Finest Stochastic Locality Updates in MANET

D. Gowthami[1], J. Shibu[2], B. T. Tharanisrisakthi[3]
[1-3]PG Scholar,
Department of ECE,
Bannari Amman Institute of Technology,
Sathyamangalam-638401,
Tamil Nadu, India.

ABSTRACT

In Mobile Ad-Hoc Network (MANET), each node needs to maintain its location information by 1) frequently updating its location information within its neighboring region called neighborhood update (NU), and 2) occasionally updating its location information to certain distributed location server in the network called Location Server Update (LSU).During this process, operation cost and the performance losses will occur. So in this paper ,we develop a stochastic sequential decision frame work to analyze this problem by using Markov Decision Process(MDP).The location update decisions of NU and LSU can be independently carried out without loss of optimality by using a separation property apart from general cost structure. From this we find that 1) there always exists a simple optimal threshold–based update rule for LSU operation; 2) For NU operation, an optimal threshold-based update rule exists in a low mobility scenario.

Keywords: Location Update, Mobile Ad Hoc Networks, Markov Decision Processes.

1. INTRODUCTION

With the advancement of Very Large-Scale Integrated circuits (VLSI) and the commercial popularity of Global Positioning Services (GPS), the geographic location information of mobile devices in a Mobile Ad Hoc Network (MANET) is becoming available for various applications. In a MANET, since the locations of nodes are not fixed, anode needs to frequently update its location information by involving neighborhood update and server update process [1] which leads to location inaccuracies. The operations of NU and LSU are more frequent. The power as-well-as communication bandwidth of nodes are wasted for those unnecessary updates. This will degrade the performance of the location update mechanism by nodes. To minimize the overall cost, we develop an optimal design that will concentrate on each node which independently chooses its location update strategies with its local information. The optimal design that we develop for the location update problem is called Markov Decision Process (MDP),[2] under a widely used Markovian mobility model. The location update decision needs to be in each time slot to formulate this problem. An MDP model is composed of four tuples such as state space, action set, state transition probability and cost. We first investigate the solution structure of the model by identifying the monotonicity properties of optimal NU and LSU operations with respect to location inaccuracies under a general cost setting. Then, given a separable cost structure for the location update decisions on NU and LSU since it can be independently carried out without loss of optimality. From the discovered separation property of the problem structure, we find that there always exists a simple optimal threshold-based update rule for LSU and for NU operations in a low-mobility scenario. This separation property not only simplifies the optimal location update strategies, but also provides guidelines on designing a practical model-free learning approach to find a near-optimal solution for the location update problem, In this case there is no prior knowledge of the MDP model, we analyze the optimal location update strategies in a hybrid position based routing scheme for minimizing overall routing overhead. The investigation of location management problem in cellular networks considers the location update cost and paging cost as main concern.

2. RELATED WORK

The MANET is becoming available for various applications. The location information not only provides degree of freedom in designing network protocols, but also critical for the success of many military and civilian applications as in the localization in advanced battlefield networks and public safety communications. In a MANET, the location of nodes are dynamic, hence it needs to frequently update its location information to all other neighboring nodes. Both neighbor and server location update operations which takes place at a node to maintain its up-to-date location information in the active network. First stage of operation is to update its location information within a neighboring region, where the surrounding neighbor region is not certainly restricted to one hop neighboring nodes. The second stage of operation is to bring the up-to date location information of neighbor nodes to the location server.

2.1 DISADVANTAGES

The disadvantage of the existing system is that the frequency of operation is not sufficient to obtain the information about nodes. The operation costs of location updates and the performance losses of the target application will occur due to the presence of location errors (i.e., application costs). The operations are too frequent, therefore the power and communication bandwidth of nodes are wasted for those unnecessary updates.

3. ROUTING PROTOCOLS IN MANET

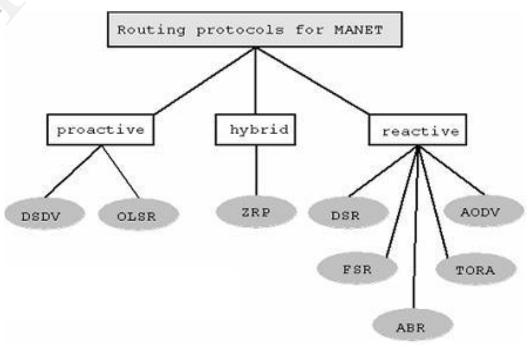

Figure.1 Classification of routing protocols.

routing information is acquired. By optimizing the routes, the system overheads can be reduced. On the other hand the latency for sending data packets will considerably increase. In hybrid, network is divided into small zones. They balance both intra region proactive routing and inter region. The routing protocols in MANETs are classified into proactive, hybrid and reactive. The proactive elements are DSDV and OLSR. They periodically maintain routes between every mobile node pair. Predefined routes are available to transmit data from source to destination. It has low latency and scalability. The reactive features are DSR, AODV, TORA, FSR and ABR. These protocols were designed to overcome the wasted effort in maintaining unused routes[3].Only when there is a need, the reactive routing. It is scalable and has high latency when compared with proactive protocols. The routing protocol ZRP comes under the category of hybrid. In this paper we discuss about the performance of DSR protocol.

4. DSR PROTOCOL

Dynamic Source Routing (DSR) is a reactive routing protocol that uses source routing to send packets. DSR allows the network to be completely self-organizing and self-configuring based on the updated shortest path infrastructure or administration. Each node maintains a route cache, which contains the route information. The DSR protocol is composed of two mechanisms that work together to allow the discovery and maintenance of source routes in the ad hoc network[4].

4.1 ROUTE DISCOVERY

When node S wants to send a packet to node D, but it does not know a route to D, so it initiates a route discovery. Source node S floods Route Request (RREQ) to neighboring nodes. Each node appends own identifier when forwarding RREQ. Destination node does not forward RREQ, because it is the intended target of the route discovery. If node is not the target, it broadcasts the RREQ to its neighbor nodes.

4.2 ROUTE REPLY

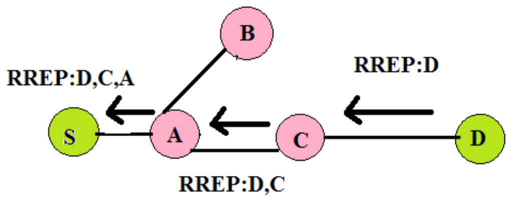

Figure.2 Route Reply of nodes

Destination D on receiving the first RREQ sends a Route Reply .RREP is sent on a route by reversing the route appended to received RREQ. This RREP includes the route from S(source) to D(destination) on which RREQ was received by node D.

4.3 ROUTE MAINTANENCE

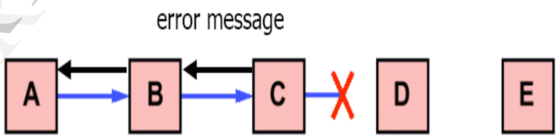

Figure.3 Error Message in Route Maintenance

Node **C** is unable to forward a packet from **A** to **E** over its link to next hop **D**. Node A learns that link between C-D is broken from the RERR message generated by C, so A removes the link from its own route cache. Then source initiates a new route discovery and piggybacks a copy of RERR message on RREQ[4]. This ensures that every node becomes aware of this link being broken and they update their route cache. It also creates solutions to overcome problems involved in route reply streams, route request reply limits, packet salvaging, route shortening process etc.

5. PROPOSED SCHEME-MDP

A stochastic decision framework to analyze the location update problem in MANETs is explained in the proposed system. The location update problem at a node is solved by using Markovian mobility model.[2] This model is used to identify some general and critical properties of the problem structure and the optimal solution that is obtained will be helpful in providing a practical protocol design. In this protocol design, the nodes which have high velocity should only perform the LSU operation instead of updating all nodes. Through identifying the monotonicity properties of neighborhood update (NU) and Location Server Update (LSU) operations with respect to location inaccuracies under a general cost setting, a separable cost structure is induced to reduce the effects of location inaccuracies. From the separation property model, there always exists a simple optimal threshold-based update rule for LSU operations and for NU operations where it takes place in low mobility scenario. There fore the location update decisions on NU and LSU can be independently carried out without loss of optimality. This will decrease the cost overhead and increase the optimality of location update. Here the frequency of operations remains sufficient.

5.1 CREATION OF NODES

In this paper for explaining the location update process in simulation we are creating thirty four nodes. Out of these nodes one act as a server, and remaining nodes are used for transmitting as well as receiving the information to and from neighboring nodes. The configuration of the nodes based on specified routing process, energy model, types of layer, power etc. Parameters of nodes like bandwidth, data rate,frequency range, power transmission values are acquired initially. Here all nodes follow the Flat Grid topology. Data traffic was generated using constant bitrate (CBR) UDP traffic sources, with 34 mobile nodes act as traffic sources generating maximum of 100packets/second each. CBR agents are created and they are attached to the node, which is then connected to the sink during packet transmission.

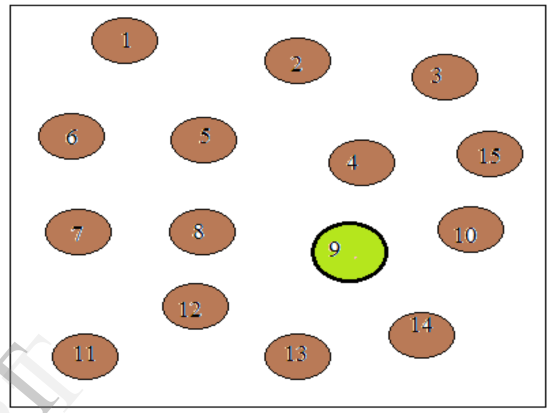

Figure.4 Representation of nodes in MANET.

5.2 CALCULATION OF NEIGHBOUR NODES

In neighborhood calculation, it is necessary to define the shortest path first. This is done by Dynamic Source Routing protocol. The source nodes send out a ROUTE REQUEST message to all nodes. After receiving this message, these nodes put themselves into the source route and forward it to their neighbors, unless they have received the same request before. If a receiving node is the destination or has a route to the destination, it does not forward the request to their neighbors, but it sends a REPLY message which contains the full source route to them. It may send that reply message along the source route in reverse order or issue a ROUTEREQUEST including the route to get back to the source. If the former is not possible due to asymmetric links, ROUTEREPLY messages from the later can be triggered by ROUTEREQUEST messages which were sent by source to destination. After receiving one or several routes from route reply messages, the source selects the best, and sends messages along that path. All other nodes also send their messages in the same way. In simulation process, once the neighborhood updating is over the color of the node will get changed from black to green color. The neighborhood calculation is formulated as

$$d=\sqrt{(x2-x1)^2+(y2-y1)^2}$$

5.3 SENDING HELLO PACKETS

Routers maintain awareness of current network topology by exchanging beacons (“HELLO messages”).Each node must detect the neighbor node with direct and bi-directional link. Then it can calculate the best route to any destination flooding the network with HELLO messages. This method will suffer from considerable overhead. These control messages (HELLO MESSAGES) are transmitted in the broadcast mode are received by all one hop neighbors, but they are not forwarded to further nodes. A HELLO messages contains a list of addresses of the neighbors to which there exists a valid bi-directional link. It also contains the list of addresses of the neighbors which are heard by this sender node; however the link is not yet validated as bi-directional. If a receiver node finds its own address in a HELLO message, it considers the link to sender node as bi-directional.

5.4 SERVER UPDATION PROCESS

Location information has recently been applied to MANET[6]. There are three types of Location Services available with the Mobile Ad hoc Networks. They are Proactive, Reactive and Hybrid. In order to provide end-to-end communication through-out the network, mobile nodes must cooperate in handling network topology functions. It is very challenging issue in order to maintain the location information of the mobile hosts due to absence of centralized/dedicated servers in Mobile ad-hoc networks. In order to keep the information at each location server up to-date, each of the mobile nodes needs to update its location servers with its new location when it moves around. The location information required by any geographical ad-hoc routing protocol is completely represented without loss of information by the use of full length node address. Thus, the node only needs to update its location servers when the address of full length node is changed,(when the nodes moves away from its current minimum partition).Each node maintains two tables for location update. They are location table and location cache. By using these two tables update packet is sent to location servers. To avoid excessive update traffic, the calculation for frequency updation is done by using threshold distance and location servers orders. The threshold distance is the distance the node has traveled since the last update. From the server, the location information of any nodes can be identified easily.

6. PERFORMANCE EVALUATION

Simulation study has been carried out to identify the performance of location update process in mobile adhoc network. Environment used for simulation work is NS -2.34version. Simulation results include the performance comparison of AODV, DSR and TORA routing protocols. The evaluation of parameters like Throughput, Packet Dropouts, Energy and Bit error rate of mobile nodes using these above protocols are done successfully.

6.1 NETWORK SIMULATOR -2

NS-2 is a discrete event simulator targeted at network research. It focused on modeling network protocols such as wired, wireless, satellite, TCP, UDP, etc. The goals of NS-2 are to provide a collaborative environment to share code and protocols. They allow easy comparison of similar protocols like AODV, DSR, DSDV, etc. It is written in C++ and OTcl language. A package of tools that create network topologies and simulate the behavior of networks. Here the physical activities are translated into events which are queued and processed in the order of their scheduled occurrences at the specified time progress.

6.2 SIMULATION PARAMETERS

PARAMETERS	PARAMETERS VALUE
Channel Type	Wireless channel
Radio Propagation Model	Two Ray Ground
MAC Layer	Mac/802_11
Area	2000m*600m
Routing protocol	DSR
Bandwidth	2 MHz
No of nodes	34
Initial Energy	100 joules
Set Power Transmission	0.1818 watts
Set Frequency	914 MHz
Data Rate	2 MHz
Idle Power	0.2 watts
Transmitted power	0.5 watts
Received power	1.0 watts
Transition time	0.003 secs
Topology	Flat Grid

7. SIMULATION RESULTS

7.1 THROUGHPUT

It is defined as the number of packets received at the receivers in the network. This graph shows the comparisonbetween the routing protocols like AODV and DSR on basics of throughput as a function of time. [5]. According to this graph, it is clear that throughput increases with decrease in congestion of packets in the network. When time is 60 seconds the throughput is increased by 29% in DSR as compared to AODV.

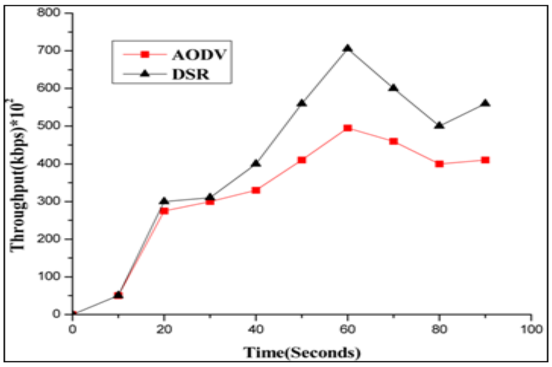

Figure: 5 Effect of Time on Throughput.

7.2 RESIDUAL ENERGY

In MANET, energy consumption includes the power consumed by the radios at the sender, intermediate and the receiver nodes in the route from the source to destination. The MDP model allows only the high mobility nodes to perform the Server updating process, so energy consumption in nodes are reduced because of minimum dropouts during packet transmission.Figure:6 Shows the effect of the routing protocols on basis of energy as a function of time. When time is 45 seconds the residual energy is decreased by 6% in DSR as compared to AODV.

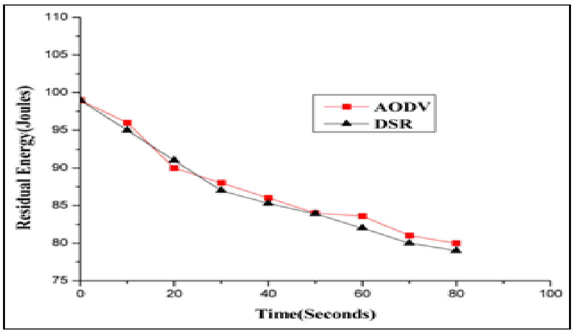

Figure:6 Effect of Time on Residual energy.

7.3 PACKET LOSS

Packet loss occurs when one or more packets of data travelling across a computer network fail to reach their destination. It may be caused due to signal degradation in network, channel congestion or faulty network hardware or drivers. These dropouts may result in jitter with streaming technologies, video conferencing and online gaming. The packet loss for DSR is less than that of AODV as it out performs with fewer nodes and no periodic update is maintained.. When time is 25 seconds the packet loss is decreased by 14% in DSR as compared to AODV.

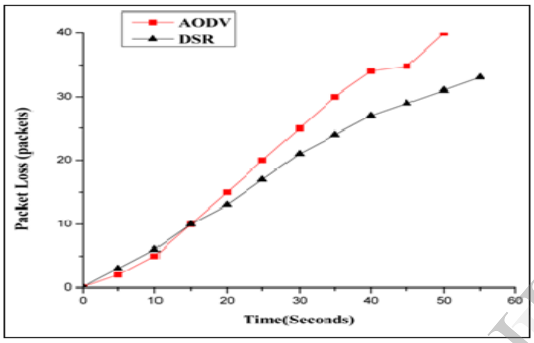

Figure: 7 Effect of Time on Packet Loss.

8. CONCLUSION

The stochastic sequential decision framework is established to analyze the location update problem in MANETs. By the existence of the monotonicity properties of optimal NU and LSU operations, location inaccuracies have been investigated under a general cost setting. If a separable cost structure exists, one important insight from the proposed MDP model is that the location update decisions on NU and LSU can be independently carried out without loss of optimality, which resolves the simple separate consideration of NU and LSU decisions in practice. From this separation principle and the monotonicity properties of optimal actions, we have further showed that 1) for the LSU decision sub problem, there always exists an optimal threshold-based update decision rule and 2) for the NU decision sub problem, an optimal threshold-based update decision rule exists in a low-mobility scenario. To make the solution of the location update problem to be practically implementable, a model-free low-complexity learning algorithm (LSPI) has developed to achieve a near optimal solution. The proposed MDP model for the location update problem in MANETs can be extended to include more design features for the location service in practice.

9. REFERENCES

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