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Analysis of Geo-graphical Routing in Wireless Adhoc Networks

[1]Srujani, [2]Dr P Chandrasekhar Reddy

[1]Asst Prof at Teegala Krishna Reddy Engineering College

[2]professor at JNTU university

ABSTRACT

Wireless mobile adhoc platforms such as manned or unmanned vehicles and peer-assisted key communication is an enabler for a vast number of routing protocol that directs the packets in the network. Mobile networks uses routing packets in fully connected mobile ad hoc networks (MANETs) has been studied to a great extent, but the assumption on full connectivity is generally not valid in a real system. Geo-graphical routing protocol must handle intermittent connectivity and the absence of end-to-end connections called location-aware routing for delay-tolerant networks (LAROD), enhanced with a location service, location dissemination service (LoDiS), intermittently connected with MANET . this approach overhead, LAROD uses a beaconless strategy combined with a position-based resolution of bids when forwarding packets. LoDiS maintains a local dataset of node locations, which is updated using broadcast review combined with routing overhearing. Our analysis design in a real time application with holistic choices in routing, location management, and the mobility model and identifies the choice of maintaining a local database of node locations is both essential and feasible, compares with a leading delay-tolerant routing algorithm (spray and wait) and is shown to have a competitive edge, both in terms of delivery ratio and overhead.

Keywords – Wireless Mobile Adhoc Networks, Geo-graphical Routing, MANET routing Techniques

I.Introduction

Mobile Adhoc Networks are used widely in many applications. A key enabler for theapplications is the routing protocol that directs the packets inthe network. Routing packets in fully connected mobile ad hocnetworks (MANETs) has been studied to a great extent, but theassumption on full connectivity is generally not valid in a realsystem. This case means that a practical routing protocol musthandle intermittent connectivity and the absence of end-to-endconnections. In this paper, we propose a geographical routingalgorithm called location-aware routing for delay-tolerant networks(LAROD), enhanced with a location service, location disseminationservice (LoDiS), which together are shown to suit anintermittently connected MANET (IC-MANET). Because locationdissemination takes time in IC-MANETs, LAROD is designed toroute packets with only partial knowledge of geographic position.To achieve low overhead, LAROD uses a beaconless strategycombined with a position-based resolution of bids when forwardingpackets. LoDiS maintains a local database of node locations,which is updated using broadcast gossip combined with routingoverhearing. The novelty of this project is the illustration of sound design choices in a realisticapplication, with holistic choices in routing, location management,and the mobility model. This holistic approach justifies that thechoice of maintaining a local database of node locations is bothessential and feasible. The LAROD–LoDiS scheme is comparedwith a leading delay-tolerant routing algorithm (spray and wait)and is shown to have a competitive edge, both in terms of deliveryratio and overhead.

The scope of the project is to propose new routing protocol for MANETS. The routing protocol like LAROD-LoDis.LAROD is designed to route packets with only partial knowledge of geographical position. LoDis maintains a local database of node locations, which is updated using broadcast gossip combined with routing overhearing. The two areas where these routing protocols can be applied is disaster areas and military operations.

The main aim of the project is to propose a new protocol like LAROD-LoDis and to compare this protocol with other non-geographic routing protocols Spray-Wait.

The objectives of the project are:

First location dissimination service (LoDis) for routing protocol LAROD.

The integrated LAROD-LoDis scheme and show that is more effective and efficient compared with a leading non geographic scheme: Spray and Wait.

The first one is to introduce a third fixed party (a base station) that will hand over the offered traffic from a station to another, as illustrated in Figure 1. The same entity will regulate the attribution of radio resources, for instance. When a node S wishes to communicate to a node D, the former notifies the base station, which eventually establishes a communication with the destination node. At this point, the communicating nodes do not need to know of a route for one to each other. All that matters is that both nodes source and destination are within the transmission range of the base station. If one of them fails to fulfill this condition, the communications base station's range is illustrated by the oval.

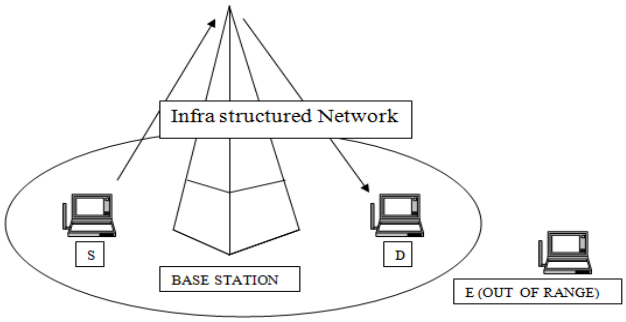

Figure1 Infra structured Network

The two nodes S and D which want to communicate are in the range of the base station. S send the message to the base station which in turn forwards it to destination node D. Thus communication is carried out with help of a base station. All messages have to pass through the base station. Node E is out of the range of the base station this prevents it from communicating to other nodes in the network. When node E wants to communicate to any node in the network it has to contact the base station. Since it is out of range communication is not possible. What happens if the base station is unavailable. Or what happens if we are in a situation where such an infrastructure does not exist at the first place.The answer is that we simply do not communicate. This is where the second approach is useful. JNote however that this form of centralized administration is very popular among wide cellular networks such as GSM etc.

SECTION II

2. Problem Definition:A routing is an issue with various computer networks when an error occurs in the operation of the routing algorithm in a group of nodes the path to a particular destination forms a loop. Routing is process of picking packet from one packet to other device on different network, every packet has source and destination deliver the packet. Routing is used to transmit user data packet across the network IP, IPX are the example of routed protocol identifies the IP protocol, IP header includes the several fields which plays leading role in routing.The concept behind these infra-structures less networks is the collaboration between its participating members, i.e., instead of making data transit through a fixed base station, nodes consequentially forward data packets from one to another until a destination node is finally reached. Typically, a packet may travel through a number of network points before arriving at its destination, Location Based Routing introduces a completely new flavor of network formation. The routers and hosts are free to move randomly and organize themselves in an arbitrary fashion, thus the network topology changes rapidly and unpredictably. Absence of a supporting structure in mobile ad-hoc networks, to a certain extent, invalidates almost all of the existing techniques developed for routine network controls in the existing wireless networks.

A MANET consists of mobile platforms (e.g., a router with multiple hosts and wireless communications devices)--herein simply referred to as "nodes"--which are free to move about arbitrarily. The nodes may be located in or on airplanes, ships, trucks, cars, perhaps even on people or very small devices, and there may be multiple hosts per router. A MANET is an autonomous system of mobile nodes. The system may operate in isolation, or may have gateways to and interface with a fixed network.

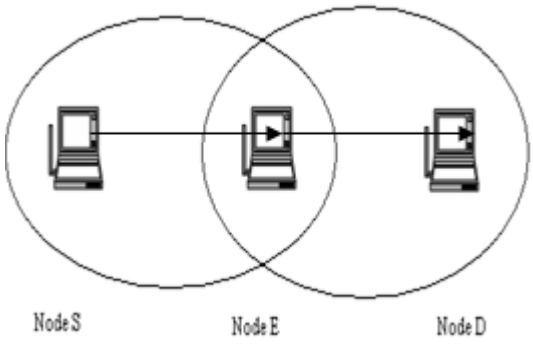

Figure 2 Infrastructure less Network

2.1. Infra-structure less Network: Here the node S wants to communicate to node D. The oval indicates the communication range of the node. The communication range of S does not exceed to include D. In this case routing is necessary, node E is in the range of S which has D in its range. So S in order to communicate to D, first sends the message to E which inturn forwards it to D. Thus the node E acts as a router and a node.

A mobile ad hoc network (MANET) is a wireless network that uses multi-hop peer-to-peer routing instead of static network infrastructure to provide network connectivity. Ad-Hoc networks are mobile wireless networks that have no fixed infrastructure. There are no fixed routers- instead each node acts as router and forwards traffic from other nodes.

MANET is a type of ad-hoc network with rapidly changing topology. Since the nodes in a MANET are highly mobile, the topology changes frequently and the nodes are dynamically connected in an arbitrary manner.In order to facilitate communication with the network, a routing protocol is used to discover the routes between nodes. Efficient routing of packet is a primary MANET challenge. Today, there exist various routing protocols for this environment.
Mobile Ad Hoc Networks (MANETs) consist of nodes that change position frequently. To accommodate the changing topology special routing algorithms are needed. For relatively small networks flat routing protocols may be sufficient. However, in larger networks either hierarchical or geographic routing protocols are needed. There is no single protocol that fits all networks perfectly. The protocols have to be chosen according to network characteristics, such as density, size and the mobility of the nodes.
MANETs have applications in rapidly deployed and dynamic military and civilian systems. The network topology in a MANET usually changes with time. Therefore, there are new challenges for routing protocols in MANETs since traditional routing protocols may not be suitable for
MANETs. For example, some assumptions used by these protocols are not valid in MANETs or some protocols cannot efficiently handle topology changes.
Current research on routing protocols for Mobile Ad-hoc Network (MANET) has converged to several dominating routing protocols, including Optimized Link State Routing (OLSR), Ad-hoc On-demand Distance Vector (AODV) and Dynamic Source Routing (DSR). At the same time, classic routing protocols such as Open Shortest Path First (OSPF) and Destination Sequenced Distance Vector (DSDV) are improved for the MANET context. Research efforts also focus on issues such as Quality of Service (QoS), energy efficiency, and security, which already exist in the wired networks and are worsened in MANET.
This paper gives brief description on what are Mobile Ad Hoc Networks, what are their uses, routing protocols in MANETs, and various types of protocols that are available for the MANETs

3. Traditional routing protocols are not suitable for MANETs

MANETs are usually highly dynamic and heterogeneous mobile networks.

No pre-existing infrastructure.
No centralized administration.
Dynamic topologies.
Variable capacity links.
Energy-constrained nodes.
Limited physical security.

3.1. MANET Routing Protocol: Some of the better known MANET protocols are AODV, TORA, DSR, TBRPF and OLSR.Each protocol has evolved over time to better suit the particular requirements of various types of mobile ad hoc networks.
These protocols are classified broadly into two categories.
Proactive
Reactive
These two protocols suffer from some problems under some situations,so there are new types of protocols developed which combine the features of both the proactive and reactive types
3.1.1. Proactive Protocols: Periodic topology updates a node always possesses the latest routing information, proactive MANET protocols update routing information in a proactive manner by exchanging route information at periodic intervals. The exchange of table-based route information is evenly distributed across the wireless networks result routes are established prior to being needed, providing a wireless network that is low in latency, at the expense of increased overhead.The well-known proactive routing protocols are TBRPF, DSDV.
3.1.2. Reactive protocols: Rather than distribute all route information across the entire network, On-demand MANET protocols perform route maintenance only when required. On-demand protocols create fewer networks overhead since the exchange of routing information is localized rather than evenly distributed. The result is a network with less overhead, at the expense of increased latency due to the route discovery process.
3.2. Geographical Routing: Geographical routing is powerful for its ability to discover existingroute to the destination without the help of global state. However,detours usually happen when the packet reaches a local minimum and inthis case, the network topology has to be reduced to planar graph andrecovery schemes such as face routing is then used. Face routingcommonly contain a large number of hops on a planar graph. When multiplepackets are generated for the same destination, such a large number ofhops tends to consume more energy. In thistalk, a simple yet effective path pruning strategy is proposed toreduce the excessive number of hops caused by the detouring mode ofgeographical routing protocols. The path pruning algorithm finds routingshortcuts by exploiting the channel listening capability of wirelessnodes, and is able to reduce a large number of hops with the help oflittle state information passively maintained by a subset of nodes onthe route. Simulation results show that in average the path pruningalgorithm can reduce as much as 80% of hops on the routes obtained byexisting geographical protocols such as Greedy Perimeter StatelessRouting (GPSR) and Greedy Other Adaptive Face Routing+ (GOAFR+) incritical network density regions.

3.2.1.LAROD: LAROD (Location Aware Routing of Delay Tolerant Networks) is a geographical routing protocol for MANET which combines geographical routing with store-carry-forwardprinciple. It is a protocol that uses greedy forwarding,when greedy forwarding is not possible,the node that holds the packet(Core node) waits until node mobility makes it possible to resume greedy forwarding.To forward a message to the destination,a core node simply broadcasts a message.All nodes within a predefined forwarding area are called tentative core nodes.The forwarding area can be of any shapes like sector,reulaux,circle and progress .The old core overhear the transmission and conclude that all tentative core nodes has taken over custody of packet.The time tr is chosen so that forwardingopportunities are not missed and band width is not wasted.All the nodes area are not able to overhear, hence there is possibility of duplication,so when a two copies are obtained from two duplicate paths, only one copy is forwarded,to reduce the load.A new node in the forwarding area is selected as a core node which has the highest probability of sending data.To prevent a packet from indefinitely trying to find a path to its destination, all packets have a time to live t TTL expressed as a duration, when the tTTLexpires,a packet is deleted by its custodian.

3.2.2. LoDis: In LoDis (Location Dissimination),every node is a location server and location data are updated by broadcast gossips and also by exchanges as nodes encounter each other. If only limited set of nodes were location servers,then the transmission of data packet will be delayed by the time taken for the location server to respond the location request.A LoDis location server regularly broadcasts the information it has in its location table.Any node that hears this broadcast merges the information with the one it has,and the most recent information will be propagated when that node makes its LoDis broadcast.In this way location information is spread like rings in water.LoDis also accepts location updates from the routing protocol.

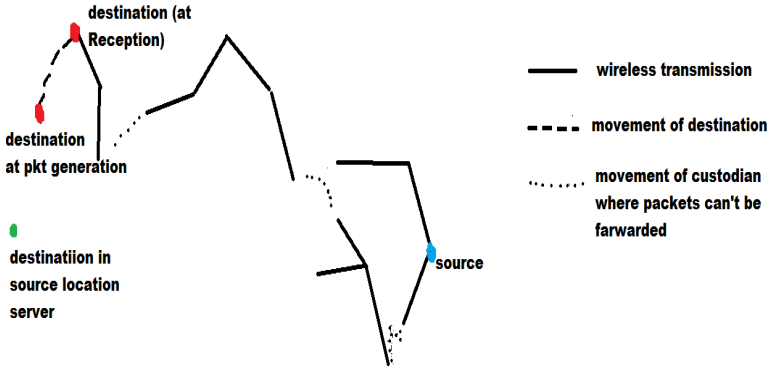

Figure: Path visualization using LAROD-LoDis

Initially the source node gets the location information of destination node (which is not fixed).In that direction it multicasts the packet. Among the neighbor nodes one of the node is selected as a core node and this process is con tinued. The core node has to wait if there are no reachable nodes. By the time the packet reaches the destination the location of destination is changed as shown in the figure.

VI. Performance of Geo-graphical Routing

In the project we propose a new geographical routing protocol like LAROD – LoDis that can route packets in mobile adhoc networks.

Mainly in this protocol two algorithms are used.

LAROD

LAROD (Location Aware Routing of Delay Tolerant Networks) is a geographical routing protocol for MANET which combines geographical routing with store-carry-forward principle.It is a protocol that uses greedy forwarding,when greedy forwarding is not possible,the node that holds the packet(Core node) waits until node mobility makes it possible to resume greedy forwarding.To forward a message to the destination,a core node simply broadcasts a message.All nodes within a predefined forwarding area are called tentative core nodes.The forwarding area can be of any shapes like sector,reulaux,circle and progress .The old core overhear the transmission and conclude that all tentative core nodes has taken over custody of packet.The time tr is chosen so that forwardingopportunities are not missed and band width is not wasted.All the nodes area are not able to overhear, hence there is possibility of duplication,so when a two copies are obtained from two duplicate paths, only one copy is forwarded to reduce the load.A new node in the forwarding area is selected as a core node which has the highest probability of sending data.To prevent a packet from indefinitely trying to find a path to its destination, all packets have a time to live t TTL expressed as a duration,when the tTTL expires, a packet is deleted by its custodian.

Algorithm

```
Source node at data packet generation
  Get destination location from location service
  Broadcast data packet
  Set up timer for rebroadcasting packet to t_r

Destination node at data packet reception
  If the packet is received for the first time
    Deliver data packet to application
  //Inform of delivery to destination
  Broadcast ack packet

All intermediate (non-destination) nodes at data
packet reception
  Update location service with data packet location
  information
  //Packet has been delivered to the destination
  If an ack has been received for the packet
    //Inform of delivery to destination
    Broadcast ack packet
  //The node is a tentative custodian
  Else if the node is in the forwarding area
    If the node does not have a copy of the packet
      Set up timer for rebroadcast to t_d
  //If the custodian is ahead of the node
  Else if custodian is in node forwarding area
    Remove packet in node if it has one

At ack packet reception
  Update location service with ack packet location
  information
  If the node has a copy of the packet
    Remove packet

When a data packet rebroadcasting timer expires
  If the packet's TTL has expired (t_TTL)
    Remove packet
  Else
    Update location information in packet with
    location server data
    Broadcast data packet
    Set up timer for rebroadcasting the packet to t_r
```

LoDis

In LoDis (Location Dissimination) ,every node is a location server and location data are updated by broadcast gossips and also by exchanges as nodes encounter each other. If only limited set of nodes were location serversthen the transmission of data packet will be delayed by the time taken for the location server to respond the location request.A LoDis location server regularly broadcasts the information it has in its location table.Any node that hears this broadcast merges the information with the one it hasand the most recent information will be propagated when that node makes its LoDis broadcast.In this way location information is spread like rings in water.LoDis also accepts location updates from the routing protocol.

Algorithm

```
At a set interval broadcast location data
  Select location data: vector with elements
  (node, location, timestamp)
  Broadcast the data

When a LoDiS broadcast is received
  For each received location data that is more
  recent
    Update the entry in the LoDiS server

When location data is received from the routing
protocol
  If the supplied information is more recent
    Update the entry in the LoDiS server
```

V.CONCLUSION

The availability of node location information enables the use of efficient geographical routing protocols in MANETs and IC-MANETs. One major component for a geographical routing protocol is a well-performing location service. The location service will provide information on where a destination is located to have a point to route a packet toward. In this paper, we have shown that, by using a MANET broad- cast gossiping technique and continuous modification of packet location information, geographical routing in IC-MANETs is feasible. The proposed location service (LoDiS) has then been integrated with a routing protocol (LAROD) and thoroughly studied in comparison with a high-performance baseline. We have also shown that the delivery ratio for LAROD–LoDiS is the same as that obtained using LAROD with an oracle location service—a very important result. The cost of LoDiS is also relatively small compared with the basic cost of routing using LAROD. Because the cost of LoDiS is constant per node, the more traffic there is in the network, the lower the relative cost will be.One reason for this difference is that spray and wait uses message replication to exploit the mobility of several nodes to reach the destination. Another reason is that spray and wait uses more packets to transfer each data packet. LAROD uses overhearing as acknowledgement, whereas spray and wait transmits an explicit acknowledgement packet.

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AUTHOR

A Srujani B.Tech from PRRM Engineering College M.Tech VLSI SD from Teegala Krishna Reddy Engineering College. Currently working as Asst Prof at Teegala Krishna Reddy Engineering College guided many UG & PG students. Her research areas include VLSI design, Wireless Communication, Embedded Systems.

Dr P Chandrasekhar Reddy B.Tech ECE from JNTU M.E Appled Electronics from Bharatiar University M.Tech DSCE from JNTU PhD ECE Wireless Routing from JNTU. He is having 25years of experience currently working as professor at JNTU university guided many UG PG & PhD students. He Published Text books, International journals and attended Conference in the areas of VLSI Embedded System and Wireless Communication.