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A Survey on Bio Inspired Algorithms for Trusted AODV Routing Optimization in Manet

[1]V. Keerthika and [2]N. Malarvizhi

[1]Department of CSE, VELTECH Dr.RR&Dr.SR Technical University, Chennai, India
[2]Department of CSE,
VELTECH Dr.RR&Dr.SR TECHNICAL UNIVERSITY, Chennai, India

Abstract: MANET is self-organized networks. An important and essential for MANET is designing secured routing protocols, is a major challenge due to the mobility of networks design establishing an optimal and efficient route between the communicating parties is the primary concern of the routing protocol in MANET. We can use bio inspired Algorithms to solve the routing challenges. This survey presents a comparison and classification of routing protocols, optimization algorithms suitable for secure routing. This paper is inspired in review the biological inspired algorithms, a branch of Natural computing used for optimization in routing and it includes evolutionary algorithms, Ant Colony Optimization, Particle Swarm Optimization.

Key words: ACO · PSO · Heuristic

INTRODUCTION

Mobile Ad hoc networks (MANETs) have several advantages compared to traditional wireless networks. These include ease of deployment, speed of deployment and decreased dependency on a fixed infrastructure. Traditional routing algorithms in MANETs do not work with cryptographic techniques, it needs a secure, trusted, optimal scheme for routing in MANETs [1]. Security in Network layer plays important in the security of entire network, because all the major attacks exist in this layer. Attacks in MANET need very specified method of security. Implicit Trust relationship with neighbors to avoid attacks is major role.

There is need to develop a routing algorithm that is fully aware of the current network topology and available resources [6]. In this present era lot of research work focuses o use evolutionary algorithms to solve the routing problems that include Genetic algorithms, particle swarm optimization, Bee colony optimization [6]. The protocol to be chosen according to network characteristics. AODV routing protocol and an ant based optimization proposed to solve routing problems.

This paper is divided into four sections. Section 2 gives detail note on the network routing protocols and the problem behind it. In section 3 there is a brief explanation of the nature evolutionary algorithm used for route optimization, section 4 contains the conclusion and also some future scope of work as well as references used in this paper.

Trust Routing Protocols in Manet: Routing in MANET is challenging task because of dynamic Network. There is no single protocol approach that fits all networks. The routing protocol play a very important role in calculating, choosing and selecting the relevant path for transferring the data from the source to the destination efficiently. There are already many accepted routing algorithms used to find the shortest path and also to increase the throughput of the network. In [8] Author proposed Trust-based security schemes in MANET, have considered 3 features to represent each node in our MANET environment which includes trust value metric, packet precision and blacklists. proposed AODV with friendships mechanism that is enhanced with trust features called Friendship-based AODV routing protocol (FrAODV) [8], Trust is an important aspect of mobile ad hoc networks. Trust computations and management are highly challenging issues in Manet. [2].Trust is a degree of belief about other entities behavior, nodes participating in data exchange should be shielded by trust mechanism [3].

Corresponding Author: V. Keerthika, Department of CSE, VELTECH Dr.RR&Dr.SR Technical University, Chennai, India.

Layers	Attacks
Application Layer	Repudiation, Data corruption
Transport Layer	Session hijacking, syn flooding
Network Layer	Wormhole attack, black hole Attack
Data link Layer	Traffic Analysis
Physical Layer	Jamming , Eavesdropping

Fig. 1: Attacks in routing

We evaluated the performance of trust-based reactive routing protocols in a network with varying number of malicious nodes and mitigate the black hole attack, in our previous work.

AD HOC On-demand Distance Vector (AODV) Routing Protocol: AODV protocol is widely used due to its ability to generate a route with minimal delay, overhead high packet delivery ratio, throughput [6]. AODV is an improvement of DSDV algorithm. It is typically minimizes the number of required broadcasts by creating routes on a demand basis, The AODV has a pure on demand route acquisition system, since nodes that are not on a selected path do not maintain routing acquisition or participate in routing table exchanges. In AODV, when a source node S wants to send a data packet to a destination node D and does not have a route to D, it initiates route discovery by broadcasting a route request (RREQ) to its neighbors. The immediate neighbors who receive this RREQ rebroadcast the same RREQ to their neighbors. This process is repeated until the RREQ reaches the destination node upon receiving the first arrived RREQ, the destination node sends a route reply (RREP) to the source node through the reverse path where the RREQ arrived. The same RREQ that arrives later will be ignored by the destination node. In addition, AODV enables intermediate nodes that have sufficiently fresh routes (with destination sequence number equal or greater than the one in the RREQ) to generate and send an RREP to the source node, no need to maintain unnecessary information [5].

AD HOC On-demand Multipath Distance Vector (AOMDV) Routing Protocol: To avoid frequent route discovery, various multipath routing protocol has been proposed based on the existing single path routing protocol in ad hoc networks. Ad hoc on-demand multipath distance vector (AOMDV) is one of extensions to the well-studied ad hoc on distance vector (AODV). In this paper an optimized AOMDV (OAOMDV) is presented to solve the "route cutoff" problem in AOMDV. The proposed protocol adds a new scheme into AOMDV and simulation results show the performance improvement [15].

DA-AODV Routing Protocol: In [16] author proposed DA-AODV routing protocol based on AODV routing protocol, makes the improvement to the route discovery stage and route maintenance stage with an optimized ant colony algorithm. according to seek path in the ant colony algorithm DA-AODV introduce two designed route FANT and BANT based on RREQ, RREP.

Review on Different Optimization Algorithms: This study aimed to address the applications of evolutionary algorithms to find efficient routes in networks an also considered the route optimization. In a network there are so many paths can exist from a source to a destination node. Among them finding optimal path is very difficult problem [9]. Different optimization technique can be used to find out an available optimal path from source to destination. it is not necessary that the optimal path should be always the shortest one, but it be feasible path, best path from source to destination. In [10] author proposed new method called Ant Based Dynamic Hop Optimization Protocol (ADHOP),routing algorithms inspired by ACO can be an effective way to deal with dynamic topologies due to the ability of ants to perceive changes in networks through pheromone as metric to make routing decision. Nature is a great inspiration source for solving different kinds of problems. It provides some efficient ways to solve real world optimization problems. study on some swarm intelligence based naturally inspired algorithms and describes how the foraging behavior of ants, swarm of birds, honey bees and bacteria are used in solving the optimization problems Ad Hoc Networks. It also includes evaluation on the performance of bio-inspired hybrid algorithms in the field of Mobile Ad Hoc Networks. In [4] author shows the efficiency of bio-inspired hybrid algorithms over other existing algorithms using results [4].

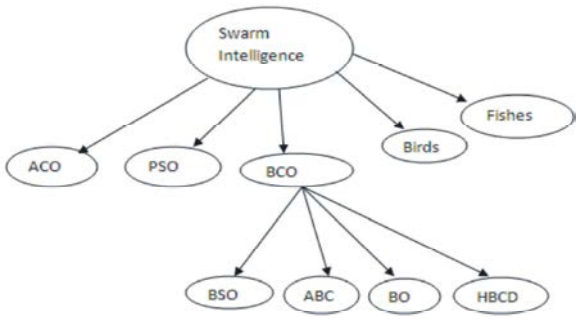

Fig. 2: Evolutionary algorithms

Ant Colony Optimization (ACO): Ant Colony optimization routing is an adaptive and efficient for MANETs. Now a days, routing in mobile ad hoc networks (MANETs) is a very challenging and growing issue because of its dynamic nature and decentralization infrastructure. Various routing protocols have been proposed for MANETs but results in limited bandwidth, high throughput, end-to-end delay, packet delivery ratio and more energy consumptions etc.

Fig. 3: Ant foraging-cooperative search by pheromone Trails

Ant colony optimization (ACO) is an algorithm based on the behavior of the real ants in finding the shortest path from a source to the food.

Ant colony Algorithm:

Step 1: Initialize the population

Step 2: Select the path randomly

Step 3: Select the final shortest path by Comparing all the paths

Step 4: Update pheromones

Step 5: Continue the steps until reach the destination

Problematic technique for solving computational problems which can be reduced to finding good paths through graphs and are inspired by behavior of ants in finding the paths from the colony to food. there are two working modes of ant is either forward or backward [16] pheromones only deposited in backward mode. the ants memory allows them to retrace path it has followed while searching for the destination node. Before moving backward on their memorized path, they eliminate any loops from it. While moving backward, the ants leave pheromones on the arcs they traversed [10].

Many special cases of the ACO meta heuristic have been proposed. The three most successful ones are: Ant System, Ant Colony System (ACS) and MAX-MIN Ant System (MMAS) [11].

An ant colony optimization algorithms have good techniques for developing different routing algorithms for MANETs. Inspired by the nature of ants as shown in Figure 2, The ants forging behavior is encompassed in the routing protocol for MANET [6].

Source Address	Destination Address	Probability	Pheromon Intensity	Hop Distance	Cost	Delay	Load	Reliability	...

Fig. 4: Ant Based Routing Algorithm Packet Format

Particle Swarm Optimization (PSO): Swarm Intelligence is a successful paradigm for the algorithm with complex problem Process. PSO is also tied to Evolutionary Computation, namely to Genetic Algorithms(GA) and to Evolutionary Programming [7].

A group of bird randomly searching for the food in an area. there is only one food in the are being searched. All the birds do not know where the food is, but they know how far the food is in each iteration, the use the effective strategy that they follow the bird which is nearest to the food all particle have the fitness value, velocity(which directs the flying of the particle).the particles fly through the problem space by following the current optimum particles. particles fly around in a multidimensional search space. During flight each particle adjusts its position according to its own experience and neighboring particle experience, Making use of the best position encountered by itself and its neighbor.

In PSO there are group of particles called swarm which move in search space to find shortest path from source to destination. Here every particle have a current position (position of particle existence in current time), personal best position (best position travel by each particle till now), global best position (best position of any particle among all particles in search space), velocity (personal velocity of each particle). In this technique every particle try to move towards the particle which is close to the solution and after some time all particle stop to particular solution which is optimal solution [13].

Velocity calculation
1.Initialize population in hyperspace
2.Evaluate fitness of individual particles
3.modify velocities based on previous best and global (or

neighborhood best positions
4. Terminate some conditions
Update each particle
V [i] = v [i] = c l * r a n d ( ) * (p b e s t [i] - p r e s e n t [ ])+c2*rand*(gbest[i]-present[i])
Present[i]=present[i]+v[i]

where c1,c2 are learning factors [7].
The pseudo code of the procedure is as follows
For each particle
Initialize particle
END
Do
For each particle
Calculate fitness value
If the fitness value is better than the best fitness value (pBest) in history
set current value as the new pBest
End
Choose the particle with the best fitness value of all the particles as the gBest
For each particle
Calculate particle velocity according equation Update particle position according equation
End

While maximum iterations or minimum error criteria is not attained

Name	Methods	Advantages	Disadvantages	Parameters used	preference	Reference
ACO	Find the best feasible path, inspired from foraging behavior of ants	Provides best path. used for static, dynamic combinatorial optimization problem	Theoretical analysis difficult. Probability Distribution changes by Iteration.	Number of Ants, the evaporation factor, candidate set, Pheromone update.	ACO is preferred in or node choosing rule	[6]
BCO	population based optimization technique, inspired from foraging behavior of honey bees	Bees return to home through direct route, effective and robust, produce excellent results,	To improve performance it requires new fitness tests with new parameters.	Number of bees, the number of forward passes.	Used to solve travelling salesman problem to find path	[18][20]
PSO	Population based stochastic optimization. Particle can transmit information to other particle.	PSO calculation is very simple, distributed, no central control or data source, ability to react environment change	Less efficient in solving the problems non-coordinate system work	Number of particles, dimension of particles, range of particles	PSO Is applicable in Fuzzy in nature. multi objective optimization problems	[7]
ABC	ABC algorithm is a recent optimization technique which simulates honey bees intelligent foraging behavior.	Used to find multiple objective parameter solution randomly	Initially the forger bees have no knowledge about the food sources around nest.	Essential control like parameters Population size, no of cycles or iteration, Limit value	ABC Preferred In Numerical Test Functions	[22]

Fig. 5: Comparisons of algorithms

Bco (Bee Colony Optimization): The Artificial Bee Colony algorithm is one of the most recent swarm intelligence based algorithms which simulates the foraging behavior of honey bee colonies. The BCO represents the new meta-heuristic capable to solve difficult combinatorial optimization problems. In this work, modified versions of the Artificial Bee Colony algorithm are introduced and applied for efficiently solving real-parameter optimization problems [17].

This algorithm is inspired by the foraging principle of honeybees it use less energy because it utilizes less control packets to do routing. In [18] the author proposed protocol BeeIP is able to faster data transmission and speed is very high and delay is very low compare than other SI protocol. Eventually, this protocol maintains balanced control overhead. BeeIP following four mechanisms, called adaptive Scouting, Adaptive Foraging, Optimal path selection, Detection of path failure.

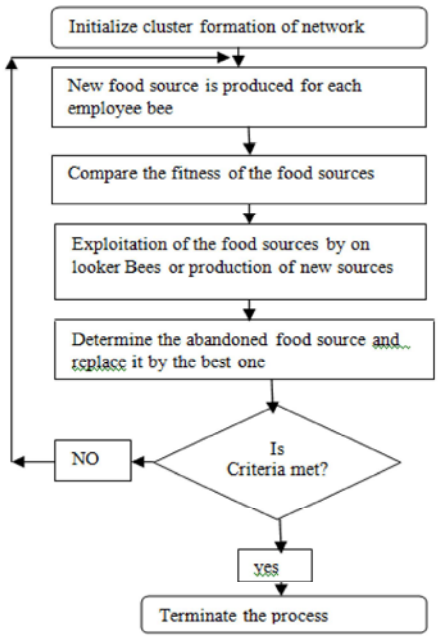

Fig. 6: Optimization procedure for Bee colony Algorithm

Artificial Bee Colony Algorithm: ABC is swarm based Meta Heuristic algorithm used For optimal solution.ABC is composed of three bees. Employed Bee, on hooker Bees and scout bees. The exchange of information among the bees is most important to form knowledge.

Initial food sources are produced for all employed bees

Repeat:

- Each employed bee goes to a food source in her memory and determines a neighbour source, then evaluates its nectar amount and dances in the hive
- Each onlooker watches the dance of employed bees and chooses one of their sources depending on the dances and then goes to that source. After choosing a neighbour around that, she evaluates its nectar amount.
- Abandoned food sources are determined and are replaced with the new food sources discovered by scouts.
- The best food source found so far is registered.

UNTIL (requirements are met)

CONCLUSION

The reactive routing protocols like, AODV using Ant Colony optimization are review in this paper and also addressed the applications of evolutionary algorithms to discover efficient routes in networks self organized natural has many desirable aspects that are suitable to routing problems in MANET [6]. To conclude, the future work on ABC algorithm should be performed, however, more factors should be considered when applying in a network routing problem, such as congestion control, delay factor, different types of network routes and directions.. In future a hybrid optimization technique using Artificial Bee Colony Optimization (ABC) to be proposed for the optimization of MANET routing.

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