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Performance Evolution and Comparison of Geographical Location Aided Routing and AODV Routing In MANET

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Abstract: *A mobile ad-hoc network (MANET) consists of mobile computing entities such as laptop and palmtop computers which communicate with each other through wireless links and without relying on a static infrastructure such as a base station or access point. Without centralized administration, a MANET is highly unpredictable due to its unstable links and resource-poor as most of the nodes have limited battery power. Due to these physical limitations, we propose a geo graphically location aided routing; in this proposed method nodes are require the cooperation of other nodes to successfully send a message to a destination. Figure 1.1 shows the mobile Ad hoc network. We follow with a simulation study to evaluate the performance in large networks. In this paper, we specifically address the issues and comparison of AODV and with the proposed geographically location aided routing (Terminode Routing) using ns2 to illustrate that routing overhead is low and packet delivery ratio is high compared to AODV.*

I. Introduction

1.1 MANET

A mobile ad hoc network is one where in all nodes work independent of any common centralized admin. Each one of them performs the tasks of a router. They should be self-adapting in that if their connection topology changes, their routing tables should reflect the change.There are numerous scenarios that do not have an available network infrastructure and could benefit from the creation of an ad hoc network:

O Rescue/Emergency operations: Rapid installation of a communication infrastructure during a natural/environmental disaster (or a disaster due to terrorism)that demolished the previous communication infrastructure.

o Law enforcement activities: Rapid installation of a communication infrastructure during special operations.

o Tactical missions: Rapid installation of a communication infrastructure in a hostile and/or unknown territory.

o Commercial projects: Simple installation of a communication infrastructure for commercial gatherings such as conferences, exhibitions, workshops and meetings.

o Educational classrooms: Simple installation ofa communication infrastructure to create an interactive classroom on demand.

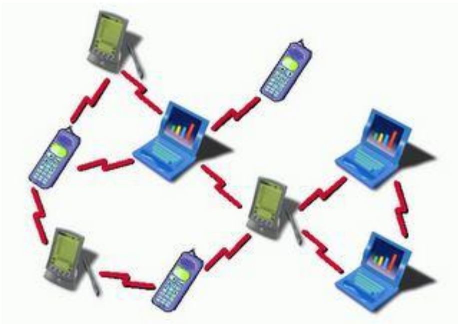

Fig:1.1 Mobile Ad Hoc Network

1.2 Main Characteristics of Ad-Hoc Networks

Dynamic topology: Hosts are mobile and can be connected dynamically in any arbitrary manner. Links of the network vary and are based on the proximity of one host to another one.

Variable capacity links: Wireless links have significantly lower capacity than their hardwired counterparts. Moreover, the realized throughput of wireless communications is often much less than a radio’s maximum transmission rate.

Autonomous: No centralized administration entity is required to manage the operation of the different mobile hosts.

Bandwidth constrained: Wireless links have a significantly lower capacity than the wired ones; they are affected by several error sources that result in degradation of the received signal.

Energy constrained: Mobile hosts rely on battery power, which is a scarce resource the most important system design criterion for optimization may be energy conservation.

Limited security: Mobility implies higher security risks than static operations because portable devices may be stolen or their traffic may cross insecure wireless links.

1.3 Classification of Ad-hoc Protocols

Routing protocols can be classified into different categories depending on their properties:

► Centralized vs. Distributed

► Static vs. Adaptive

►Reactive vs. Proactive

In centralized algorithms, all route choices are made at central node, while in distributed algorithms, the computation of routers is shared among the network nodes.

1.4 Routing And Types Of Routing Protocols In Manet

In order to enable communication within a MANET, a routing protocol is required to establish routes between participating nodes. Because of limited transmission range, multiple network hops may be needed to enable data communication between two nodes in the network. Since MANET is an infrastructure less network, each mobile node operates not only as a host but also as a router, forwarding packets for other mobile nodes in the network. Mobile Ad hoc ETworks (MANET), are characterized by wireless nodes, which are free to move arbitrarily, but cooperate to forward packets for each other in a totally wireless environment.

The routing requirement of a mobile ad hoc network is achieved in distributed fashion among the nodes. Conventional routing protocols based on distance vector or link state algorithms cannot be applied here, since the amount of routing related traffic would waste a large portion of the wireless bandwidth, and such discovered routes would soon become obsolete due to mobility of Nodes. In MANETs mobile nodes share the same frequency channel thereby limiting the network capacity. Thus one of the highly desirable properties of a routing protocol for MANETs is that it should be bandwidth efficient. The routing protocols are categorized into two broad categories: namely, on-demand protocols and table driven protocols. They are also known as reactive and proactive protocols respectively.

1.4.1 Proactive or Table-driven protocols

It maintains one or more routing tables in every node in order to store routing information about other nodes in the MANET. These routing protocols attempt to update the routing table information either periodically or in response to change in network topology in order to maintain consistent and up-to-date routing information. The advantage of these protocols is that a source node does not need route-discovery procedures to find a route to a destination node. The drawback of these protocols is that maintaining a consistent and up-to-date routing table requires substantial messaging overhead, which consumes bandwidth and power usage, and decreases throughput, especially in the case of a large number of high-mobility mobile nodes. The different types of Table driven protocols are: Destination Sequenced Distance Vector routing (DSDV), Wireless routing protocol (WRP), Fish eye State Routing protocol (FSR), Optimized Link State Routing protocol (OLSR), Cluster Gateway switch routing protocol (CGSR), Topology Dissemination Based on Reverse path forwarding (TBRPF).

1.4.2 Reactive or On-demand routing protocols

Another in the family of routing protocols for mobile ad-hoc network is on-demand routing protocols. It initiates a route discovery mechanism by the source node to discover the route to the destination node when the source node has data packets to send to the destination node. After discovering the route, the route maintenance is initiated to main this route until the routes no longer required or the destination is not reachable. The main advantage of these protocols is that overhead messaging is less. One of the drawbacks of these protocols is the delay of discovering a new route. The different types of Reactive routing protocols are: Dynamic Source Routing (DSR), Ad hoc On-Demand Distance Vector routing (AODV), Location-Aided Routing (LAR), Temporally Ordered Routing Algorithm (TORA) and Dynamic MANET On-demand (DYMO).

1.5 Major MANET Issue Categories

In this section the MANET research issues are presented and classified. Hundreds of research aspects have been developed and discussed in this field. To analyze various research issues, this article covers most of the major investigation problems. Various fundamental and frequently discussed aspects of MANETs are identified and grouped into fifteen categories. These issues have the potential to significantly increase MANET survivability:

Routing: Routing is an essential one, because change in network topology occurs frequently. An efficient routing protocol is required to cope with highly fluid network conditions.

Multicasting/ Broadcasting: Multicast service supports users communicating with other members in a multicast group. Broadcast service supports users communicating with all members on a network.

Location Service: Location information uses the Global Positioning System (GPS) or the network-based geo-location technique to obtain the physical position of a destination.

Mobility Management: In the ad-hoc network environment, mobile hosts can move unrestricted from place to place. Mobility management handles the storage, maintenance and retrieval of the mobile node position information.

Multiple Accesses: A major issue is to develop efficient medium access protocols that optimize spectral reuse, and hence, maximize aggregate channel utilization in MANETs.

Bandwidth Management: Bandwidth management in MANETs is a typical characterization. Because the bandwidth is usually limited, effectively managing and using it is a very important issue.

Power Management: A power management approach would help reducing power consumption and hence prolonging the battery life of mobile nodes. Because most devices operate on batteries, power management becomes an important issue.

Security: The mobile nodes in MANETs are highly susceptible to malicious damage. Security issues are important in MANETs to prevent potential attacks, threats and system vulnerabilities.

Fault Tolerance: This issue involves detecting and correcting faults when network failures occur. Fault-tolerance techniques are brought in for maintenance when a failure occurs during node movement, joining, or leaving the network.

QoS/ Multimedia: Quality of Service (QoS) and Multimedia require high bandwidth, low delay, and high reliability.

Standards/ Products: The standards and products issues that allow the development of small scale is emerging for this field. For instance, Bluetooth is a low-cost technology for short-range communications techniques.

II. Geographical Map Path Discovery (GMPD)

The basic idea behind GMPD is that, mapping information of the network density is known to all nodes in the network. Areas with high node density are called “towns”. The Source node determines the town area in which it is actually situated; also determines the town area of the destination node. The Source node refers the network map in order to find anchor path from source to destination. The shortest path between source and destination is chosen for routing the packets. For GMPD each town, a map gives the location of its center and the size of the square area. A map of the network can be presented as a graph with nodes corresponding to towns and edges corresponding to highways. Macroscopically, the graph of towns does not change frequently.

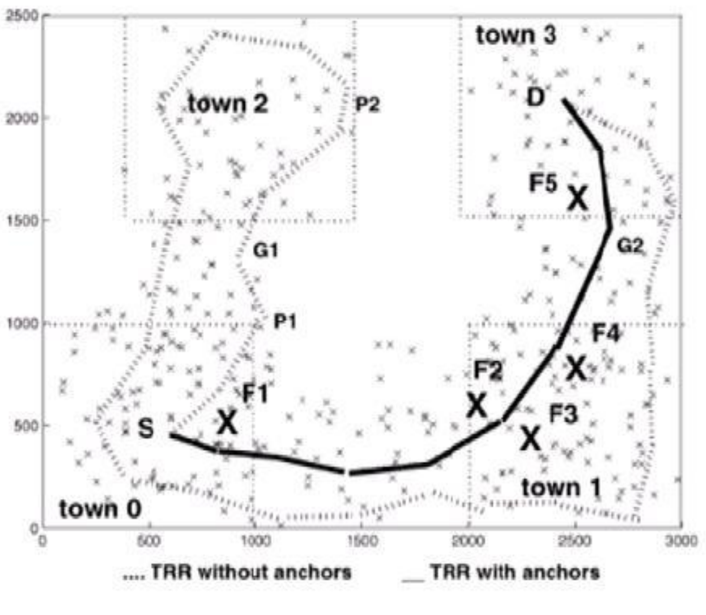

Fig: 2.1 GMPD with a given map of towns works as follows

For Figure 2.1 Source S determines from its own location LDAS the town area ST (Source town) in which S is situated (or, the nearest town to LDAS if it is not in the town area). In addition, since S knows the location of destination D (LDAD), it can determine from the LDAD the town area DT (Destination town),where D is situated (or, the nearest town to LDAD if it is not in the town area). Then, S accesses the network map in order to find the anchored path from S to D. An anchored path is the list of the geographical points: The points correspond to centers of the towns that the packet has to visit from ST in order to reach DT.

III. Location Based Routing

In ad hoc network location information to help routing is often routing (Terminode remote Routing, TRR), used when the destination is far, and link state routing (Terminode Local Routing (TLR), proposed as a means to achieve scalability in large mobile ad hoc networks. In order to enhance the life time of the network a location based routing protocol which uses anchored paths a list of geographic points is used as loose source routing information .It is a high probability that there are nodes to ensure connectivity from one town to another source and destination of the location have sufficient of its centre and size of the square area.

3.1 Terminode Routing

First, it combines a location-based routing method with a link state-based mechanism. Second, it uses a special form of restricted search mode (Restricted Local Flooding, RLF). These first two ingredients solve problems due to the inaccuracy of location information, in particular for control packets. Third, it introduces the concept of anchors, which are geographical points imagined by sources for routing to specific destinations. This helps efficiently route around connectivity holes. In order for the comparison to be fair to MANET protocols, we implemented an ad hoc location management scheme. In smaller ad hoc networks we compared Terminode routing to some existing MANET like routing protocols (AODV and LAR1) and found similar performance.

In larger mobile ad hoc networks of 500 nodes, MANET-like routing protocols do not perform well (except when mobility is small), while our routing protocol still performs well. In networks that are regularly populated with nodes, Terminode routing performs comparable to GPSR when the location management accuracy is high; however, terminode routing performs better when the location information accuracy is low. We also consider irregular networks with holes in node distribution. Here, too, we find that terminode routing outperforms GPSR. An existing MANET and location-based routing protocols we compared it to. Non uniform topologies are likely to appear in metropolitan .

IV. Performance Evaluation OF Terminode Routing

4.1. Performance Evaluation

In the NS 2 settings, The IEEE 802.11 Medium Access Control (MAC) protocol is used. And the radio range is 250 meters. The channel capacity is 2Mb/s. The propagation model is two-ray. It uses free space path loss for near sight and plane earth path loss for far sight.

4.2 Protocol Constants

We used the following configuration for the Helloing protocol. The HELLO timer is 1 second. Each entry in the routing table expires after two seconds, if it is not updated. All nodes promiscuously listen to all HELLO messages within their radio range. Nodes that have data or control packets to send should defer sending HELLO messages (up to the timer value) and piggyback the HELLO message to the data or control packet.

V. Network Simulator 2

The simulator used and the experimental results are explained in this chapter.

5.1 NS-2

The NS network simulator(www.isi.edu/nsnam/ns), from U.C. Berkeley/LBNL, is a object oriented discrete event simulator targeted at networking research and available as public domain. Its first version (NS-1) began in 1989 as a variant of the REAL network simulator and was developed by the Network Research Group at the Lawrence Berkeley National Laboratory (LBNL), USA. Its development was then part of the VINT project (www.isi.edu/nsnam/vint/index.html), supported by DARPA, at LBNL, Xerox PARC, and UCB,under which NS version 2.0 (NS-2) was released, evolving substantially from the first version. NS-2 is widely used in the networking research community and has found large acceptance as a tool to experiment new ideas, protocols and distributed algorithms.

Currently NS-2 development is still supported through DARPA. NS has always included substantial contributions from other researchers, including wireless code for both mobile ad hoc networks and wireless LANs from the UCB Daedelus and CMU Monarch projects and Sun Microsystems. At the time being, NS-2 is well suited for packets switched networks and wireless networks (ad hoc, local and satellite), and is used mostly for small scale simulations of queuing and routing algorithms, transport protocols, congestion control, and some multicast related work. It provides substantial support for simulation of TCP, routing, and multicast protocols over wired and wireless networks. NS-2 is suitable not only for simulation but also for emulation, that is, it is possible to introduce the simulator into a live network. Special objects within the simulator are capable of introducing live traffic into the simulator and injecting traffic from the simulator into the live network.

NS-2 plays an important role in the research community of mobile ad hoc networks, being a sort of reference simulator. NS-2 is the most used simulator for studies on mobile ad hoc networks, and it comes with a rich suite of algorithms and models. Unfortunately, its software architecture is such that adding new components and/or modifying existing ones is not a straightforward process. That is, in terms of ease to implement/test new algorithms or scenarios, NS-2 scores poorly with respect to other candidates. Moreover, NS-2 does not scale well in terms of number of nodes and it is reported to be in general quite slow from a computational point of view. Implementation and simulation under NS-2 consists of 4 steps.

1. Implementing the protocol by adding a combination of c++ and Otcl code to NS-2 source base.
2. Describing the simulation in an Otcl script
3. Running the simulation
4. Analyzing the generated trace files.

VI. Simulation Results

6.1 Simulation Environment

An event driven simulator ns-2 was used for simulations. The simulation setup 10 nodes and Radio range of each node is assumed to be 250m. Reliable connections are established at random n the network and the connections with constant bit rate. Two ray ground propagation models were used. The size of the data payload was 512 bytes

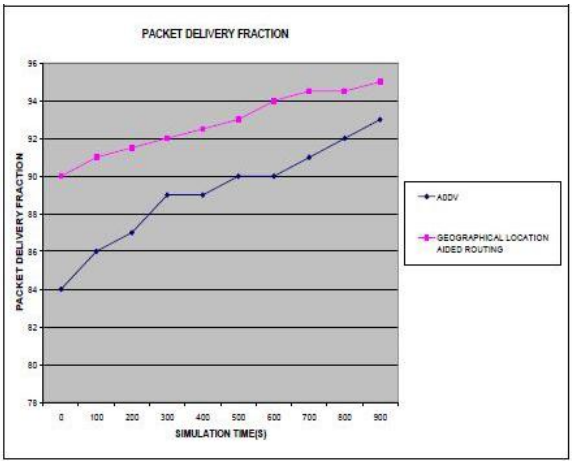

Fig:6.1 Cumulative sum of Numbers of Received Packets vs receive event time(s)

6.1.1 Cumulative sum of Numbers of Received Packets

In Figure 6.1 shows the Cumulative sum of Numbers of Received Packets vs received event time (s) of Geographical location aided routing

6.1.2 Packet Delivery Ratio

It is the ratio between the numbers of data packets delivered to that of the number of packets supposed to be received by it. This metric gives a measure about the packet loss. A high packet delivery ratio implies an efficient protocol. The figure 6a shows the packet delivery fraction vs simulation time of AODV and Geographical location aided routing. PacketDelivery Ratio (in%)= Actual packets received divided by Packets supposed to be received x 100 On an average, the packet delivery ratio improved by 5.08% than AODV.

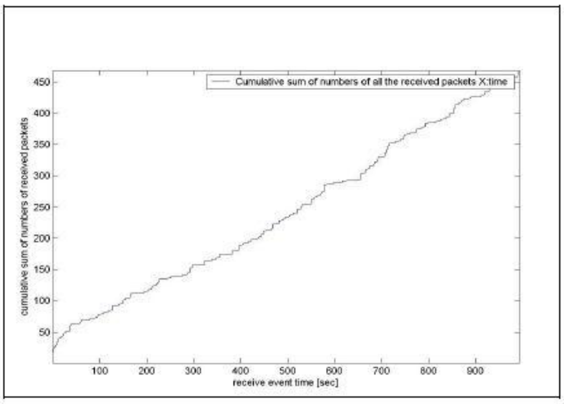

Fig:6.2 Packet Delivery fraction vs Simulation time(s)

6.1.3 Throughput

Throughput are mainly of network parameters in figure 6.5and 6.6 shows the throughput receiving packets vs simulation time in that manner slightly increase in simulation of throughput receiving packets in simulation time of 300 sec. It is observed that throughput is better than AODV by 37.5%

VII. Conclusion

Terminode routing aims to support Geographical map path discovery (GMPD) location-based routing on irregular topologies with mobile nodes. It achieves its goal by combining a location-based routing method with a link state-based mechanism. Further, it introduces the concept of anchors, which are geographical points imagined by sources for routing to specific destinations, and proposes low overhead methods for computing anchors.

Last, a special form of restricted search mode (Restricted Local Flooding, RLF), solves problems due to the inaccuracy of location information, in particular for control packets. The performance analysis shows that, in large mobile ad hoc networks, terminode routing performs better than existing location-based routing protocols. It does so by maintaining its routing overhead low and by efficiently solving location inaccuracies GMPD(Geographical Map Path Discovery) It is a high probability and packet received information's are good that there are nodes to ensure connectivity from one town to another source and destination of the location have sufficient of its centre and size of the square area.

VIII. Future Work

In this implementation,the communication is established between single sender and receiver in future versions ,this can be extended to multiple senders and receivers and the performance levels and using Global positioning system still can be improved.

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