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A Brief Study of Routing Protocols for Finding Efficient Path in MANETS

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Abstract: Routing is the process of transmitting data packets from a node to another. MANETs does not require any network infrastructure or any centralized node to administer. Deci1ding the route is important for performance. The routing protocols have been classified in to Proactive, Reactive and Hybrid protocols. In the present paper we tried to compare reactive routing protocols namely Ad hoc On Demand Distance Vector (AODV), Dynamic Source Routing (DSR) protocols, Temporarily Ordered Routing Algorithm (TORA) and Associativity Based Routing (ABR) protocol. The performance of the above mentioned protocol has also been tabulated in the present exposition.
Keywords: MANET, Reactive, Table driven, Topology, Hybrid

I. INTRODUCTION

Mobile ad hoc network is an autonomous system of mobile nodes attached by wireless links; each node operates as an end system as well as a router for all other nodes in the network. Nodes can freely and dynamically self-organize and co-operate into random and temporary network topologies, permitting people and devices to communicate without any pre-existing communication architecture. MANET may be classified on base of minimum power routing algorithm or increasing the network lifetime [1].

The protocols is based on minimum-power routing algorithms chooses a path which minimizes the total energy consumption from source to destination.

On its contrary, a protocol based on increasing the network life time attempts to distribute the forwarding load over multiple paths. This is accomplished by reducing a set of nodes needed for the forwarding duties and allowing subset of nodes to sleep over different periods of time. In this way, they balance the traffic inside the MANET and increase the overall useful life of the network. Hence to enhance MANET's performance, many reactive routing protocols have been put forward for consideration.

Some of these protocols are being described in this paper with a comparative study. Hence this paper gives a detailed amount of distinctive reactive routing protocols like AODV [2], TORA [3] and ABR[4] for MANET along with proactive routing protocol DSDV[5].

II. CATEGORIES OF PROTOCOLS

The protocols may be divided into two types, Proactive and Reactive. Other group of MANET routing protocols which is a combination of both proactive and reactive is referred as Hybrid.

(a) Proactive routing protocols: In this protocol, each and every node is in search for routing information amidst a network. One or more tables are maintained by each node which represents analysis situs of network. As and when a route is required, it is previously known due to regular updating process of these tables, which takes place at regular intervals.

If any node wants to send information to others, path is already known and thus time leg to deliver and transfer information between each node is low.

(b) Reactive Routing protocols: In this protocol, a node initiates a route discovery process throughout the network, only when it wants to send packets to its destination. This process is completed once a route is determined or all possible permutations have been studied. Once a path has been established, it is maintained by a route maintenance process until either the destination becomes inaccessible along every path from the source or the route is no longer desired. In this process routing information is collected only when it is needed, and route determination depends on sending route queries throughout the network. That is whenever there is a need of a path from any source to destination then a type of query reply dialog does the work. Therefore, the latency is high; however, no unnecessary control messages are required.

(c) Hybrid protocols: These protocols incorporate the merits of proactive as well as reactive routing protocols. Nodes are grouped into zones based on their geographical locations or distances from each other. Inside a single zone, routing is done using table-driven mechanisms while an on-demand routing is applied for routing beyond the zone boundaries. The routing table size and update packet size are reduced by including in them only art of the network thus, control overhead is reduced.

III. REACTIVE PROTOCOLS

In reactive protocols a route search is needed for every unknown destination. Therefore, theoretically the communication overhead is reduced at expense of delay due to route search. Some reactive protocols are Ad hoc On-Demand Distance Vector (AODV), Dynamic Source Routing (DSR)[6], Temporally Ordered Routing Algorithm (TORA), Associativity-Based Routing (ABR).

(a) Dynamic Source Routing (DSR): The Dynamic Source Routing (DSR) is one of the purest examples of an on-demand routing protocol that is based on the concept of source routing. It is designed particularly for use in multihop ad hoc networks of mobile nodes. It allows the network to be totally self organizing and self-configuring and does not need any existing network infrastructure or administration. DSR is composed of the two mechanisms of Route Discovery and Route Maintenance, which work together to permit nodes to discover and maintain source routes to arbitrary destinations in the network. DSR has a unique benefit by virtue of source routing. As the route is section of the packet itself, routing loops, either short – lived or long – lived, cannot be formed as they can be immediately detected and removed. This property opens up the protocol to a variety of useful optimizations.

(b)Ad hoc On-demand Distance Vector Routing (AODV): AODV belongs to the class of Distance Vector Routing Protocols (DV). In a DV every node knows its neighbours and the costs to reach them. Ad hoc On Demand Distance Vector (AODV) is a reactive routing protocol which initiates a route discovery process only when it has data packets to transmit and it does not have any route path towards the destination node, that is, route discovery in AODV is called as on-demand. AODV is composed of three mechanisms: Route Discovery process, Route message generation and Route maintenance. The significant feature of AODV is whenever a route is available from source to destination; it does not add any overhead to the packets. Though, route discovery process is only initiated when routes are not used and/or they expired and consequently discarded. This strategy decreases the effects of stale routes as well as the need for route maintenance for unused routes. Another characteristic feature of AODV is the ability to offer unicast, multicast and broadcast communication. AODV uses a broadcast route discovery algorithm and then the unicast route reply message

(c) Associativity-Based Routing (ABR): ABR is a source initiated on-demand routing protocol. It is free from loops, deadlock and packet duplicates. It only maintain routes for sources that actually desire routes. However,

ABR does not employ route re-construction based on alternate route information stored in intermediate nodes (thereby avoiding stale routes). In addition, routing decisions are executed at the destination and only the best route will be selected and used while all other possible routes remain passive. Its distinct feature is the use of associativity ticks which is required to only form routes based on the strength of nodes, under the fact that there is no use to form a route using a node which will be moving out of the topology and thus making the route to be broken. ABR has three modes of operation namely route discovery phase, route reconstruction phase and route deletion.

(d) Temporally Ordered Routing Algorithm (TORA): The Temporally Ordered Routing Algorithm (TORA) is a highly adaptive, well organized and scalable distributed routing algorithm based on the concept of link reversal. TORA is proposed for highly active mobile, multi-hop wireless networks. It is a source-initiated on-demand routing protocol. It has a unique feature of maintaining multiple routes to the destination so that topological changes do not require any reaction at all. The protocol responds only when all routes to the destination are lost. In the experience of network partitions the protocol is able to detect the partition and erase all invalid routes. The protocol has three basic purposes: Route creation, Route maintenance and Route removal.

There exist many on-demand routing protocols for mobile Ad hoc networks (MANETS). Most of the protocols, though, discover a single route and fail to utilize multiple alternate paths. Multipath routing permits the establishment of multiple paths between a single source and single destination node and in the event the path breaks, an alternate path is used instead of initiating a new route discovery. Hence multipath routing stands a promising routing method for wireless mobile Ad hoc networks. Multipath routing protocols get lower routing overhead, lower end-to-end delay, more resilient to route failures and alleviate congestion in comparison with single path routing protocols.

In this paper we have provided descriptions of several routing scheme proposed for mobile ad hoc networks. We have provided a classification of these schemes according the routing strategy i.e. table driven and on demand and presented a comparisons of these categories of routing protocols. Reactive protocols were introduced. The basic actions related to the routing process were studied in details. Also the advantages and disadvantages of the protocols based on their routing processes were given in the end.

Comparison of on-demand routing protocols with one of the efficient table driven routing protocol DSDV has also been made to illustrate that on-demand protocols work better than table driven protocols. Functioning of all protocols was carried out under identical traffic load and mobility patterns condition. The overall study of routing protocols has been summarized in the table 1.

Table1. COMPARISON OF REACTIVE PROTOCOL

Protocol	Route Selection	Route Maintenance	Route Reconfiguration	Stored Information	Update Information	Update destination	Update period	Multiple routes	Unidirectional links
AODV	Newest and shortest path	Route table	Delete route, Inform source	Next hop for desired destination	Route Error packet	Source	Event driven	Yes	No
ABR	Stability of wireless link nd may be longer than shortest one	Route table	Delete routes and inform source	Next hop	Route Error packet	Source	periodically	No	No
DSR	Newest with intermediate nodes	Route table	Intermediate nodes with route cache, inform source	Route cache for desired destination	Route Error packet	Source	Event driven	Yes	Yes
TORA	Newest and available path	Route table	Delete route, Inform source	Next hop	Route Error packet	Neighbours	Event driven	Yes	Yes

IV. CONCLUSION

A large number of different kinds of routing protocols are practiced in mobile Ad hoc networks. The utilizing of a specific routing protocol in mobile Ad hoc network depends upon number factors including size of the network, load, mobility requirements, routing overhead and end-to-end delay. In current years on-demand routing protocols have attained more attention in mobile Ad hoc networks as compared to other routing schemes due to their potential flexibility in deployment and efficiency in terms throughput. They are able to organize themselves dynamically with lower memory overhead and lower bandwidth requirement than table driven protocols.

V. FUTURE WORK

Ad hoc networking is a boiling concept in personal communications worldwide research is going on in this area and many issues still have to be addressed. We focused on concepts like unipath and multipath routing protocols with respect to their performance in the mobile Ad hoc network. Multipath routing is a step towards getting a network with better Quality of Service. Though there are many more issues related to routing that could be subjected to further research studies. The present research work can be extended to design and develop new routing protocols to meet the following additional desirable features.

Robust Scenario- A routing protocol should work with robust scenarios where mobility is high, nodes are dense, area is large and the amount of traffic is more.

Probabilistic Route Maintenance- A additional research in the field like probabilistic route maintenance is required to identify the probability of route failure before the occurrences of route failures.

Quality of service (QoS) - Ad hoc routing protocols must meet the desired requirements of QoS to achieve lower end-to-end delay, high throughput improved delivery ratio, reduced routing overhead and more energy efficiency.

Security- A vital issue that has to be addressed is the security in Ad hoc networks. Applications like Military and Confidential Meetings require high degree of security against enemies and active /passive eavesdropping attackers. A new protocol must have authentication headers and necessary key management to distribute keys to the members of Ad hoc networks.

Routing Overhead – Routing messages will utilize most of the precious bandwidth of Ad hoc networks; a new protocol has to be devised to reduce the routing overhead still further compared to AOMDV.

Energy Aware Routing – Since mobile nodes are working on small portable batteries in most of the applications, developing an energy aware routing protocol, which maximizes the life of batteries, is of paramount importance.

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