater resources, investigating parameters, and planning military action. The extent of battery power is the network's primary focus because UWSN can only carry out specific tasks. This study compares the performance of the routing protocols AODV, DSR, DYMO, LAR1, Bellman-Ford, OLSR, Fisheye, STAR-ORA, ZRP, and STAR-LORA in UWSN networks with variable deployment applications such as FTP, CBR, and VBR for 60 and 120 nodes, respectively. Several metrics were tracked, such as average transmission delay, average jitter, utilization rate, and energy used in transmit and receive modes. The simulation results show that, when compared to the DSR, DYMO, LAR1, Bellman-Ford, OLSR, Fisheye, STAR-ORA, ZRP, and STAR-LORA routing protocols, the AODV routing protocol generates the least overall energy with a slight variation of additional nodes as well as 88.6 percent less average transmission delay.

[8] This paper has presented the SLR results regarding the communication model in vehicular adhoc network systems. The 4 categories in vanet system topology, namely position based routing protocols, broadcast based routing protocols, cluster based routing protocols and multicast / geocast routing protocols, have fundamental differences, especially in the concept of sending data and information between nodes. In addition, standardization and integration of data delivery between nodes is still an interesting thing to study. The ability to send data properly in busy and fast traffic conditions has its own challenges. For this, there are many variables that must be considered, so that communication between nodes will be better. This research is expected to be the basis for future research into the vanet system subsection. Looking at the

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comparison of the results of this study, the routing protocol indicates that there are many variables that affect the result of the data and information transmission smooth process. Node Moving, path topology, signal transmission behavior, and data/information transmission processes need to be better results. So it must develop protocols to form the direction of the data transmission process.

[9] In mobile ad hoc networks (MANETs), nodes are connected by multihop wireless connections and topology is changing very frequently due to movement of nodes. Therefore, it leads to the need of efficient dynamic routing protocols. Many routing protocols have been proposed for communication in dynamic environments and it is observed that multipath routing protocols are more preferred over the single path routing protocols in terms of many network parameters such as delay, energy consumption etc. These protocols are designed to fulfil the requirements of communication in the network. Therefore, the aim of this paper is to determine the difference between multipath routing protocols when operating in large-area MANETs with the help of constant bit rate, and variable bit rate data-traffic patterns; and these traffic patterns applied on the network with the different speeds and varying simulation pause time. This paper tests the performance of the following multipath protocols AOMDV, BAOMDV, BAMR, and LLECP-AOMDV on the NS-2 network platform.

[10] Mobile Ad-hoc Networks (MANETs) are a special kind of network that organize by itself, and they provide high-quality service despite the cost of routing. In MANET, there exist no option to reach other hosts in a single-hop where it needs multi-hop. Many intermediary hosts relay packets transmitted by the source host before reaching the destination host in a multi-hop situation. The level of energy at each node plays a significant role in MANET. Routes are frequently broken, and new routes are discovered in MANETs because of node mobility. In this paper, Energy-Efficient Perspicacious Ant Colony Optimization Based Routing Protocol (EEPACORP) is proposed to determine the optimum route to transfer the data to reduce energy spent by each node for data transmission. EEPACORP is based on the ant's inherent disposition to seek for food. EEPACORP is inspired from genetic character of ant towards finding its food.

#### **IV. Problem Statement**

MANET is always limited to energy leading to have shorter network lifetime. Every node may act as a source, a destination node, or a router, directing messages to their desired destinations. To transfer data, a node's energy is used heavily. In the event that a number of network nodes or connections fail, the network will be partitioned. Finding a new route after discovering a failed route causes additional delay and consumes a large amount of energy. The life span of mobile nodes is limited by their battery capacity, which necessitates using an energy-efficient routing protocol. Unlike infrastructure networks, MANET nodes rely on batteries and exhaustible power resources. This limitation affects the performance of these networks and is also a vulnerability that can be exploited by attackers. The traditional network routing protocols are not suitable for ad-hoc networks for many reasons, mostly because of their high mobility. Therefore, special network protocols are devised for this specific type of network. The key concern with these protocols is how to choose the right protocol for the right application and on what criteria this is to be done. These networks do not rely on routers and their nodes function as routers. For a node to reach another node that is not close to it, it uses adjacent nodes functioning as routers to reach the destination. The way from source to destination is called a route. The route can change frequently due to the nodes' high mobility.



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### **V. Conclusion**

The task of the routing protocol is restricted not just by the prerequisite to interface MANET nodes for exchanging of information yet additionally by the need to keep data streaming at a satisfactory level consistently. In some explicit circumstances, when mobility of the nodes rapidly increases which affect the performance of the protocol, the available MANET routing protocol which was created to address the future case, cannot be used to assist in this situation. Routing protocols are means for sending the data from the source node to the destination node. For this transmission to be done correctly, two main tasks take place. Firstly, a confirmation on the best route way the data can take to reach the destination. And this transfer to be done using the best utilization of power. In this work present the different comparative study for literature work in wireless communication with different routing protocol.

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