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Survey on MANET Optimization using Mobile Agent Routing

Anu A Varghese [1] Dr. Ashutosh Verma [2]
[1].Research Scholar ,Maharishi University of Information
[2].Department of Computer Science and Engineering, Maharishi University of Information

Abstract :-A Mobile Adhoc Network (Manet) is a esteem challenging environment due to its dynamic topology, limited processing capability, limited storage, band width constraints, high bit error rate and lack of central control. Due to dynamic change of network on ad hoc networks, links between nodes are not permanent. In occasions, a node cannot send packets to the intended next hop node and as a result packets may be lost. Loss of packets may effect on route performance in different ways. A malicious node can easily disrupt the proper functioning of the routing by refusing to forward routing message (misbehavior node), inject the wrong routing packets, modifying routing information, etc. Hence the design of secured routing algorithm is a major issue in Manets. Mobile Agent based algorithms also called Ant Routing algorithms are a class of swarm intelligence and try to map the solution capability of ant colonies for routing in Manets. In this paper we discuss diverse prominent MANET Optimization using mobile agent routing.

Key-Words: Manets, Mobile Agents, Ant Routing, Security, AntNet , AntHocNet, ARA

1. Introduction

MANET is a communication network of a set of mobile nodes placed together in ad-hoc manner, in which nodes communicate via wireless link. All nodes have routing capabilities and forward data packets to other nodes in multi-hop transmission. Nodes can enter or leave the network at any time and may be mobile, so that the network topology continuously changes. Hence the primary challenge is to design effective routing algorithm that is adaptable to the changes in the behavior and topology of the MANETs. Table-driven (proactive), on-demand (reactive) and hybrid routing protocols are three main categories of routing protocols for ad hoc wireless networks. Table driven routing

algorithms include Destination Sequenced Distance Vector (DSDV), Clustered Gateway Switch Routing (CGSR) and Wireless Routing Protocol (WRP). On demand routing algorithms include Dynamic Source Routing

(DSR), On-Demand Distance Vector Routing (AODV),Temporally Ordered Routing Algorithm (TORA) and Zone Routing Protocol (ZRP)[1]. Hybrid routing algorithms aim to use advantages of table driven and on demand algorithms and minimize their disadvantages. Ant colony Mobile agent based algorithms are a special category of algorithms (proactive, reactive and hybrid) that provide features such as adaptivity and robustness which essentially deal with the challenges of the MANETS.

2.Background of Mobile *Ad Hoc* Network Routing

Many routing protocols have been proposed for Mobile *Ad Hoc* Networks (MANETs) [1]. In this section we review two standard MANET routing protocols, *i.e.*, Destination Sequenced Distance Vector (DSDV) routing protocol and *Ad Hoc* On Demand Distance Vector (AODV) routing protocol. To establish communication path between nodes, efficient routing protocols are needed. In MANETs there are various routing protocols and are categorized into three major categories: Reactive, Proactive, and Hybrid routing protocols.

2.1. DSDV Routing Protocol

DSDV is based on the Bellman-Ford routing algorithm [5,14]. The MANETs that use this protocol try to make all the nodes store the routes to all the other nodes. Therefore, it requires the participating nodes periodically to broadcast maintenance information to keep the other nodes updated. Each node in the network has own routing table for all reachable nodes. Each entry of the routing table has corresponding sequence number and the number of hops to reach the destination node. The sequence number is used for identify obsolete routing information so that the algorithm can discard loops as well as diversions. During the updating process, each node periodically submits its own routing table to the neighbor nodes. Whenever the table is drastically modified, it sends the table to the neighbor nodes well. Each *route update packet* has a sequence number assigned by the source node as well as the routing table information so that the latest route information can be identified and used. When two different routes have the same sequence number, the shorter one is stored in the routing table. *2.2. AODV Routing Protocol*

MANETs employing AODV routing protocol do not store routes to all other nodes. They maintain only routing information that is strictly necessary. Therefore, a participating node that wants to send a message to another node needs to find the route to the destination in the first place. When a node that uses this protocol wants to send a message to a destination node, and it does not know the route to the destination, it must perform the route finding procedure to identify the route to the destination [7].The source node broadcasts the *route request packet* (*RREQ*) to its neighbor nodes. On receiving the message, the neighbor nodes further broadcast the message to its neighbors. These chains of broadcasting are continued until *RREQ* reaches the destination node, or *RREQ* reaches a node that has enough information to provide the route to the destination node. The left hand side of Figure 1 shows how *RREQ*s move in the network. Unlike MANETs based on DSR use the source routing in which each data packet carries the complete path to the destination, MANETs based on AODV use on-demand routing in which each data packet has only next-hop information. Like DSDV protocol, AODV protocol avoids forming loops by using sequence numbers. Each node has its own sequence number as well as the broadcast identifier. The sequence number is incremented when the neighbor node is updated, and the broadcast identifier is incremented when the node performs the route finding procedure. In addition to these identifiers, the source node includes the sequence number to the destination node in *RREQ*. An intermediate node may have a larger sequence number than the one in *RREQ*. In such case, the intermediate node must know about the destination better than the source node, and therefore the intermediate node halts the *RREQ* and responds to the source node instead of re-broadcasting *RREQ*. Thus, in AODV, the data packet may have multiple paths to the destination, and can use the latest route to the destination.

Networking management primitives

The basic data structure abstraction is the *data packet*. PICA offers a small set of functions to send and receive (capture) packets. The approach taken in Linux and Windows are quite different. In Windows we inherited

the functions to send and receive packets offered by the *PACKET.DLL* library which is part of the *winpcap* distribution. While Linux does not offer such a library it provides direct read and write access to a network interface (NIC) by using the *PF PACKET* socket domain. The socket interface is also one of the most frequently used interfaces when developing protocols implementations. PICA encapsulates this API using macros and eliminates the *apparently* slight differences between the various platforms. It should be noticed, though, that the *Windows Sockets Version 2* (WinSock 2) API [12] does not provide useful functions such as the *recvmesg* and *sendmsg* whereas in Linux they are available. WinSock 2 also lacks of some of the options that are available on Linux based implementations. These factors should be taken into account by programmers, because they can compromise the compatibility between platforms. Handling timers is also of extreme relevance. Protocols and applications are often required to perform scheduled actions,

e.g., to take into account network congestion status. Differently from Windows, the Linux architecture imposes a single timer per application. This ”restriction” encouraged us to provide PICA with multiple timers, by means of a priority queue. In this queue all events make use of the same timer in a way that only the first to-happen event affected will be used to set the value of the timer. There is a thread that executes the code indicated by the user, allowing the event handling to be not only.

Finally, PICA provides functions to handle the IP routing functionalities. The PICA routing functions allow the designer to add and remove entries in the forwarding table. These functions are not frequently used, but we found that they are sometimes useful in protocol design to provide dynamic connectivity. See, for example, the AODV implementation [13]. Moreover some protocols need to check some of the entries, like the broadcast ones, and this can be easily accomplished using these functions. We also give the possibility to get access to the current forwarding status and to the time-to-live (TTL) attributes. It should be noticed that the TTL value affected is the global system's TTL. Lowering this value too much might cause loss of connectivity to other networks (e.g., Internet). For a per-socket definition of this value, the socket options available in most systems should be used.

Mobile Agents: Mobile agents are software entities that act on behalf of their creators and move independently between hosts. In general, a mobile agent executes on a machine that hopefully provides the resources or services that it needs to do its work. If a machine does not contain the needed resources or services, the mobile agent can transfer itself to a new machine. Lange and Oshima enumerate several benefits of using mobile agents. Of particular interest to MANET routing are:

• Mobile agents are able to upgrade protocols in use by moving to a destination and setting up communications operating under revised policies.

• After being dispatched, mobile agents become independent of the process that created them and can operate asynchronously and react dynamically and autonomously to environmental changes.

• Mobile agents can reduce network load and latency by running remotely.

Recently, a number of mobile agent systems have been developed to address applications in areas including telecommunication services, Ecommerce and personal assistance. Included among these are Agent TCL, ARA, Concordia, and Aglets. All such systems provide common functions including agent migration, inter agent communication and security. One potential drawback of using mobile agents is that the agents require an "execution environment" in which to run. This has become less of an issue in recent years as mobile devices become more capable and the execution environments become somewhat leaner.

3.DIFFERENT OPTIMIZATION APPROACHES FOR MANETs

A. Genetic algorithms (GA)

This technique was proposed by Holland in 1975. Genetic algorithm is branch of computational models, which are based on the principles of natural selection. This optimization technique is the most powerful among others. These algorithms are inspired by human evolution. Genetic algorithms perform best in the optimization and referred to as function optimizer. In this population of solution called chromosome is initialized for the algorithm [4]. Fitness is evaluated for each chromosome using appropriate fitness function. From this, the best chromosomes are selected and undergo crossover and mutation for better offspring. GA is useful and efficient when:

- The search space is large complex or poorly known.
- No mathematical analysis is available
- Domain knowledge is scarce to encode to narrow the search space
- For complex or loosely defined problems since it works by its own internal rules.
- Traditional search method fails.

B. Particle Swarm Optimization (PSO)

PSO is a population based stochastic optimization technique and was proposed by Kennedy and Eberhart in 1995.This technique is inspired by group behavior of bird flocking and fish swimming. In PSO, each member is represented by particle having velocity and position of each of them. The particle's best position is evaluated by the highest fitness value [6].

C. Ant Colony Optimization (ACO)

ACO is the Meta heuristic technique which is inspired by foraging behavior of ants [8]. This optimization technique was proposed by Dorgio and Dicario in 1999. In this three main functions are structured:

- Ant Solution Construct: In this artificial ants move through adjacent states of problem.

- Pheromone Update: Once the solution is built completely, pheromone trails are updated.
- Daemon actions: In this additional pheromone is applied to the best solution.

D. Artificial Bee Colony Optimization (ABC)

Based on the behaviour of the bees in nature, various swarm intelligence algorithms are available. This algorithm is based on the foraging behaviour of honeybee swarm and was proposed by Basturk and Karaboga. These algorithms are classified into two; foraging behaviour and mating behaviour [12].

In ABC algorithm there are mainly three groups of bees:

- Onlookers
- Employed
- Scouts

For a food source, bee waiting for making a decision is referred as onlookers. As it goes to the food source, which it visited before is named as employed bee. The bee carries out random search referred to as scouts.

E. Bacterial Foraging Optimization Algorithm (BFOA)

This algorithm is global optimization algorithm inspired by foraging behavior of bacteria named ac Escherichia Coli. BFOA is inspired by chemotaxis behavior of bacteria. These bacteria get the direction to food based on gradients of chemicals [11]. The information processing strategy is achieved through series of processes.

- Chemotaxis: Cells move along the surface one at a time.
- Reproduction: Best set of bacteria of is selected, so that it contributes to the next generation.
- Elimination and Dispersal: Cells are discarded and new samples are inserted.

F.Simulated annealing (SA)

Is a generic probability metaheuristic, based on the cooling process of metal during annealing, a technique involving heating and controlled cooling of a material to increase the size of its crystals and reduce their defects. It is used for the global optimization problem of applied mathematics, namely locating a good approximation to the global minimum of a given function in a large search space. For certain problems, simulated annealing may be more effective because the main goal is merely to find an acceptably good solution in a fixed amount of time, rather than the best possible solution in a larger time period.

G.Particle swarm optimization (PSO)

The PSO belongs to the class of direct search methods used to find an optimal solution to an objective function (fitness function) in a search space. Direct search methods are usually derivative-free, meaning that they depend only on the evaluation of the objective function. The particle swarm optimization algorithm is simple, in the sense that even the basic form of the algorithm shows results and it can be implemented very fast. Particle swarm optimization is a population-based stochastic optimization technique developed by Kennedy and Eberhart (1995) and is inspired by the social behaviour of bird flocking or fish schooling. In PSO, each solution in search space is analogous to a member of the swarm (bird, fish) and generally called “particle”. The system is initialized with population of random particles (called swarm) and search for optimum solution continues by updating generations. The fitness value of each particle is evaluated by objective function to be optimized. Each particle remembers the coordinates of the best solution (pbest) achieved so far. The coordinates of current global best (gbest) are also stored. PSO is simple to implement and does not need as much parameters to adjust as GA. In some cases, Wong and Komarudin (2008) reported that the PSO has been more efficient than GA.

Various steps involved in PSO algorithm are as:

- Initialize the particle in a given search space.
- Evaluate the performance of each particle.
- Compare the particle’s fitness value with pbest. If the value of particle is better than pbest then set this value as pbest .
- Update the position and velocity of particles.

H.Support vector machine

SVM is a relatively new binary classification used by Yao and Yang (2009) method with algorithm improvements. It is a margin classifier. Unlike the parameter settings of the neural networks and fuzzy-net systems, which tie the goal to reduce the errors between actual and predicted responses in the training procedure, the parameters in the SVM are used to maximize the "margin" for a credible separation of the data points. It draws an optimal hyper – plane in a high dimensional feature space. This space is determined by w and b – this defines a boundary that maximizes the margin between data samples in two classes – it gives a good generalization properties. The goal of employing SVM is to create predictions more robust than the methods described earlier. The main advances of SMV:

• swift response,

• improved scalability.

Considering and analysing all these techniques, we decided to use PSO algorithm, although the last technique, SVM, is quite new and promising so we consider using it in later research.

4. **Conclusion**

Optimization is the basic criteria for finding optimal and best solution from the possible outcomes. There are various optimization techniques available and could be applied accordingly to give the better results. Main focus is on optimization approach which makes the network more reliable, efficient and without any loss of original link during data transmission. These optimization schemes should be used according to the scenario.

soft computer techniques (optimization) also to new technologies and materials. With the help of optimization tools we can reduce production time, improve end finishing by raising the quality and in the same time produce more parts. Also the process control procedures are very important, to assure proper function of the machining centre. For further work we would suggest further tests and implementation of new techniques. One of them is emerging on the horizon. The technology is new and it has to prove its potential – DNA computers – smaller and faster, for faster data handling and larger applications.

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