Performance Evaluation of DSR, FSR and LAR Routing Protocols in MANETS

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ABSTRACT-Mobile Ad hoc Network (MANET) is a collection of mobile nodes that are arbitrarily located so that the interconnections between nodes are dynamically changing. A routing protocol is used to find routes between mobile nodes to facilitate communication within the network. The main goal of such an ad hoc network routing protocol is to establish correct and efficient route between a pair of mobile nodes. Route should be discovered and maintained with a minimum of overhead and bandwidth consumption. There are number of routing protocols were proposed for Adhoc networks. It is quiet difficult to compare all of the protocols. This paper performance evaluation of three different routing protocols i.e. Dynamic Source Routing Protocol (DSR), Fisheye State Routing (FSR) and Location aided routing (LAR) with respect to number of nodes. Performance of DSR, FSR and LAR is evaluated based on Average end-to-end delay, Throughput and Average Jitter using Qualnet 5.0.2 simulator.

KEYWORDS*: DSR, FSR, LAR MANETs*

1. TRODUCTION TO MANETS

A mobile ad hoc network is a collection of wireless mobile nodes that dynamically establishes the network in the absence of fixed infrastructure. One of the distinctive features of MANET is, each node must be able to act as a router to find out the optimal path to forward a packet. As nodes may be mobile, entering and leaving the network, the Topology of the network will change continuously. MANETs provide an emerging technology for civilian and military applications. One of the important research areas in MANET is establishing and maintaining the ad hoc network through the use of routing protocols.

Mobile Ad Hoc Networks are the self-organizing and self-configuring wireless networks which do not rely on a fixed infrastructure and has the capability of rapid deployment in response to application needs. Nodes of these networks function as routers which discover and maintain routes to other nodes in the network. The Ad hoc network applications include military applications, casual conferences, meeting, virtual classrooms, emergency search-and-rescue operations, disaster relief operation, automated battlefield and operations in environments where construction of infrastructure is difficult or expensive. In MANET, due to lack of centralized entity and mobile nature of nodes, network topology changes frequently and unpredictably. Hence the routing protocols for ad hoc wireless networks have to adapt quickly to the frequent and unpredictable changes of topology.

2. INTRODUCTION TO DSR

The Dynamic Source Routing protocol (DSR) is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. Using DSR, the network is completely self-organizing and self-configuring, requiring no existing network infrastructure or administration. Network nodes (computers) cooperate to forward packets for each other to allow communication over multiple “hops” between nodes not directly within wireless transmission range of one another. As nodes in the network move about or join or leave the network, and as wireless transmission conditions such as sources of

interference change, all routing is automatically determined and maintained by the DSR routing protocol. Since the number or sequence of intermediate hops needed to reach any destination may change at any time, the resulting network topology may be quite rich and rapidly changing.

2.1 ADVANTAGES AND DISADVANTAGES of DSR

This protocol uses a reactive approach which eliminates the need to periodically flood the network with table update messages which are required in a table-driven approach. In a reactive (on-demand) approach such as this, a route is established only when it is required and hence the need to find routes to all other nodes in the network as required by the table-driven approach is eliminated. The intermediate nodes also utilize the route cache information efficiently to reduce the control overhead. The disadvantage of this protocol is that the route maintenance mechanism does not locally repair a broken link. Stale route cache information could also result in inconsistencies during the route reconstruction phase. The connection setup delay is higher than in table-driven protocols. Even though the protocol performs well in static and low-mobility environments, the performance degrades rapidly with increasing mobility. Also, considerable routing overhead is involved due to the source-routing mechanism employed in DSR. This routing overhead is directly proportional to the path length.

3. INTRODUCTION TO FSR

Fisheye State Routing (FSR).FSR introduces the notion of multi-level fisheye scope to reduce routing update overhead in large networks. Nodes exchange link state entries with their neighbors with a frequency which depends on distance to destination. From link state entries, nodes construct the topology map of the entire network and compute optimal routes. Simulation experiments show that FSR is simple, efficient and scalable routing solution in a mobile, ad hoc environment.

For routing this approach translates into an accurate information in the immediate neighborhood of a node and less detail as the distance increases.FSR is similar to link state (LS) routing in that each node maintains a view of the network topology with a cost for each link. In LS routing link state packets are flooded into the network whenever a node detects a topology change. In FSR nodes maintain a topology table (TT) based on the up-to-date information received from neighboring nodes and periodically exchange it with their local neighbors. For large networks in order to reduce the size of the routing update messages the FSR technique uses different exchange periods for different entries in the routing table. Relative to each node the network is divided in different scopes.

ADVANTAGES

- Scales well to large network sizes
- Control traffic overhead is manageable

DISADVANTAGES

- Route table size still grows linearly with network size
- As mobility increases routes to remote destinations become less accurate
- What happens if the target node is out of the scope of all nodes in the source nodes scope

4. INTRODUCTION TO LAR

A mobile ad hoc network consists of wireless hosts that may move often. Movement of hosts results in a change in routes, requiring some mechanism for determining new routes. Several routing protocols have already been proposed for ad hoc networks. This paper suggests an approach to utilize location information (for instance, obtained using the global positioning system) to improve performance of routing protocols for ad hoc networks. By using location information, the proposed Location-Aided Routing (LAR) protocols limit the search for a new route to a smaller “request zone” of the ad hoc network. This results in a significant reduction in the number of routing messages. We present two algorithms to determine the request zone, and also suggest potential optimizations to our algorithms.

Advantages

- Reduces the scope of route request flood
- Reduces overhead of route discovery

Disadvantages

Nodes need to know their physical locations
Does not take into account possible existence of obstructions for radio transmissions

5. SIMULATION SETUP

The Qualnet 5.0.2 simulator is used for performance comparison of DSR, FSR and LAR.. The IEEE 802.11 is used as the Medium Access Control layer protocol for wireless Local Area Networks. The 50 nodes are placed uniformly over the region of 1500mx1500m. In the scenario UDP (User Datagram Protocol) connection is used and over it data traffic of Constant bit rate (CBR) is applied between source and destination. The random waypoint model of mobility model is used in a rectangular field. The multiple CBR application is applied over different source and destination nodes

Throughput

Throughput is the number of packet that is passing through the channel in a particular unit of time. This performance metric show the total number of packets that have been successfully delivered from source node to destination node and it can be improved with increasing node density

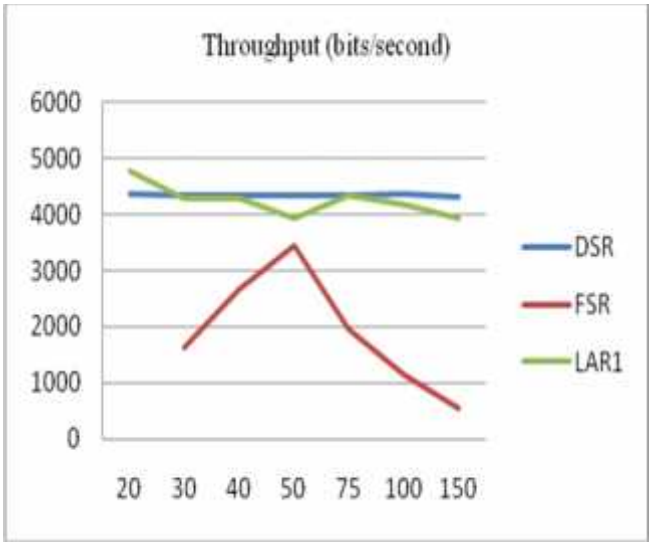

Figure 1: Throughput Vs No of Nodes

The throughput is analyzed with varying CBR data traffic. According to our simulation results better performance is shown by DSR at high mobility but in other cases it has lower throughput. Throughput of DSR and LAR is increasing as the network size is increasing but FSR decreasing large sized networks. It is found that DSR performs better than FSR and LAR.

End-to-End Delay

A specific packet is transmitting from source to destination node 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.

From the figure 2 the average packet delay increases with number of nodes while routing protocols try to find valid route to the destination. Besides the actual delivery of data packets, the delay time is also affected by route discovery, which is the first step to begin a communication session .In this analysis it is observed as expected the delays are more for DSR in comparison to FSR.. The end-to-end delay of FSR is less because it has reduced routing overhead and queuing delay. Also LAR has variable delay with respect to node density.

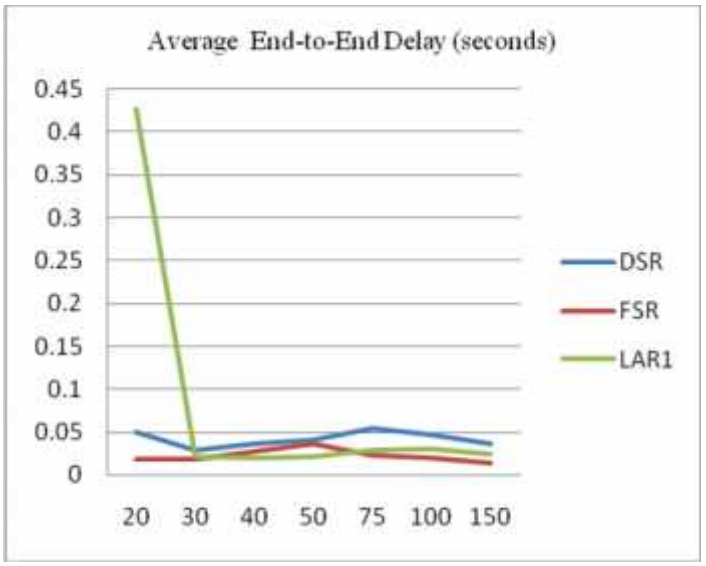

Figure2: Average End-to-End Delay Vs No of Nodes

Average Jitter

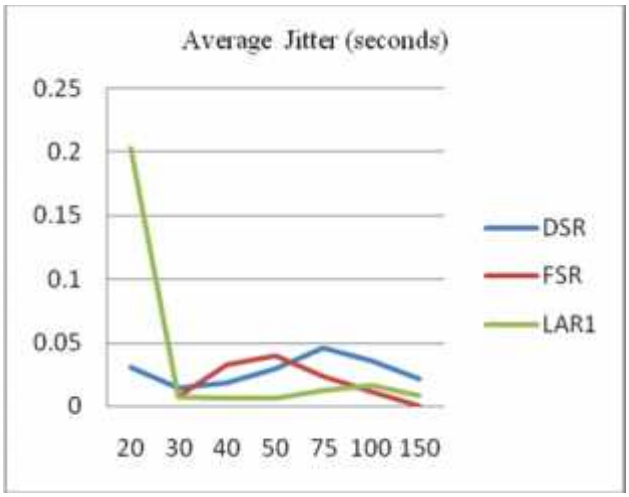

Figure3: Average Jitter Vs No of Nodes

From the figure 3 the average jitter is decreases with increases no of nodes in FSR and DSR. LAR average jitter is less compare to DSR and FSR

CONCLUSION

It is observed in the analysis that DSR, FSR and LAR in general for all the scenarios due to reduced overhead and multi level scope technique. DSR and FSR is highly suitable for dynamically changing network topology and thus the throughput is high with high mobility of nodes whereas throughput of LAR is higher at start but it falls as the node density increases. FSR reduces the size of tables which is exchanged by maintaining less accurate information about nodes farther away. The simulation results have been carry out using network simulator Qualnet 5.0.2 for the performance comparison ofDSR,FSR and LAR protocols. There is an improvement in LAR when compared to other protocols. Hence we can conclude that LAR is best when compared to all other routing protocols with parameter of average end to end delay and jitter.

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