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A Review on Ant Based Hybrid Routing Protocols for MANETs

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Abstract — *MANET is a collection of mobile nodes connected in dynamic manner which acts as a router. So, routing is the most important issue due to the mobility of these nodes. Analysis shows that Ant Colony Optimization (ACO) performs better for finding the best route. Ants based algorithms are more robust, scalable and reliable then the other conventional routing algorithms. Main objective of this review is to study different ant based hybrid routing protocols for MANETs.*

Keywords- *Ant colony optimization, MANETs, routing, hybrid*

I. INTRODUCTION

Mobile Ad-hoc Networks (MANET) are wireless networks, where nodes can move and communicate with each other without any centralized control.[1] Each node can act as a source transmitting data packets, as a destination receiving packets and also act as router. In MANET, the topology of network changes frequently and link failure may occur. This means that routing information should be updated regularly.

Several protocols are developed for routing and categorized as (i) Reactive/on demand, (ii) Proactive/Table Driven and (iii) Hybrid protocols. [1] In reactive protocols, routes are generated when they are required by the source using a route discovery process. In proactive routing protocol every node maintains the information about the other nodes in the tables. Hybrid routing protocols is a combination of basic properties of these two routing protocols. So, they act as both reactive and proactive in nature.

II. ANT COLONY OPTIMIZATION (ACO)

ACO is the ant based routing protocol that solves the routing problem based on an artificial intelligence concept called swarm intelligence. ACO is based on the foraging behavior of real ants. They walk towards food in random way and release a chemical substance, called as pheromone which serves as a route mark that the ants have taken. New ants will select the path having higher pheromone concentration and also will reinforce the path they have taken. [2]

The reason behind choosing ACO is its distributed nature and inherent randomness. The algorithm used for optimization is a purely a distributed algorithm. Since in a MANETs the nodes are constrained by power, storage and processing power limitations, a purely distributed algorithm like ACO prevents per node computation load, reduces state information to be stored per node.

III. ANT BASED HYBRID ROUTING PROTOCOLS

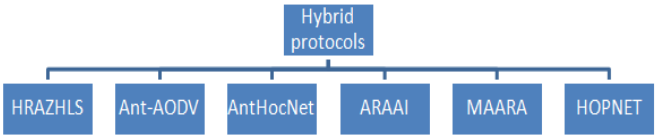

Figure 1. Ant based hybrid routing protocols

A. Hybrid Routing Algorithm Based On Ant Colony And ZHLS (HRAZHLS):

It uses zone based hierarchical link state (ZHLS) protocol which has proactive routing within zones and reactive routing outside the zone. The network is divided into non-overlapping zones and the size of these zone depends on network density, transmission power and node mobility. Each node knows its physical location by GPS.[3] Nodes are categorized as interior node and gateway nodes. Two types of routing tables are maintained named as intrazone routing table and interzone routing table. This algorithm uses five types of ants: internal forward ant, external ant, backward ant, notification ant, error ant. Node periodically sends internal forward ant to neighbors to maintain Intrazone routing table. This table is used to transmit data packets. External forward ants are sent to gateway nodes which checks that particular node is within the zone or not. If it is not within the zone then ant jumps between border zones, called broadcast. At the

destination forward ants are converted to backward ant and sent to source. If the zone is damaged then local repair or alternate path is selected and notification ant is sent to source to allow the change of route. Error ant sent to source if new path is not found instead of failure path.

B. Ant-AODV:

In this algorithm ant uses proactive behavior and AODV uses reactive behavior of routing. The main goal of this algorithm is to continuously create route to reduce end-to-end delay and network latency.[4] The disadvantage is, this algorithm have more overhead then AODV. Use of ants with AODV increases node connectivity and decreases route discovery. There are fixed amount of ants in the network.

C. AntHocNet:

This algorithm maintains routes only for open data sessions. Algorithm has a reactive route setup phase in which, reactive forward ants are sent by source to find multiple paths to the destination. Here, backward ants are used to actually setup route. If the data session is open then path is monitored, maintained and improved using proactive ants. Thus, this algorithm improves the efficiency.[5]

D. Ant Routing Algorithm Based On Adaptive Improvement (ARAAI):

This algorithm provides multipath and offers adaptive control. It uses two routing tables. One is routing table in which initial node contains the leaving initial place of ants, last node contains address of previous node and heuristic value contains local node energy information collection. Second table contains neighbor information and represented as connection between local and other nodes.[6]

E. Multi Agent Ant Based Routing Algorithm (MAARA):

This hybrid algorithm is proactive because the path is established only when needed. And it is reactive because the routing table is maintained till the end of communication session.[7] This algorithm has five phases: Route Update, Route Discovery, Route Maintenance, Data Routing and Route Failure.

F. HOPNET:

This hybrid algorithm has features of ZRP and DSR both. The network is divided into zones and thus maintains two tables: IntaRT and InterRT. Routing table includes four elements: pheromone values, visited times, hops and sequence number. Ant chooses the node which produce best path from node to destination.[8] This algorithm is highly scalable for large network.

IV. ANALYSIS OF VARIOUS HYBRID ACO ALGORITHMS

Table 1. Comparision of Hybrid ACO Algorithms

PARAMETERS	HRAZHLS	AntHocNet	Ant-AODV	ARAAI	MAARA	HOPNET
Routing Overhead	Decreases with increasing network	More	More	Less	Less	Less but increase with zone radius
Scalability	More	Less	-	Less	-	More
Multiple Paths	Yes	Yes	No	Yes	Yes	Yes
Route Discovery Latency	-	-	Less	More	Less	-
Average End - to - End delay	Less	Less	Less	-	Less	Less
Packet Delivery Ratio	More	Decrease with increasing MANET size	Less	Less	More & not affected by network size	More than AntHocNet for larger network
Routing Approach	Both	Both	Reactive	Both	Both	both
Loop / Cycle	-	No	No	No	-	No
Load Balancing	-	-	No	-	-	No

V. CONCLUSION

ACO routing algorithms performs better than the conventional routing algorithms. In this paper various ACO based hybrid routing algorithms have addressed. ACO algorithm provides reliability, scalability and robustness which deals with the challenges of MANETs. In this paper various hybrid ACO algorithms are analyzed with their respective advantages and disadvantages in detail.

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