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ANALYSIS OF MANET ROUTING PROTOCOLS

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ABSTRACT

MANET stands for mobile ad hoc network. It is an infrastructure less network. In these mobile nodes are moved randomly and changes their link quickly. So, topology changes quickly. Due to changing topology and limited bandwidth manet is important research area. In MANET nodes acts as a host and router. In this if nodes are within range they can communicate directly otherwise the node forwards the packet to other nodes. Manet is divided into three categories based on their routing methodology that is reactive, proactive and hybrid routing protocols. This paper gives overview of routing protocols of MANET that is reactive, proactive and hybrid routing protocols.

Keywords: AntHocNET , AODV , DSDV ,Mobile Ad Hoc Networks, Routing Protocols, ZRP

I. INTRODUCTION

MANET stands for Mobile Ad Hoc Networks. Manet is wireless infrastructure less network. In Manet nodes are free to move randomly, limited transmission range and topology changes frequently due to this manet is important research area[1][2]. The various application of MANETs are Military Use, Search and Rescue, Vehicle-to-Vehicle communication in intelligent transportation, Temporary network in meeting rooms, airports etc. The overhead in manet cannot be ignored due to bandwidth of 802.11b wireless interface is at most 11 Mb. Manet is divided into different routing protocols that is reactive, proactive and hybrid routing protocols. In proactive routing protocols path are already defined in the routing table from source node to destination node due to this delay is less and overhead is more. In Reactive routing protocols route discovery is initiated when there is demand for it. This route discovery is initiated by a source node through discovery process within the network[1]. The hybrid routing protocols is a combination of proactive routing protocol and reactive routing protocol. The hybrid routing protocols supports routing in large networks.

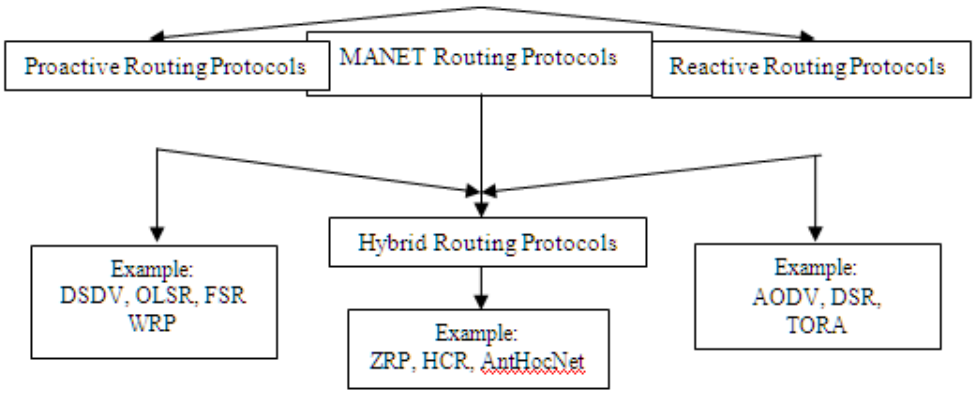

Figure 1 Classification of MANET routing Protocols

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II. OVERVIEW OF PROACTIVE ROUTING PROTOCOLS:

2.1 Destination Sequenced Distance Vector Routing (DSDV)

It is an enhanced version of distributed Bellman-Ford algorithm. In this each node maintain a table which contains the shortest distance. In this when a node receive an update it disseminates to its neighbor thus in this protocol broken link information is propagated to the whole network[3]. DSDV can be applied to MANETs with few modifications. DSDV suffers from excessive a control overhead due to this it is not scalable in MANETs which have limited bandwidth and topology changes frequently.

2.2 Optimized Link State Routing Protocol (OLSR)

It is based on Multipoint Relaying (MPR) flooding technique[1]. This reduces the number of topology broadcast packets. This technique also reduces the size of broadcast packet. As a result this protocol saves the bandwidth. In this shortest path from one node to other node is computed with Dijkstra's algorithm which goes along a series of MPR node. The Scope of OLSR is in large and dense MANETs.

2.3 Fisheye State Routing Protocol (FSR)

The scope of FSR protocols is in large and high mobility manet[3]. This Protocol is based on fisheye as fish can see near object with high resolution and far object with low resolution[1]. This protocol adopts the same idea as the network is divided into different scope based on the distance of node and relative node to it. For example the node with 2 hops is in inner scope and all nodes greater than 2 hops are in outer scope. In this link state update are broadcast to the neighbor. The routing entries in inner scope are sent at highest frequency and the other are sent at lower frequency.

2.4 Wireless Routing Protocol (WRP)

It is a table based distance vector routing protocol. In this protocol each node in the network maintains a Distance table, a Routing table, a Link-Cost table and a Message Retransmission list[4]. This algorithm utilizes the information of destination and second-to-last hop (predecessor) along the path to each destination. This algorithm eliminates the counting-to-infinity problem of distributed Bellman-Ford-algorithm by using predecessor information.

III. OVERVIEW OF REACTIVE ROUTING PROTOCOLS

3.1 Dynamic Source Routing Protocol

It does not maintain the routing table because it utilizes the source routing option in data packets[5]. It uses route cache which contains the address of the node along the path towards the destination. In this to send the packet sender construct a source route in the packet header giving the address of each host in the network through which the packet should be forwarded in order to reach the destination. In this when a node receives a packet and that node is not the final destination then it simply send the packet to the next hop identifies in the source route of the packet's header. When packet reaches the destination, the packet is delivered to the network layer software on that host. In this each node maintain a route cache in which it caches source route that it has learned. When a packet is send from one host to another host it check its route cache for source route to the destination if the route is find then sender send the packet to that route otherwise it follow the route discovery protocol. Routes will also no longer if any of the host along the route fail. The route maintenance detects the problem and route discovery may be used again to discover a new and correct route to the destination.

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3.2 Ad hoc On-demand Distance Vector Routing Protocol (AODV)

This protocol used the broadcast route discovery mechanism as in Dynamic Source Routing but in AODV protocols routing table is used instead of source routes in each data packet which cause the large overheads[6][2]. In this to maintain the most recent information of routing it borrows the concept from Destination Sequence Numbers from DSDV. The combination of these techniques provides an algorithm which uses the bandwidth efficiently. The AODV routing protocol ensure loop free routing and responsive to changes in topology. It broadcast discovery packets only when needed. This protocol also disseminates information regarding changes in local connectivity to those neighboring mobile nodes that are likely to need the information.

3.3 Temporary Ordered Routing Algorithm (TORA)

It is based on the concept of link reversal and it is proposed for highly dynamic mobile, multi-hop wireless networks. It is a source initiated on-demand routing protocol and find the multiple routes from source node to the destination node[3]. The three basic functions of this protocol is route creation, route maintenance and route eraser. It uses the directed acyclic graph (DAG) to define route either as upstream or downstream. This protocol has unique feature that it maintain multiple routes to the destination so that topological changes do not require any reaction at all. It reacts only when all the routes to the destination is lost. In this protocol when there is network partition it detects the partition and erase all invalid routes.

IV. OVERVIEW OF HYBRID ROUTING PROTOCOLS

4.1 Zone Routing Protocol (ZRP)

It is a combination of proactive and reactive routing protocol. In this proactive routing is used within the zone also called the IntrAzone Routing Protocol (IARP) and outside the zone reactive routing is used also called the IntErzone Routing Protocol (IERP)[7][8]. The Zone is defined by the parameter called the zone radius. The nodes which are equal to this routing zone are called the peripheral nodes. In this flooding mechanism is different from other routing protocol. It uses the Bordercast Resolution Protocol (BRP) to send the packet to the peripheral nodes which is called the Bordercasting[9].

4.2 Hybrid Cluster Routing Protocol (HCR)

This protocol overcomes the delay and routing overhead. In this using an efficient and distributed clustering algorithm nodes are organized into hierarchical structure of multi-hop clusters. In this structure one distinguish node is called the clusterhead, a gateway and ordinary node. This gateway node is located between the multiple cluster[10][11]. In HCR the high level that is cluster level information is maintained by the proactive protocol and lower level that is node level is maintained by the reactive routing protocol.

4.3 ANTHOCNET

It is based on ideas from ant colony optimization which inspired from self-configuring and self –healing nature of social ant behavior. In these when ant moved from one place to other they leave a substance called the pheromone[12]. This pheromone trail is followed by other ants. In this the ants which find the shortest routes are fastest to return and this attract the other ants by depositing the food trail pheromone. The other ants follow this route[13]. In computer field this pheromone is replaced by artificial stigmergy the probabilities values used in the routing table. The two agents forward and backward is used to update this probabilities value.

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V. RELATED WORK

Hongbo Zhou[1] has provides the detail study of routing protocols. Traditional routing protocols and MANETs routing protocols are described for unicast, multicast and broadcast. The unicast routing protocols proactive, reactive and hybrid are described in the paper. Different protocols have different strengths and drawbacks. One protocol cannot fit into all the possible scenario and traffic patterns of MANET applications. Hybrid unicast routing protocol is seem to be better than the pure proactive and reactive routing protocols.

Petteri Kuosmanen[4] has provides the classification of ad hoc routing protocols and also presents the some specified protocols according to that classification. This paper presents the main features of wide variety of different protocols and evaluates their suitability and tradeoffs

David B. Johnson and David A. Maltz[5] have presented the dynamic source routing protocol for routing in ad hoc networks. In this when host movement is frequent this protocol adapts quickly to route changes also in this there is no or little overhead when host moves less frequently. The result shows that this protocol performs well in variety of environment conditions such as host density and movement rates. The overhead of this protocol is quite low failing to just 1% of total data packets transmitted for moderate movement rates in a network of 24 mobile hosts.

Charles E. Perkins and Elizabeth M. Royer[6] have presented the Ad-hoc On Demand Distance Vector Routing (AODV), a novel algorithm. In this each mobile host operates as a specialized router and routes are obtained as needed with little or no reliance on periodic advertisement. It provides loop free routes even while repairing broken links. Because the protocol does not require global periodic routing advertisement the overall bandwidth available to the mobile nodes is less than in those protocols that do necessitate such advertisements. The algorithm scales to large population of mobile nodes wishing to form ad-hoc networks.

Anuj K.Gupta et.al [3] have provided an overview of a wide range of existing routing protocols with particular focus in their characteristics and functionality. The comparison is providing based on the routing methodology and routing information. The performance of the routing protocols is also discussed.

Zygmunt J. Haas[8] has proposed the new routing protocol, the ZRP for reconfigurable wireless networks, large scale and highly mobile ad-hoc networking environment. It is applicable to large flat-routed networks. It exhibits adjustable hybrid behavior of proactive and reactive routing schemes through the use of zone radius. The performance of the protocols shows reduction in number of control message as compared with other reactive schemes such as flooding.

Marc R. Pearlman and Zygmunt J.Haas[9] have demonstrated the effects of relative node velocity, node density, network span and user data activity on the performance of the ZRP. The two different schemes introduced by them are “min searching” and “traffic adaptive” allows the individual node to identify and appropriately react to changes in network configuration, based on the information derived from the received ZRP traffic. Through test-bed simulation, demonstrated that these radius estimation techniques can allow the ZRP to operate within 2% of the control traffic resulting from perfect radius estimation.

Zygmunt J.Haas and Marc R. Pearlman[7] have proposed the query control scheme exploit the structure of routing zone to provide enhance detection and prevention of overlapping queries. It improves delay and control traffic performance of ZRP and can be applied to single-or multiple channel ad hoc networks. Query control

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mechanism allow the ZRP to provide routes to all accessible network nodes with less control traffic than purely proactive link state and purely reactive routing, and with less delay than conventional flood searching.

Xiaoguang Niu et.al[10] have proposed a novel hybrid routing protocol for large scale mobile ad hoc networks namely HCR (Hybrid Cluster Routing). In this nodes are organized into hierarchical structure of multi-hop cluster using stable distributed algorithm. Each cluster is composed of clusterhead, several gateway nodes and other ordinary nodes. In this Intra-cluster routing information operated in an on-demand and inter cluster routing operates in a proactive way. The result shows that HCR conduces better scalability, robustness and adaptability to large scale ad hoc networks compared with routing protocols, e.g. AODV, DSR and CBRP.

Galla Divya et.al [11] have incorporated a new procedure in the existing Distributive Mobility Adaptive Clustering Algorithm (DMAC) because the existing DMAC algorithm does not address the issue of updating a node leaving a cluster. The performance of DMAC algorithm is compared with the Lowest ID (LID) and Weighted Clustering Algorithm (WCA).The simulation analysis shows that DMAC outperforms the others two in terms of throughput, packet delivery fraction and normalized routing load.

Gianni Di Caro et.al [12]have presented AntHocNet, a new algorithm for routing in MANETs. It is based on ideas from Ant Colony Optimization. In this reactive path is set up between the source and destination and during communication ants proactively test the existing path and explore new ones. The simulation test shows that AntHocNet outperform AODV in terms of end-to-end delay and packet delivery ratio.

Tasbir Singh and Jaswinder Singh [13]have implemented a new Ant Colony Optimization (ACO) based protocol SARA. Simple Ant Routing Algorithm (SARA) a new technique which reduces the overhead by using route discovery based on the concept of Control Neighbor Broadcast (CNB). The result of SARA is compared with the AntHocNet protocols on four parameters average energy, throughput, delay and overhead. The result shows the SARA performance is better than AntHocNet Protocol.

VI. CONCLUSION

MANET is Infrastructure less network and applications of MANET is increases day by day therefore continuous research and development is required. In this paper, we review the different protocols of proactive, reactive and hybrid routing protocols of MANET. Each routing protocols has different features, based on the environment we have to choose the suitable routing Protocols. Still MANET have posed a great challenge for the researcher due to limited bandwidth and changing topology.

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