Abstract—This paper presents the study of the performance study of five protocols that represent various routing categories in MANET. The set of applications for MANET's is diverse, ranging from small, static networks that are constrained by power sources, to large-scale, mobile, highly dynamic networks. The design of network routing for these networks is a complex issue. Irrespective of the application, MANET's need efficient distributed algorithms to determine network organization, link scheduling, and routing. Overall, it is analyzed from the reported research papers that protocols performed much better with the group mobility model than with the random waypoint model.

Index Terms—MANET, Proactive, Reactive, On-Demand, Hybrid

I. INTRODUCTION
Mobile ad-hoc networks (MANET) are free to move randomly and organize themselves arbitrarily; thus, the topology may change rapidly and unpredictably. Such a network may operate in a standalone fashion, or may be connected to the larger Internet. However, determining viable routing paths and delivering messages in a decentralized environment where network topology fluctuates is not a well-defined problem. In a military networks are designed to maintain a low probability of intercept and/or a low probability of detection. Hence, nodes prefer to radiate as little power as necessary and transmit as infrequently as possible, thus decreasing the probability of detection or interception. A lapse in any of these requirements may degrade the performance and dependability of the network.

II. RESEARCH REVIEW OF MOST POPULAR ROUTING PROTOCOLS IN MANET
Routing is the process of finding a path from a source to some arbitrary destination on the network. The routing protocol can be generally classified as: (A) Proactive (Active) Protocols; (B) Reactive or On-Demand (Passive) protocols; (C) Hybrid Protocols; The first category modify a traditional table-driven scheme to adapt to ad hoc networks.

(A) On-demand or reactive routing protocols (DSR) are proposed specifically for ad hoc networks. These protocols do not maintain permanent route table. Instead, routes are built by the source on demand. These types of routing protocols determine route paths when required by using data dissemination techniques such as flooding. On-demand protocols are generally associated with low overheads and have been known to have good scalability properties due to the transmission of control messages in the system only when necessary. They usually have a high latency for packet forwarding as the routing path discovery is initiated when there is data to be sent.

(B) The Proactive (Active) Protocols (location based – DREAM) consist of the distance vector based protocol WRP and the linked state based protocol FSR. Each node in the network maintains information about every other network edge by using periodic or event-triggered routing update exchanges. These types of routing protocols generally have very high overhead due to the route updates exchanged periodically but very low latency for packet forwarding as the requested route path is already known. Examples are Destination Sequenced Distance Vector Routing Protocol (DSDV), Wireless Routing Protocol (WRP), Optimized Link State Routing Protocol (OLSR) etc.

(C) The Hybrid Protocols combine characteristics from active and passive routing protocols to achieve properties such as hierarchical routing. These types of protocol are generally implemented in clustered networks, where nodes are grouped into small clusters to form smaller networks within a large network. Intra-cluster routing among nodes are usually proactive, while Inter-cluster routing is done on-demand. Examples are Zone Routing Protocol (ZRP). Some of these protocols have been submitted for RFCs (Request for Comments) to the IETF while others are still being improved upon. Extensions to these protocols have also been developed that make use of redundant paths for the specialized case of multicast routing where a sender tries to transmit data to multiple receivers e.g. Ad hoc On-Demand Multiple Distance Vector Routing Protocol (AOMDV), Multipath Dynamic Source Routing Protocol (MDSR) etc.

Wireless Routing Protocol
Wireless Routing Protocol (WRP) is a distance vector based protocol designed for ad hoc networks. WRP modifies and enhances distance vector routing in the following three ways. First, when there are no link changes, WRP periodically exchanges a simple HELLO
tuples contain the destination, distance, and the packet rather than exchanging the whole route table. If topology changes are perceived, only the 'path-vector tuples contain the destination, distance, and the predecessor (second-to-last-hop) node ID. Second, to improve reliability in delivering update messages, every neighbor is required to send acknowledgments for update packets received. Retransmissions are sent if no positive acknowledgments are received within the timeout period. Third, the predecessor node ID information allows the protocol to recursively calculate the entire path from source to destination.

**Fisheye State Routing**

Fisheye State Routing (FSR) is a link state type protocol which maintains a topology map at each node. To reduce the overhead incurred by control packets, FSR modifies the link state algorithm in the following three ways. First, link state packets are not flooded. Instead, only neighboring nodes exchange the link state information. Second, the link state exchange in only time-triggered, not even-triggered. Third, instead of transmitting the entire link state information at each iteration, FSR uses different exchange intervals for different entries in the table. To be precise, entries corresponding to nodes that are nearby (within a predefined scope) are propagated to the neighbors more frequently than entries of nodes that are far away. These modifications reduce the control packet size and the frequency of transmission.

**Dynamic Source Routing**

Dynamic Source Routing (DSR) [2] is a reactive protocol that uses source routing to send packets. It is reactive like AODV which means that it only requests a route when it needs one and does not require that the nodes maintain routes to destinations that are not communicating. It uses source routing which means that the source must know the complete hop sequence to the destination. It computes the routes, when necessary and then maintains them. Source routing is a routing technique in which the sender of a packet determines the complete sequence of nodes through which the packet has to pass, the sender explicitly lists this route in the packet’s header, identifying each forwarding “hop” by the address of the next node to which to transmit the packet on its way to the destination host. There are two significant stages in working of DSR: Route Discovery and Route Maintenance. A host initiating a route discovery broadcasts a route request packet which may be received by those hosts within wireless transmission range of it. DSR uses no periodic routing advertisement messages, thereby reducing network bandwidth overhead, particularly during periods when little or no significant host movement is taking place. DSR has a unique advantage by virtue of source routing.

**Location-Aided Routing**

Location-Aided Routing (LAR) is an on-demand routing protocol which exploits location information. In fact, LAR operates very similarly to DSR. The major difference between the two protocols is that LAR uses location information obtained from GPS to restrict the flooded area of ROUTE REQUEST packets. There are two schemes to determine which nodes propagate ROUTE REQUESTS. In scheme 1, the source defines a circular area in which the destination may be located. The position and size of the circle is decided with the following information: (a) the destination location known to the source; (b) the time instant when the destination was located at that position; and (c) the average moving speed of the destination. The smallest rectangular area that includes this circle and the source is the request zone. This information is attached to a ROUTE REQUEST by the source and only nodes inside the request zone propagate the package. In scheme 2, the source calculates the distance between the destination and itself. This distance, along with the destination location known to the source, is included in a ROUTE REQUEST and sent to neighbors. When nodes receive this packet, they compute their distance to the destination, and continue to relay the packet only if their distance to destination is less than or equal to the distance indicated by the packet. When forwarding the packet, the node updates the distance to the destination. In both schemes, if no ROUTE REPLY id received within the timeout period, the source retransmits a ROUTE REQUEST via pure flooding.

**Distance Routing Effect Algorithm for Mobility**

Distance Routing Effect Algorithm for Mobility (DREAM) is another location based routing protocol. In the contrast to LAR, DREAM is a proactive scheme (i.e., it maintains permanent routing tables). The scheme partially floods data to nodes in the direction to the destination. In the route table, coordinates of each node are recorded instead of route vectors. Each node in the network periodically exchanges control messages to inform all other nodes in the networks of its location. Distance effect is achieved by assigning “TTL (Time-To-Live)” value to the location control messages. Location updates with low TTL value (long-lived updates). In addition, DREAM adjusts to network dynamics by controlling update frequency based on movement speed. When sending data, if the source has “fresh enough” location information of the destination, it selects a set of one hop neighbors that are located in the direction from source to destination. If no such nodes are found, the data is flooded to the entire network. If such node exists, the list is enclosed in the data header and transmitted. Only nodes specified in the header are qualified to receive and process the packet. These nodes in turn select their own list of possible next hops and forward the packet with such updated list. If no neighbors are located in the direction of the destination, the packet is simply dropped. When the destination receives data, it sends ACKs back to the source in a similar fashion. However, ACKs are not transmitted when data was received via flooding. When the source sends data with designated next hops, (i.e., not by pure flooding), it starts a timer. If no ACK is received before the timer expires, ordinary flooding retransmits the data.

**Destination Sequenced Distance Vector (DSDV)**

Destination Sequenced Distance Vector (DSDV) [1] is a Proactive routing protocol that solves the major problem...
associated with the Distance Vector routing of wired. The DSDV protocol requires each mobile station to advertise, to each of its current neighbours, its own routing table (for instance, by broadcasting its entries). In addition, each mobile computer agrees to relay data packets to other computers upon request. At all instants, the DSDV protocol guarantees loop-free paths to each destination. Temporally-Ordered Routing Algorithm (TORA)

The Temporally-Ordered Routing Algorithm (TORA) [3, 4] is an adaptive routing protocol for multi-hop networks that possesses the following attributes:

- Distributed execution
- Multipath routing
- The protocol can simultaneously support both source-initiated, on-demand routing for some destinations and destination-initiated, proactive routing for other destinations.
- Minimization of communication overhead via localization of algorithmic reaction to topological changes.

TORA is distributed, in that routers need only maintain information about adjacent routers (i.e., one-hop knowledge). Like a distance-vector routing approach, TORA maintains state on a per-destination basis. However, TORA does not continuously execute a shortest-path computation and thus the metric used to establish the routing structure does not represent a distance. The destination-oriented nature of the routing structure in TORA supports a mix of reactive and proactive routing on a per-destination basis. During reactive operation, sources initiate the establishment of routes to a given destination on-demand. This mode of operation may be advantageous in dynamic networks with relatively sparse traffic patterns, since it may not be necessary (or desirable) to maintain routes between every source/destination pair at all times. At the same time, selected destinations can initiate proactive operation, resembling traditional table-driven routing approaches. This allows routes to be proactively maintained to destinations for which routing is consistently or frequently required. TORA is designed to minimize the communication overhead associated with adapting to network topological changes. The scope of TORA’s control messaging is typically localized to a very small set of nodes near a topological change.

CONCLUSIONS

Distance vector protocols work well in static networks. Since they maintain the full topology view all the time, distance vector type protocols are good choices when delivering real-time and heavy traffic. Link state algorithms are best suited for networks that require QOS (Quality of Service) guarantees because they provide link costs and capacities. Similar to distance vector protocols, however, link state protocols do not scale well to large networks and suffer from enormous amount of control overhead, especially in highly dynamic situations. On-demand routing protocols produce less control traffic overhead than the above mentioned proactive schemes since no route tables are periodically ex-changed. Control packets are generated only as needed, i.e., there are no control messages which are not utilized. WRP and FSR, especially, were the main beneficiaries of the group movement model. Each protocol’s performance degraded as mobility rates increased, but DREAM was the most robust to the speed of network hosts. However, because of the data flooding, DREAM became less effective under heavy traffic scenarios. On-demand protocols were highly effective and efficient in most of our scenarios. Extra delay in acquiring routes, though, makes them less attractive in delivering real-time traffic. LAR further improved an on-demand protocol by using location information, but produced more overhead to exchange location information. In summary, there is no single routing strategy that is best for all network situations. Every protocol has its advantages and disadvantages in different scenarios. The choice of a routing protocol should be made carefully after considering every aspect we provided in this section (and possibly more). In future work we must add certain routing protocols with multi-strategy and multi-efficient (i.e. highly real time traffic control, less delay in acquiring route, etc.).

REFERENCES