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A Comparative Study of Proactive and Reactive Routing Protocol

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ABSTRACT *A mobile ad hoc network (MANET) is a self-configuring infrastructure less network of mobile devices connected by wireless. Ad hoc is Latin and means "for this purpose".[1]Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Each must forward traffic unrelated to its own use, and therefore be a router. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic. Such networks may operate by themselves or may be connected to the larger Internet. MANETs are a kind of Wireless ad hoc network that usually has a routable networking environment on top of a Link Layer ad hoc network. Mobile ad hoc networks (MANET) that contain wireless mobile nodes that can freely and dynamically self organize into arbitrary and temporary ad hoc network topologies. Mobile Ad-hoc Network (MANET) is a collection of communication devices or nodes that wish to communicate with infrastructure less support and without predetermined organization of available links. In MANET, Routing is main problem to route the data packets from one source node to destination node in networks.*

I. INTRODUCTION

MANETs form a network without the help of pre defined infrastructure. In this network collection of mobile node can communicate or send data packets freely to each other with the help of routing protocols. Mobile nodes can join and leave the network at any time due to the wireless links. The range of the MANETs applications can be static small area networks to highly dynamic area networks. The main challenge of designing MANETs is to develop scalable routing protocol which can help to communication between mobile nodes [1]. Due to the dynamically changing topology, wired network routing protocols cannot be directly apply on ad hoc networks. So that ad hoc networks have required the need of dynamic mechanism of routing protocols [2]. Consideration of mobility in the network may influence the performance of routing protocols because nodes that forward and receive the data packets through the routing protocol may go out of range to each other that's why link breakage is happened over any time. In this case Manets require to search or establish a new optimum route. As a result, the quick route discovery mechanism should be the aim of the routing protocols. It is helpful to detailed study of the various performance metrics for understanding and usage of routing protocol.

Manet aimed is to provide communication capabilities to areas where limited or no predetermined communication infrastructures exist. MANET share several salient

characteristics.

1) Dynamic topologies
2) Bandwidth constrained links
3) Energy con strained operation
4) Limited physical security.

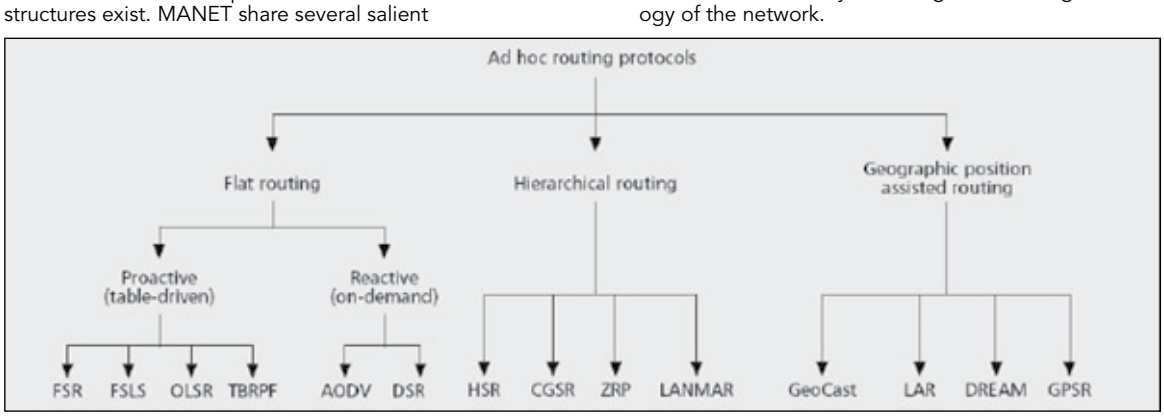
The application areas of ad hoc networking include students using laptop computers to participate in an interactive lecture, sharing information awareness by military persons in Battlefield, earthquake, business associates sharing information during a meeting. MANET does not use a static network infrastructure. It uses multi-hop routing to provide network connectivity.

The goal of routing protocols are-

Find short routes, Decrease routing-related overhead and find - stable || routes.

II. ROUTING PROTOCOL

A routing protocol specifies how routers communicate with each other, disseminating information that enables them to select routes between any two nodes on a computer network. Routing algorithms determine the specific choice of route. Each router has a priori knowledge only of networks attached to it directly. A routing protocol shares this information first among immediate neighbors, and then throughout the network. This way, routers gain knowledge of the topology of the network.



The routing protocols for Manet considered are classified into two categories:
Proactive (table driven)
Reactive (on demand)

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Routing protocols for MANETs can be broadly classified[3] into three main categories:-

1.) Proactive routing protocols:- Every node in the network has one or more routes to any possible destination in its routing table at any given time.
2.) Reactive routing protocols:-Every node in the network obtains a route to a destination on a demand fashion. Reactive protocols do not maintain up-to-date routes to any destination in the network and do not generally exchange any periodic control messages.
3.) Hybrid routing protocols:-Every node acts reactively in the region close to its proximity and proactively outside of that region, or zone.

2.1- PROACTIVE (table driven) ROUTING PROTOCOLS-

Each node in the network has routing table for the broadcast of the data packets and want to establish connection to other nodes in the network. These nodes record for all the presented destinations, number of hops required to arrive at each destination in the routing table. The routing entry is tagged with a sequence number which is created by the destination node. To retain the stability, each station broadcasts and modifies its routing table from time to time. How many hops are required to arrive that particular node and which stations are accessible is result of broadcasting of packets between nodes. Each node that broadcasts data will contain its new sequence number and for each new route, node contains the following information:

- – How many hops are required to arrive that particular destination node
- – Generation of new sequence number marked by the destination
- – The destination address

The proactive protocols are appropriate for less number of nodes in networks, as they need to update node entries for each and every node in the routing table of every node. It results more Routing overhead problem. There is consumption of more bandwidth in routing table..

Example of Proactive Routing Protocol is Destination Sequenced Distance Vector (DSDV)

2.2- REACTIVE (On Demand) ROUTING PROTOCOL-

Reactive Protocol has lower overhead since routes are determined on demand. It employs flooding (global search) concept. Constantly updation of route tables with the latest route topology is not required in on demand concept.

Reactive protocol searches for the route in an on-demand manner and set the link in order to send out and accept the packet from a source node to destination node. Route discovery process is used in on demand routing by flooding the route request (RREQ) packets throughout the network.

Examples of reactive routing protocols are the dynamic source Routing (DSR), ad hoc on-demand distance vector routing (AODV).

III. DESTINATION SEQUNCE DISTANCE VECTOR (DSDV) ROUTING PROTOCOL-

The first MANET algorithm that we implemented as part of this work is called the Destination-Sequenced Distance Vector (DSDV) routing algorithm. It is a proactive routing algorithm. The DSDV algorithm is a Distance Vector (DV) based routing algorithm designed for use in MANETs, which are defined as the cooperative engagement of a collection of Mobile Hosts without the required intervention of any centralised Access Point (AP).

The Destination-Sequenced Distance-Vector (DSDV) Routing Algorithm is based on the idea of the classical Bellman-Ford. Routing Algorithm. Routing Loop problem is solved which is present in Bellman-Ford algorithm.To solve the routing loop problem, this routing makes use of sequence numbers.

Each mobile node maintains a routing table that includes the number of hops to reach the destination, all available destinations and the sequence number tagged by the destination node. The sequence number is used to distinguish stale routes from new ones and thus avoid the formation of loops. So, the update is both time-driven and event-driven. A "full dump" or an incremental update technique is used to update the routing table.

A full dump sends the full routing table to the neighbors and could span many packets whereas in an incremental update only those entries from the routing table are sent that has a metric change since the last update and it must fit in a packet. When the network is relatively stable, incremental updates are sent to avoid extra traffic and full dump are relatively infrequent .If there is space in the incremental update packet then those entries may be included whose sequence number has changed.DSDV protocol guarantees loop free paths and Count to infinity problem is reduced in DSDV.

IV. DYNAMIC SOURCE ROUTING PROTOCOL (DSR)

It is a routing protocol for wireless mesh networks. It is similar to AODV in that it forms a route on-demand when a transmitting computer requests one. However, it uses source routing instead of relying on the routing table at each intermediate device. This protocol is truly based on source routing whereby all the routing information is maintained (continually updated) at mobile nodes. It has only two major phases, which are Route Discovery and Route Maintenance. Route Reply would only be generated if the message has reached the intended destination node (route record which is initially contained in Route Request would be inserted into the Route Reply). Therefore, it is an on-demand protocol designed to restrict the bandwidth consumed by control packets in ad hoc wireless networks by eliminating the periodic table-update messages required in the table-driven approach. The major difference between this and the other on-demand routing protocols is that it is beacon-less and hence does not require periodic hello packet (beacon) transmissions, which are used by a node to inform its neighbors of its presence. The basic approach of this protocol (and all other on-demand routing protocols) during the route construction phase is to establish a route by flooding RouteRequest packets in the network. The destination node, on receiving a RouteRequest packet, responds by sending a RouteReply packet back to the source, which carries the route traversed by the RouteRequest packet received.

V. ADHOC ON DEMAND DISTANCE VECTOR ROUTING

(AODV)- uses traditional routing tables, one entry per destination. This is in contrast to DSR, which can maintain multiple route cache entries for each destination. Without source routing, AODV relies on routing table entries to propagate an RREP back to the source and, subsequently, to route data packets to the destination. AODV uses sequence numbers maintained at each destination to determine freshness of routing information and to prevent routing loops. All routing packets carry these sequence numbers. Unlike DSR The packet size in AODV is uniform. In AODV there is no need for system-wide broadcasts due to local changes, unlike DSDV.AODV has multicasting and uncasing routing protocol property within a uniform framework. Source node, destination node and next hops are addressed using IP addressing. AODV builds routes using a route request /route reply cycle.

To determine freshness of routing information and to prevent routing loops, AODV uses sequence numbers maintained at each destination. Sequence number for both destination and source are used. These sequence numbers are carried by all routing packets. Maintenance of timer-based states in each node, regarding use of individual routing table entries is an important feature of AODV. If routing table entry is not used recently then routing table entry is expired. When the next-

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hop link breaks nodes are notified with RERR packets. Each predecessor node, forwards the RERR to its own set of predecessors, thus effectively erasing all routes using the broken link.. Route error propagation in AODV can be visualized conceptually as a tree whose root is the node at the point of failure and all sources using the failed link as the leaves. It is loop free, self starting, and scales to large numbers of mobile nodes.

Result and discussion

Table 1: Characteristics of Various Ad Hoc Mobile Multicast Routing Protocols [15]

Parameters	DVMRP	AODV	CAMP	ODMRP
Multicast delivery structure	Source-based tree	Core-based tree	Multicast mesh	Group-based
Use of centralized node	No	Yes (Multicast group leader	Yes (Core nodes)	No
Core node recovery	N/A	Yes	Yes	N/A
Routing scheme	Table-driven	On-demand	Table-driven	On-demand
Dependence on unicast routing protocol	No	No	Yes	No
Routing approach	Flat	Flat	Flat	Flat
Routing metric	Shortest path	Shortest path to another multicast member along the existing shared tree	Shortest path	Shortest path

Conclusion

A mobile ad hoc network (MANET) is a collection of mobile nodes that is connected through a wireless medium forming rapidly changing topologies. Mantes are infrastructure less and can be set up anytime, anywhere. We have conducted survey of protocol properties of various MANET routing algorithms and analyzed them. The routing algorithms considered are classified into two categories proactive (table driven) and reactive (on demand). The algorithms considered are DSDV, DSR, and AODV. The comparison among three routing protocols are based on the various protocol property parameters such as Route Discovery, Network Overhead, Periodic Broadcast ,Node overhead etc.

In this paper, analysis and investigations are carried out on the acquired simulation results of three prominent routing protocols, AODV, OLSR and ZRP. All the simulations are performed over Mobile Adhoc networks. The three protocols are the representative of proactive, reactive and hybrid type of Routing Protocols respectively. From the investigation, it can be easily determined that the performance of OLSR which is a proactive protocol is best when we compare on the basis of jitter. AODV has the poorest performance amongst the three protocols examined. ZRP which is a hybrid protocol has moderate performance but as the number of nodes increase to 80 its performance deteriorates considerably, so ZRP can be used for small networks. So it is concluded that OLSR (On-Demand Routing Protocol) [9] shows the comparatively high performance than all other type of protocols. So when aim is to minimize the jitter, On Demand Routing protocols can be used. This work can be further extended to improve this system by implementing another parameters like end to end delay, packet delivery ratio, security issues etc. such that the overhead of selecting routing protocol can be minimized.

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