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NOVEL REVIEW OF MANET ROUTING PROTOCOLS

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ABSTRACT

In recent years mobile ad hoc networks (MANET) become very popular and useful for communication. Mobile ad hoc network is a collection of mobile nodes which communicate to each other without any infrastructure and base station. Because of its infrastructure less nature it is easy to deploy without construction of any infrastructure. There are many routing protocols in mobile ad hoc networks which are used to route the data between nodes. Ad hoc networks have many imperatives and challenges in future like scalability, bandwidth utilization, power consumption. This paper gives a novel overview of the concept of mobile ad hoc networks, the existing MANET routing protocols & future scope thereof in the field of mobile ad hoc networks.

KEYWORDS: Ad hoc, Bandwidth, MANET, Protocols, Review, Routing.

INTRODUCTION

Mobile ad hoc network is a collection of mobile nodes which are free to move and communicate to each other with wireless system as shown in figure 1. Mobile ad hoc networks are infrastructure less networks & without any base station node that's why these are easy to deploy. In MANET a node can only communicate to those nodes which are belongs to its radio range. In order to transmit data packets from one node (Source node) to a node which is located outside its radio range, data packets are sent over a sequence of intermediate node using multi-hop principle. Hence, mobile ad hoc networks are also called as multi-hop network. Mobile ad hoc networks are useful for applications where infrastructure is unavailable or unreliable. E.g. Mobile ad hoc network is used in military communication, emergency rescue operation etc.

Fig. 1: MANET Connection

ROUTING PROTOCOLS

Routing protocols [1, 2] is one of the important aspect of mobile ad hoc networks. There are basically three type of roting protocols in MANET as shown in figure 2.
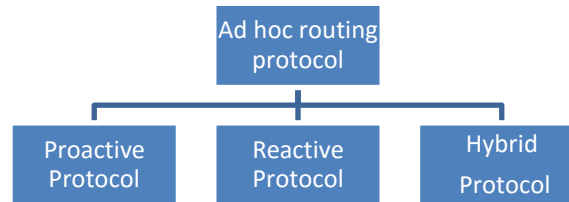

Fig. 2: Different type of protocols.

Proactive Protocol [1, 2]

Proactive roting protocols are also called as table driven routing protocol. In this routing protocol every node in the network needs to maintain the routing table which contains the information about the network topology even before it is needed. A node updates routing table when there is any change in the network topology. Proactive routing protocol are not useful for large system because every node needs to maintain node entries for each and every node in routing table of every node.This Problem leads to more overhead in the network, low bandwidth utilization, and more power consumption.this is the main drawback of proactive routing protocol.

Types of Proactive Routing Protocol [1, 2]

Proactive routing protocols, shown in figure 3, are classified on the basis of their efficiency and different routing strategies of different protocols. These are discussed as under:-
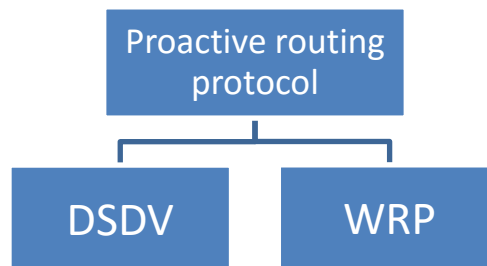

Fig. 3: Proactive routing protocol

Destination Sequenced Distance Vector [1, 2]

Destination-Sequenced distance routing protocol (DSDV) is based on Bellman Ford routing algorithm with some changes. In this routing protocol each node in the network contains a routing table. In DSDV each routing table contains the list of every destination & numbers of hops to each other nodes. Each entry in the routing table tagged with a sequence number which is originated by the destination node. When there is any significant change in the network every node change its routing table for future transmission. In DSDV node update their routing table when required and advertise this routing table to its current neighbors. The advertisement is done either by broadcast or by multicast. With the help of advertisement, a node knows about any changes in the network due to mobility of nodes. The routing tables are sent to other nodes in two ways: first is "Full Dump" and second is "incremental". In full dump all the information about routing table is sent to the nodes and in case of incremental only changed information is sent to the nodes. The major Issue in DSDV routing protocol is traffic overhead, nodes updates their routing table regularly and sent to its neighbors becomes the cause of overhead. DSDV routing protocol is not used for large network because it requires more bandwidth and more power for transmission of data.

Wireless Routing Protocol [2]

Wireless routing protocol comes under the category of proactive routing protocols (Table Driven). This is similar to DSDV routing protocol with some difference. DSDV maintain only two routing table for each node but WRP maintain four tables for each node (a) A routing table (b) A link-cost table (c) A message retransmission list (MRL) (d) A distance table. If there is no change in the network a node send a hello message to other nodes to ensure connectivity. If nodes do not respond then it becomes dead node means connection is lost between nodes. WRP gives more efficient network then DSDV routing protocol. This introduces a lot of memory overhead at each node when size of network increase; this is the main drawback of WRP. The comparison of DSDV and WRP protocols has been shown in table 1.

Table 1: Comparison of DSDV & WRP

Performance Parameters	DSDV	WRP
Loop-Free	Yes	Yes, but not instantaneous
Number of Tables	Two	Four
Overhead	Low	High
Efficiency	Low	High

Reactive Protocol [2, 3, 8, 9]

Reactive protocols are also known as On Demand routing protocol. In reactive protocols route is discovered whenever needed, when communication is required source node broadcast a route request packets through the network then nodes on the network sends route reply to the source node. After getting route source nodes send data packets to the destination. Reactive protocols are divided in two categories (a) source routing (b) hop by hop routing. In source routing on demand routing, each data packets follows the whole source to destination address. In this type intermediate nodes forward data packets to another node on the basis of information kept in header attached with the data packet. Intermediate nodes are not permissible to select route for communication. But in hop to hop routing, each data packet contains only the destination address and next hop address. Intermediate hop use its routing table to forward data to the next hop and this procedure runs until data reaches to the destination. There are number of reactive routing protocols which are used for increasing the performance of MANET'S.

Types of Reactive Routing Protocol: Reactive protocols or On Demand protocol discovers route when communication is required i.e. a link is established when one node want to send data to the destination. Due to reactive nature of these protocols they lead to low overhead in the network.
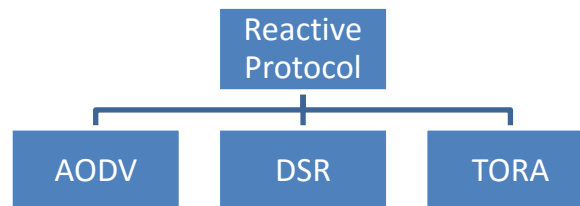

Fig. 4: Reactive routing protocol

Ad Hoc on Demand Distance Vector Routing [4, 5, 7]

Ad hoc on demand distance vector routing protocol (AODV) comes under the category of reactive protocol. When a source node wants to forward data packet to the destination node, it broadcast a route request packet (RREQ) through network. In turn intermediate forward the data packet to neighboring nodes until data reaches to the destination. During route request packet (RREQ) nodes maintains the route information in the routing table, which helps for creating

reverse path. The reply is forwarded with the help of reverse path. If the duplicate RREQ is received, packet is discarded. This process has been shown in figure 5.
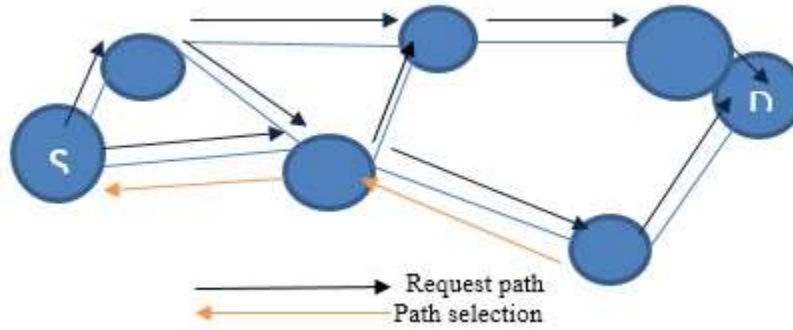

Fig. 5: AODV routing protocol

Dynamic Source Routing [6, 9]
It is an Ad hoc routing protocol which is based on the theory of source-based routing rather than table-based. This protocol is source-initiated rather than hop-by-hop. It is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. DSR allows the network to be completely self-organizing and self-configuring, without the need for any existing network infrastructure or administration. Dynamic Source Routing, DSR, is a reactive routing protocol that uses source routing to send packets. It uses source routing which means that the source must know the complete hop sequence to the destination. Each node maintains a route cache, where all routes it knows are stored. The route discovery process is initiated only if the desired route cannot be found in the route cache. To limit the number of route requests propagated, a node processes the route request message only if it has not already received the message and its address is not present in the route record of the message. As mentioned before, DSR uses source routing, i.e. the source determines the complete sequence of hops that each packet should traverse. This requires that the sequence of hops is included in each packet's header. A negative consequence of this is the routing overhead every packet has to carry. However, one big advantage is that intermediate nodes can learn routes from the source routes in the packets they receive.

Since finding a route is generally a costly operation in terms of time, bandwidth and energy, this is a strong argument for using source routing. Another advantage of source routing is that it avoids the need for up-to-date routing information in the intermediate nodes through which the packets are forwarded since all necessary routing information is included in the packets. Finally, it avoids routing loops easily because the complete route is determined by a single node instead of making the decision hop-by-hop. The protocol is composed of the two main mechanisms of "Route Discovery" and "Route Maintenance", which work together to allow nodes to discover and maintain routes to arbitrary destinations in the ad hoc network. All aspects of the protocol operate entirely on demand, allowing the routing packet overhead of DSR to scale automatically to only what is needed to react to changes in the routes currently in use. The protocol allows multiple routes to any destination and allows each sender to select and control the routes used in routing its packets, for example, for use in load balancing or for increased robustness.

Temporally Ordered Routing Algorithm [2, 9]
Temporary ordered routing algorithm is a reactive protocol and finds route on demand. Ii maintains and creates directed acyclic graph (DAG) at the destination node. TORA does not provide shortest path instead it uses longer paths to avoid finding new paths. There are three main phases in TORA (a) Route Creation (b) Route Maintenance (c) Route Erasure. The comparison of all reactive protocols discussed so far has been shown in table 2.

Table 2: Comparison between Reactive Protocols

Performance Parameters	AODV	DSR	TORA
Loop- Free	Yes	Yes	Yes
Multicast Facility	Yes	No	No
Multi Route Possibility	No	Yes	Yes
Route Maintained in	Route Table	Route Cache	Route Table

The comparison between reactive and proactive protocols is shown in table 3 given below.

Table 3: Comparison between Reactive & Proactive Routing Protocols:

Comparison Parameters	Proactive Protocols	Reactive Protocols	Hybrid Protocol
Path Finding	Always available	Created on demand	Use both mechanism
Delay	Small	High	Average
Scalability	Upto 100 nodes	Higher than proactive	Highest
Storage	Higher	Lower than proactive	Larger than reactive
Updates	Always Required	Not required	Required
Usability	Not useful in natural hazards	Useful in natural hazards	Useful in natural hazards
Efficiency	High	Low	Highest

Hybrid Protocol [9]
Hybrid protocols are combination of both reactive & proactive protocol. There are some problems in both routing protocols, in proactive there is problem of traffic overhead in the network & in reactive protocols, there is problem of latency. So hybrid protocols are used to overcome these problems of both routing protocols. Hybrid protocol uses table maintenance mechanism of proactive protocol & route discovery mechanism of reactive protocolto overcome traffic overhead & to avoid latency. In hybrid protocol network is divided into different zones, where routing is done outside the zone is performed by reactive protocols & inside the zone is performed by proactive protocols. Hybrid protocols are useful for large network where the number of nodes is huge. Zone Routing Protocol is a hybrid protocol.

Zone Routing Protocol (ZRP) [9]
Zone routing protocol is a type of hybrid protocol with higher scalability. In ZRP route creation is done on the basis of query-reply mechanism. Routes are immediately available for the nodes which belongs to the routing zone & for nodes lies outside the routing zone, routes are given by on demand. The significant of ZRP is that it reduces the degree of latency delay in reactive protocol & also reduces the network overhead in proactive protocol. But ZRP has also a disadvantage that it behaves like proactive routing protocol when numbers of zones are very large & behaves like reactive protocol when number of routing zone is less.

OBSERVATION [10]
After studying of literature of MANET we observe some the shortcomings of the MANET and these are as follows: The core shortcoming of MANET is energy conservation. With the advance of wireless communication, Communicating devices like laptop, Mobiles etc. are increasingly used in conferences, Seminar & class rooms. In Ad hoc network each node has its own battery power. Communicating nodes has limited battery power and it is difficult to replace or recharge the battery during communication. Once a power of a node exhausted the communication link will break & this also leads to inefficient communication. Ad hoc networks do not have any fixed communication infrastructure. For a communication sender node, Destination node & intermediate nodes can be mobile. These mobile nodes maintain routing tables for sending data. Once a battery of node is exhausted then link brakes between the nodes & leads to more routing process to make communication between nodes. More routing process leads to more power consumption. So, for making a communication more efficient we have to manage battery power of the node. We can manage the power of a wireless node on the basis of some parameters which are as follows:

- Route discovery & Route selection: The route selection is based on route discovery. We choose the route on the basis of routing protocol like DSR & AODV. The route selection selects the optimal path for stable network
- Cost Function: The main aim of cost function is to give more cost to the node with less energy which helps in making optimal path selection.
- Modification of control packets: Modification of control format means to modify the format of Route Request(RREQ)& Route Reply(RREP). Two extra fields are added to extend DSR, One is Max Cost Field &second is Cost (Cumulative) Field.

Source Address	Destination Address	Identification Field	TTL	Max Cost	Cost	Hop	Path

Fig. 6: Modified format of DSR

- Modification at Source & Destination node: Modification at source node & destination node means to select optimal path. If source node wants to send data to destination, it checks its route cache to check is there any route from source to destination exists. If any route exists it selects the route to send the data. But in some protocols selection of optimal path is assigned to destination node instead of source to reduce the overhead of the network.

Minimizing energy consumption is the important challenge in the mobile ad hoc network. The main aim of this paper is efficiently management of the power of nodes. Proper power management increase the lifetime of network with low overhead for more routing processes also makes the network more stable.

CONCLUSION AND FUTURE SCOPE
This paper presents overview of the MANET & their routing protocols. After going through the literature survey, it has been found that, in mobile ad hoc networks wireless links are broken easily because of mobility of nodes. Mobility of nodes leads to link breakage and instability of the links. Secondly, use of battery powered wireless devices in MANET leads to network break down whenever battery is exhausted.

Therefore energy management is the core issue in the MANET because if power of a node goes down it can't perform any action in the network and become idle which leads to instability of the network. Concluding, stability of network and energy management are major concerns in mobile ad hoc networks and it is a great challenge for the researchers.

PROPOSED WORK
A new routing strategy is proposed which takes care of the two core issues of stable routing and energy management. If a routing protocol can enhance stability, it leads to higher efficiency & low overhead. A link between two nodes remains until both the nodes are in radio transmission range of each other, as much as these link breaks frequently, more routing processes occurs that leads to more overhead on network resources such as bandwidth and energy. If we add a new constraint i.e. threshold value for a link then we can enhance stability of the link. Each node in the MANET have some link life time, if a link life time value is greater than its threshold value then we consider this link for routing otherwise denied. In MANET resources are very limited. Energy of the node is very important resource for MANET. In routing protocols links are broken due to less battery power and node mobility. So power management is also an important technique to reduce the energy consumption. In MANET there is no centralized administrator for communication we provides power to the different nodes with the help of batteries for proper transmission of data. If power of a node goes diminished then node become idle and link breaks between idle node and its neighbors. In future we introduce energy efficient routing protocol (EERP) which balances node energy utilization to reduce energy consumption. Purpose of this work is to reduce the link breakages & having energy efficient routing in mobile ad hoc network.

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