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Performance Based Analysis of ACO Based DSR and DSR

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Abstract- This paper outlines our experience with the implementation and deployment of two routing protocols on different- different nodes in network. In this paper, the comparative analysis of the two routing protocols, namely DSR and A-DSR has been shown. The average end-to-end delay, throughput, jitter and packet delivery ratio have been considered as the four performance parameters. The comparison has been done by using simulation tool NS-2 which is the main simulator, awk file and NAM(Network Animator) which is used for preparing results. These two routing protocols have been described and evaluated theoretically and empirically.

Keyword- MANET, NS-2, A-DSR, DSR, Throughput, Jitter, Packet delivery ratio, End-to-End delay.

I. Introduction

A mobile ad hoc network is a collection of wireless mobile nodes that dynamically establishes the network in the absence of fixed infrastructure. Mobile Ad-hoc networks are self-organizing and self-configuring, this is mainly due to the mobility of the nodes. Nodes in these networks utilize the same random access wireless channel, cooperating in a friendly manner to engaging themselves in multihop forwarding. The node in the network not only acts as hosts but also as routers that find out the optimal path to forward a packet. Many routing protocols have been proposed for the ad hoc networks. They are classified into plane routing protocols and hierarchical routing protocols. As shown in Figure. 1, the plane routing protocols are composed of table driven (Proactive) and source-initiated on-demand driven (Reactive) protocols.

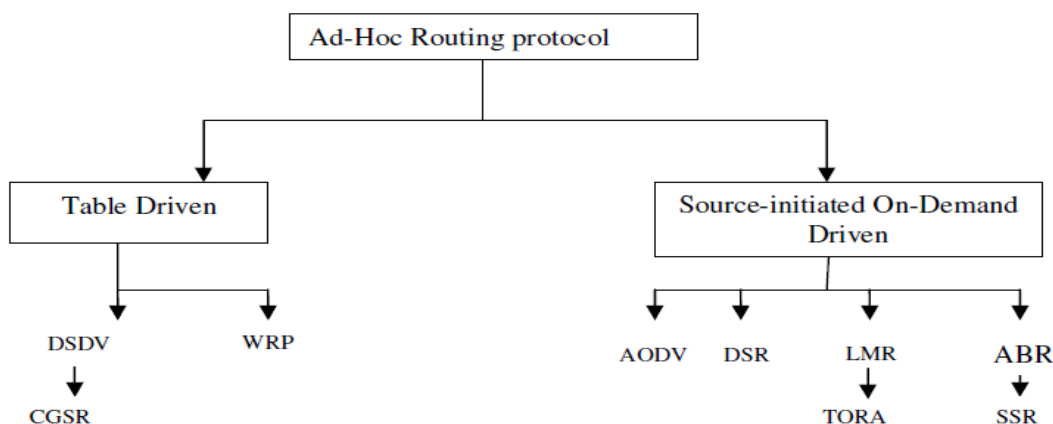


Figure1 Categorization of Ad-Hoc Routing Protocol

A. Table Driven Routing Protocol

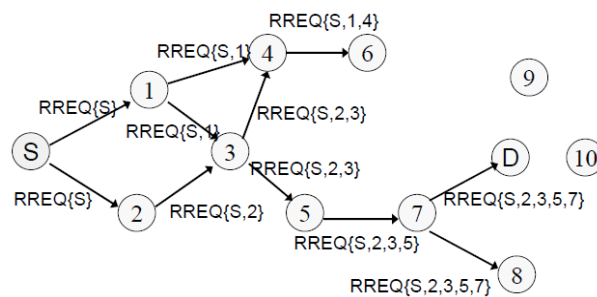
In Table Driven routing protocols each node maintains one or more tables containing routing information to every other node in the network. All nodes keep on updating these tables to maintain latest view of the network. Some of the existing table driven or proactive protocols are: DSDV, DBF, GSR, WRP and ZRP.

B. Source-initiated On-Demand Driven

In these protocols, routes are created as and when required. When a transmission occurs from source to destination, it invokes the route discovery procedure. The route remains valid till destination is achieved or until the route is no longer needed. Some of the existing on demand routing protocols are: DSR, AODV, and TORA. The emphasis in this research paper is concentrated on the Review of various On Demand/Reactive Protocol such as DSR and Ant Colony Optimization Protocol A-DSR, as these are best suited for Ad Hoc Networks. The next sub-section describes the basic features of these protocols.

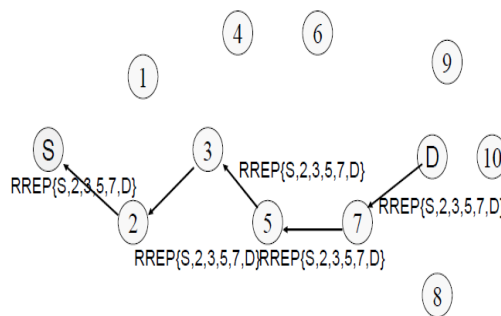
II. Dynamic source Routing (DSR)

The Dynamic Source Routing (DSR) protocol is an on-demand routing protocol based on source routing. It uses source routing, in this source is responsible for providing information of whole path, intermediate node not provide any information about destination. In DSR, every mobile node in the network needs to maintain a *route cache* where it caches source routes that it has learned. When a host wants to send a packet to some other host, it first checks its route cache for a source route to the destination. In the case a route is found, the sender uses this route to propagate the packet. Route discovery and route maintenance are the two major parts of the DSR protocol. When a node desires to send a packet to some node, it first checks its entry in the cache. If it is there, then it uses that path to transmit the packet and also attach its source address on the packet which is shown in figure 2. If it is not there in the cache or the entry in cache is expired (because of long time idle), the sender broadcasts a route request packet to all of its neighbors asking for a path to the destination. The sender will be waiting till the route is discovered. During waiting time, the sender can perform other tasks such as sending/forwarding other packets. As the route request packet arrives to any of the nodes, they check from their neighbor or from their caches whether the destination asked is known or unknown.



C. Building of the route record

If route information is known, they send back a route reply packet to the destination as shown in figure 3 otherwise they broadcast the same route request packet. When the route is discovered, the required packet will be transmitted by the sender on the discovered route. Also an entry in the cache will be inserted for the future use. The node will also maintain the age information of the entry so as to know whether the cache is fresh or not. When a data packet is received by any intermediate node, it first checks whether the packet is meant for itself or not. If it is meant for itself (i.e. the intermediate node is the destination), the packet path attached on the data packet. Since in Ad hoc network, any link might fail anytime. Therefore, route maintenance process will constantly monitors and will also notify then odes if there is any failure in the path.



D. Propagation of the route reply

Consequently, the nodes will change the entries of their route cache is received otherwise the same will be forwarded using the path attached on the data packet. Since in Ad hoc network, any link might fail anytime. Therefore, route maintenance process will constantly monitor and will also notify the nodes will change the entries of their route cache.

Benefits and Limitations of DSR

One of the main benefits of DSR protocol is that there is no need to keep routing table so as to route a given data Packet as the entire route is contained in the packet header. The limitations of DSR protocol is that this is not Scalable to large networks and even requires significantly more processing resources than most other protocols. DSR is based on source routing thus requires considerably greater routing information. In DSR a route has to discover prior to the actual data packet transmission. This initial search latency may degrade the performance of interactive applications. Moreover, the quality of path is not known prior to call setup. It can be discovered only while setting up the path. This quality of path needs monitoring by all intermediate nodes during a session. It increases the cost of additional latency and overhead penalty. Due to source routing DSR has major scalability problem. Nodes use routing caches to reply to route queries. This results in an „uncontrolled“ replies and repetitive updates in hosts“ caches. In addition, early queries cannot stop the propagation of all query messages which are flooded all over the network. Therefore when the network becomes larger, the control packets and message packets also become larger. This could degrade the protocol performance after a certain amount of time.

DSR protocol also having higher value of jitter, end-to-end delay, packet delivery ratio in large network. So in order to overcome these drawbacks, modified the DSR protocol with antnet algorithm, so called it A-DSR.

III. Performance metrics

In this paper, assume that all nodes can reach each other by some route through the network. There are two main performance criteria for network routing algorithms. The first one is effectiveness and the second one is efficiency. Effectiveness means how good the algorithm is capable of doing its job, and efficiency means how well the resources are used.

Effectiveness:

- Average Throughput: a throughput value is the number of bytes sent in the network per second. This calculated value subtracts the dropped and lost bytes from the received bytes.
- Packet Deliver Ratio (PDR): The (PDR) is defined as the ratio between the amount of packets sent by the source and received by the destination.

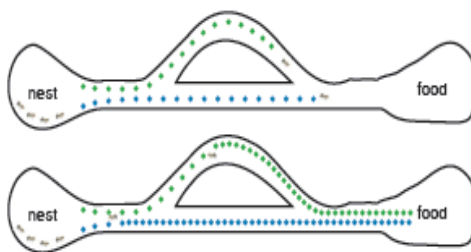
Efficiency:

- End-to-End Delay: A specific packet is transmitting from source to destination and calculates the difference between send times and received times. Delays due to route discovery, queuing, propagation and transfer time are included in the delay metric.
- Jitter: Jitter is the variation time in the packet arrival. It is different from the delay and caused due to congestion, topology change etc. in network. It is expected to be low for better performance in ad-hoc networks. It becomes a matter of concern if it is more than the threshold value which is different for each type of transmission as data, voice or video.

IV. Basic Ant Algorithm

Ants utilize a specialized form of communication, which is called *stigmergy* in biology and means indirect communication through the environment. Every ant constantly deposits pheromone on the trail taken, a messenger substance related to hormones, which other ants are able to sense as they move along their path. Ants are attracted by the pheromone and tend to follow trails with higher pheromone concentrations. This causes a self-accelerated reaction, more and more ants following the same trail laying even more pheromone. This autocatalytic effect has many advantages, for it allows path optimization within the colony for instance. Suppose two different trails between nest and food in the colony, as illustrated in figure 3.1. Two ants leaving the nest at the same time and looking for food autonomously decide, which trail to take at the intersection. More, we assume that both ants take a different path at the beginning and reach the food after certain time. This means, that the ant taking the detour reaches the food as well as the first intersection later when moving back to the nest. So, the double amount of pheromone is on the shorter path, influencing subsequent ants to primarily follow this path and not to take the

detour. The adaption of ant algorithms to computer networks behaves as follows: virtual ants, so called *mobile routing agents*, are transmitted across the network and independently measure the current network state, such as packet delay or hop count for instance. The stored information is then evaluated by the receiving node and used to lay an artificial amount of pheromone to reinforce that specific link. The pheromones are often expressed by a routing table holding probability information for every outgoing link.



E. Ants take the shortest path between nest and food.

Since real pheromones evaporate after certain time, also some decay function is required at the nodes holding the routing tables. An approach based on swarm intelligence is very promising compared to other routing protocols, as it shows many advantages in terms of scalability, fault tolerance, adaptiveness, autonomy and parallelism. The number of agents transmitted can easily be adjusted to the network size. Agents can also be killed or reproduced dynamically based on the state of the network. In addition, new links, link breaks and congestions can rapidly be detected and new paths be reinforced by the autocatalytic effect described before. Finally, all agents operate independently, autonomous and also parallel. Therefore, the loss of one agent doesn't affect the network function nor needs the flow of agents to be controlled by any human.

V. A-DSR

Ant Dynamic Source Routing (A-DSR) is a reactive protocol that implements a proactive route optimization method through the constant verification of cached routes. This approach increases the probability of a given cached route express the network reality. Mobile nodes are required to maintain route caches that contain the source routes of which the mobile is aware. Entries in the route cache are continually updated as new routes are learnt. The protocol consists of two major phases: route discovery and route maintenance. In Ant DSR (ADSR) the Forward ant (FANT) and backward ant (BANT) packets are added in the route request and route reply of DSR respectively. Forward ants are used to explore new paths in the network. Ants measure the current network state for instance by trip times, hop count or Euclidean distance travelled. Backward ants serve the purpose of informing the originating node about the information collected by the forward ant.

Table 1 Compare Parameters of DSR and A-DSR

Parameters	DSR	A-DSR
Routing type	Reactive	Reactive
Throughput	Low	High
End-to-End Delay	High	Low
Jitter	Low	High
Packet delivery Ratio	High	Low

VI. Conclusion

This paper presents the algorithms being proposed which utilize distributed cooperative Mobile Agents for routing in Dynamic Networks such as MANETs. It is evident from this review that by utilizing ant-like mobile agents in MANETs, the network topological information can be disseminated to the nodes in the network without incurring

high control overhead compared to reactive routing schemes. With the enhanced topological information available at the nodes in the network, better routing decisions can be made to reduce the end-to-end packet delays, jitter and route discovery latency.

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