International Journal of Engineering Research and Development
e-ISSN: 2278-067X, **p**-ISSN : 2278-800X, www.ijerd.com
Volume 5, Issue 4 (December 2012), PP. 61-68

Study on Traveling Algorithm for Quality of Service In Mobile Network

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Abstract:- Packet travelling algorithm in mobile ad-hoc network provides an effective and quality data transformation. Effective communication system provides a sophisticated communication environment for the users. The communication system components include MAC protocol, a routing protocol, and the treatment of voice packets. The telephone system performance is assessed in terms of packet transformation from one device to another. The performance is based on the percentage of blocked and dropped calls, packet loss, and packet delay. The telephone system efficiency can be increased through effective packet transformation and control. The packet transformations achieved various routing and traveling algorithms. Focusing is on two packet travelling algorithms. We measure the performance characteristics in terms of the percentage of blocked and dropped calls, packet loss, and packet delay.

I. INTRODUCTION

Mobile communication system changed the life style of the human being in the past two decades. Various research and development process is carried out to increase the effective communication system to provide sophisticated communication environment to the users. Packet traveling algorithm for effective mobile ad-hoc networks is a topic of emerging interest in the research arena of telecommunication networks. In mobile *ad hoc* wireless networks, multiple mobile clusters communicate without the support of a centralized coordination cluster for the scheduling of transmissions. In this project we determine the packet routing algorithm for wireless ad-hoc network to avoid the congestion over data transmission. This algorithm takes into account network scalability by investigating how the size of the multi-hop ad-hoc network impacts the quality of service. We measure the performance characteristics in terms of the percentage of blocked and dropped calls, packet loss, and packet delay.

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II. OBJECTIVES

Determine the packets routing algorithm for wireless ad-hoc network to avoid the transformation conflict for the effective mobile communication system. In the mobile communication system quality of service can be achieved via effective packet transformation. The performance is based on percentage of blocked and dropped calls, packet loss and packet delay. We will propose the algorithm to fulfill the above characters of packet transformation in a ad-hoc mobile network environment.

III. SCOPE

The quality of service in the ad-mobile network is achievable via providing uninterrupted data transformation mobile infrastructure. This research derives the path to take the decision on routing of packets algorithm to achieve the reliable ad-hoc mobile network

The packet traveling algorithm implemented ad-hoc mobile network infrastructure provides an effective and quality data transformation service; it will increase the mobile communication applications potentiality.

IV. METHODOLOGY

In this research, the researcher adopts the scientific research methodology which contains the following steps:

a. The problem is described with its integrated factors.
b. Analysis the existing scientific technology which involves concepts, algorithms and derived solutions.

c. Design the travel algorithm which provides an uninterrupted sophisticated packet transformation ad-hoc mobile network infrastructure.
d. Develop the model according to the design.
e. Observe the results and the critical evaluation for the same.

Mobile Communications Principles

Each mobile uses a separate, temporary radio channel to talk to the cell site. The cell site talks to many mobiles at once, using one channel per mobile. Channels use a pair of frequencies for communication—one frequency (the forward link) for transmitting from the cell site and one frequency (the reverse link) for the cell site to receive calls from the users. Radio energy dissipates over distance, so mobiles must stay near the base station to maintain communications. The basic structure of mobile networks includes telephone systems and radio services. Where mobile radio service operates in a closed network and has no access to the telephone system, mobile telephone service allows interconnection to the telephone network (see the following Figure).

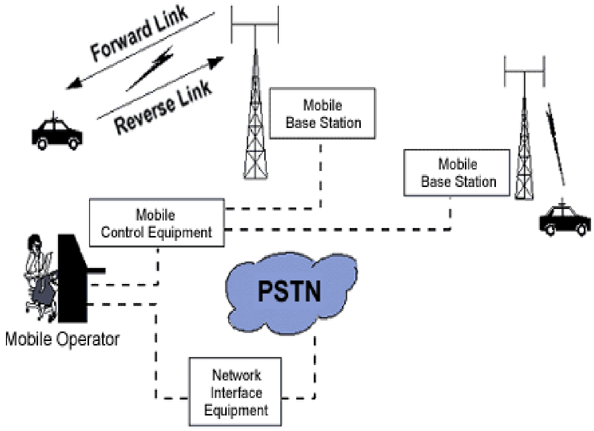

Figure Basic Mobile Telephone Service Network

Early Mobile Telephone System Architecture

Traditional mobile service was structured in a fashion similar to television broadcasting: One very powerful transmitter located at the highest spot in an area would broadcast in a radius of up to 50 kilometers. The cellular concept structured the mobile telephone network in a different way. Instead of using one powerful transmitter, many low-power transmitters were placed throughout a coverage area. For example, by dividing a metropolitan region into one hundred different areas (cells) with low-power transmitters using 12 conversations (channels) each, the system capacity theoretically could be increased from 12 conversations—or voice channels using one powerful transmitter—to 1,200 conversations (channels) using one hundred low-power transmitters.

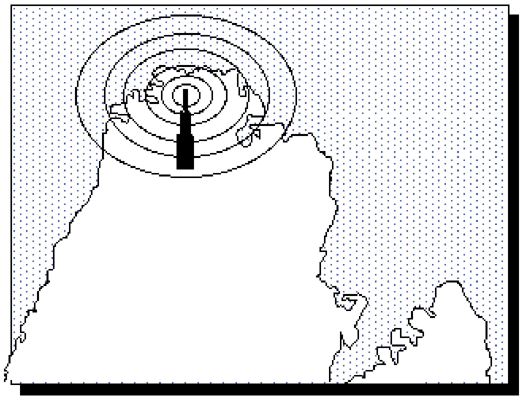

Figure Telephone Network Transmitter

Mobile Telephone System Using the Cellular Concept

Interference problems caused by mobile units using the same channel in adjacent areas proved that all channels could not be reused in every cell. Areas had to be skipped before the same channel could be reused. Even though this affected the efficiency of the original concept, frequency reuse was still a viable solution to the problems of mobile telephony systems.

Engineers discovered that the interference effects were not due to the distance between areas, but to the ratio of the distance between areas to the transmitter power (radius) of the areas. By reducing the radius of an area by 50 percent, service providers could increase the number of potential customers in an area fourfold. Systems based on areas with a one-kilometer radius would have one hundred times more channels than systems with areas 10 kilometers in radius. Speculation led to the conclusion that by reducing the radius of areas to a few hundred meters, millions of calls could be served.

The cellular concept employs variable low-power levels, which allow cells to be sized according to the subscriber density and demand of a given area. As the population grows, cells can be added to accommodate that growth. Frequencies used in one cell cluster can be reused in other cells. Conversations can be handed off from cell to cell to maintain constant phone service as the user moves between cells (see Figure).

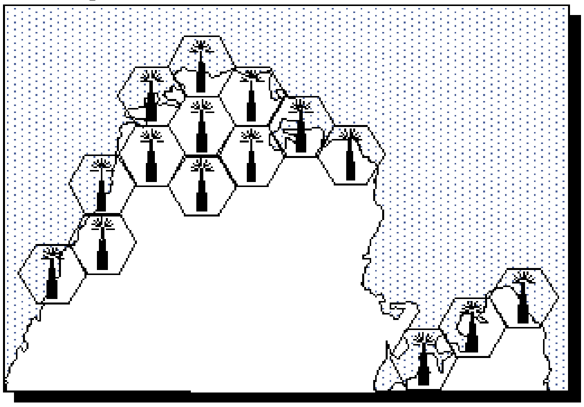

Figure : Mobile Telephone System Using a Cellular Architecture

The cellular radio equipment (base station) can communicate with mobiles as long as they are within range. Radio energy dissipates over distance, so the mobiles must be within the operating range of the base station. Like the early mobile radio system, the base station communicates with mobiles via a channel. The channel is made of two frequencies, one for transmitting to the base station and one to receive information from the base station.

Cellular System Architecture

Increases in demand and the poor quality of existing service led mobile service providers to research ways to improve the quality of service and to support more users in their systems. Because the amount of frequency spectrum available for mobile cellular use was limited, efficient use of the required frequencies was needed for mobile cellular coverage. In modern cellular telephony, rural and urban regions are divided into areas according to specific provisioning guidelines. Deployment parameters, such as amount of cell-splitting and cell sizes, are determined by engineers experienced in cellular system architecture. Provisioning for each region is planned according to an engineering plan that includes cells, clusters, frequency reuse, and handovers.

Cells

A cell is the basic geographic unit of a cellular system. The term *cellular* comes from the honeycomb shape of the areas into which a coverage region is divided. Cells are base stations transmitting over small geographic areas that are represented as hexagons. Each cell size varies depending on the landscape. Because of constraints imposed by natural terrain and man-made structures, the true shape of cells is not a perfect hexagon.

Cell Splitting

Unfortunately, economic considerations made the concept of creating full systems with many small areas impractical. To overcome this difficulty, system operators developed the idea of cell splitting. As a service area becomes full of users, this approach is used to split a single area into smaller ones. In this way, urban centers can be split into as many areas as necessary to provide acceptable service levels in heavy-traffic regions, while larger, less expensive cells can be used to cover remote rural regions (see Figure).

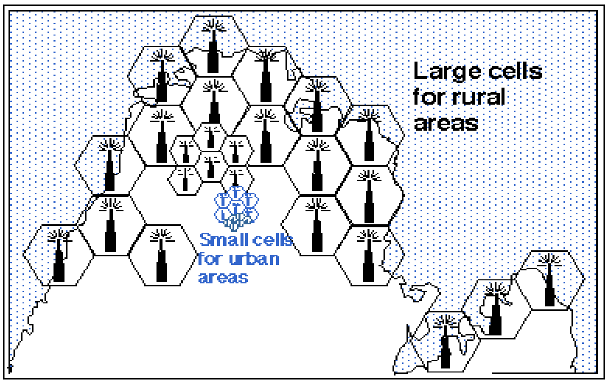

Figure Cell Splitting

Handoff

The final obstacle in the development of the cellular network involved the problem created when a mobile subscriber traveled from one cell to another during a call. As adjacent areas do not use the same radio channels, a call must either be dropped or transferred from one radio channel to another when a user crosses the line between adjacent cells. Because dropping the call is unacceptable, the process of handoff was created. Handoff occurs when the mobile telephone network automatically transfers a call from radio channel to radio channel as mobile crosses adjacent cells.

During a call, two parties are on one voice channel. When the mobile unit moves out of the coverage area of a given cell site, the reception becomes weak. At this point, the cell site in use requests a handoff. The system switches the call to a stronger-frequency channel in a new site without interrupting the call or alerting the user. The call continues as long as the user is talking, and the user does not notice the handoff at all.

1. Packet travelling algorithms
   - Single linkage clustering algorithm
   - K-means clustering algorithm
2. Packet scheduling algorithms
   - Weighted distance algorithm
   - Weighted hop algorithm
   - Greedy algorithm
3. Comparison and Recommendations

V. PACKET TRAVELLING ALGORITHMS

Determination of travelling algorithms

The communication path available from source to requested object with the neighborhood level then it will select the single link process otherwise select the broadcasting methods with the communication path.

Single-Linkage Clustering:

In single-linkage clustering, we consider the distance between one cluster and another cluster to be equal to the shortest distance from any member of one cluster to any member of the other cluster.

Single-Linkage Clustering: The Algorithm

Consider N*N proximity matrix is D = [d(i,j)]. The clusterings are assigned sequence numbers 0,1,......, (n-1) and L(k) is the level of the kth clustering. A cluster with sequence number m is denoted (m) and the proximity between clusters (r) and (s) is denoted d [(r),(s)].

The algorithm is composed of the following steps:

Step 1: Begin with the disjoint clustering having level L(0) = 0 and sequence number m = 0.

Step 2: Find the least dissimilar pair of clusters in the current clustering, say pair (r), (s), according to

$$d[(r),(s)] = \min d[(i),(j)] \quad \text{……(Eqn-3.1)}$$

where the minimum is over all pairs of clusters in the current clustering.

Step 3: Increment the sequence number: m = m +1. Merge clusters (r) and (s) into a single cluster to form the next clustering m. Set the level of this clustering to

$$L(m) = d[(r),(s)] \quad \text{……(Eqn-3.2)}$$

Step 4: Update the proximity matrix, D, by deleting the rows and columns corresponding to clusters (r) and (s) and adding a row and column corresponding to the newly formed cluster. The proximity between the new cluster, denoted (r,s) and old cluster (k)is defined in this way:

d[(k), (r,s)] = min d[(k),(r)], d[(k),(s)] ..….(Eqn-3.3)

Step 5: If all objects are in one cluster, stop. Else, go to Step 2.

K-means algorithm:

Clustering analysis is to group data in such a way that similar objects are in one cluster and objects of different clusters are dissimilar. The k-Means algorithm basically consists of four steps:

Step 1: An initial set of 'k' (where 'k' is the number of clusters) so-called centroids, i.e. virtual points in the data space is randomly created.

Step 2: Every point of the data set is assigned to its nearest centroid and

Step 3: The position of the centroid is updated by the means of the data points assigned to that cluster. In other words, the centroid is moved toward the center of its assigned points.

Step 4: This is done until no centroid was shifted in one iteration resulting in 'k' subsets/cluster.

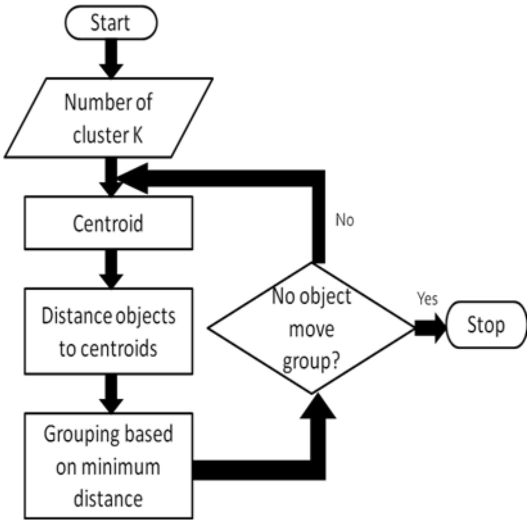

Figure k-means clustering algorithm

VI. PACKET SCHEDULING ALGORITHMS

Scheduling Algorithms

Scheduling algorithms determine which packet is served next among the packets in the queue(s). The scheduler is positioned between the routing agent and above the MAC layer. All nodes use the same scheduling algorithm. We consider the conventional scheduling (priority scheduling) typically used in mobile ad hoc networks and also propose other applicable scheduling policies to study. All scheduling algorithms studied are non-preemptive.

As a buffer management algorithm, the drop tail policy is used with no-priority scheduling. The drop tail policy drops incoming packets when the buffer is full. For the scheduling algorithms that give high priority to control packets, we use different drop policies for data packets and control packets when the buffer is full. When the incoming packet is a data packet, the data packet is dropped. When the incoming packet is a control packet, we drop the last enqueued data packet, if any exists in the buffer, to make room for the control packet. If all queued packets are control packets, we drop the incoming control packet. We explain the scheduling algorithms we analyze below.

VII. SCHEDULING ALGORITHMS FOR ANALYSIS OF GIVING HIGH PRIORITY TO CONTROL TRAFFIC

In on-demand routing protocols such as DSR, under frequent topology changes, delivering control packets (routing packets) quickly can be more important than in proactive routing protocols for propagating route discoveries or route changes quickly. To study the effect of timely delivery of control packets in on demand and proactive routing protocols, we compare a scheduling algorithm that does not distinguish control packets from data packets with a scheduling algorithm that gives high priority to control packets.

Non-priority Scheduling

No-priority scheduling services both control and data packets in FIFO order. We include this scheduling algorithm to contrast with the effect of giving high priority to control packets.

Priority Scheduling

Priority scheduling gives high priority to control packets. It maintains control packets and data packets in separate queues in FIFO order. Currently, this scheme is used in most comparison studies about mobile ad hoc networks.

VIII. SCHEDULING ALGORITHMS FOR ANALYSIS OF SETTING PRIORITIES IN DATA TRAFFIC

After examining the effects of giving priority to control traffic, we look at the effects of setting priorities in data traffic. We devise different scheduling algorithms by using distance metrics, considering fairness, and applying the multiple roles of nodes as both routers and data sources. All the scheduling algorithms we explain below give higher priority to control packets than to data packets. Their differences are in assigning weight or priority among data queues.

A class of scheduling algorithms uses distance metrics to setting priorities in data traffic. It is well understood that in a single node if the task sizes are known, shortest-remaining processing- time (SRPT) scheduling is the policy that minimizes mean response time. We apply this concept to an ad hoc network with multiple nodes. Although remaining processing time is not known in many cases, in a network we can assume that the remaining processing time of a packet is likely to be proportional to the "distance" (remaining hops or physical distance) from a forwarding node to a destination. We study weighted-hop scheduling with DSR and weighted-distance scheduling with GPSR.

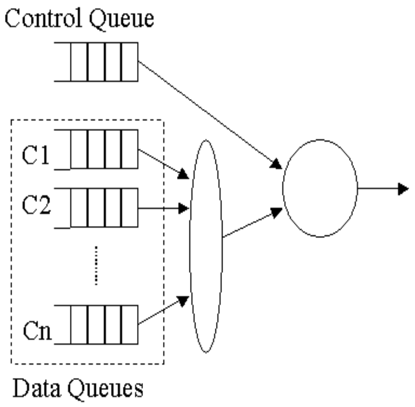

Figure: Packet Scheduler

Besides the scheduling algorithms using distance metrics, we study round robin scheduling and greedy scheduling to see how fairness or greediness of a node's packet forwarding affects the performance.

Weighted-distance Scheduling

We also consider a scheduling algorithm that uses physical distance with GPSR. Using physical distance may be a unique feature of ad hoc wireless networks. In the GPSR protocol, each data packet carries a destination's position. Nodes that are close in physical distance are likely to be close in the network topology (i.e., a small number of hops from each other). As the remaining physical distance to a destination decreases, the remaining hops to a destination in the network topology are likely to decrease.

The weighted-distance scheduler is also a weighted round robin scheduler. It gives higher weight to data packets that have shorter remaining geographic distances to the destinations. The remaining distance (Remaining Distance) is defined as the distance between a chosen next hop node and a destination. Each class C_i ($1 < i < n$) is determined by the virtual hop:

$$VirtualHop = \lceil \frac{RemainingDistance}{QuantizationDistance} \rceil + 1 \qquad \text{……(eqn-3.4)}$$

Where QuantizationDistance is a distance for mapping the physical distance into the class. For simplicity we choose this uniform quantization method. Better quantization methods might be used for further improvement. When the VirtualHop of a data packet is greater than n (number of data queues), the data packet is classified as C_n. For example, if n = 8, QuantizationDistance is 250m, and RemainingDistance is 350m, the VirtualHop = 3 and the packet belongs to C_3. The data queue of the class C_i receives weight W_i $(1< i<n)$. The higher weight is assigned to the lower class.

Weighted-hop Scheduling

Weighted-hop scheduling gives higher weight to data packets that have fewer remaining hops to traverse. The fewer hops a packet needs to traverse the more potential it has to reach its destination quickly and the less queuing it incurs in the network. In Figure 3.2, the data packet scheduler serves packets in weighted round robin fashion. We use a weighted round robin scheduler instead of a static priority scheduler since the weighted scheduler guarantees all service classes at least the configured amount of service chances, thus avoiding starvation. If we consider packet length variations to allocate the correct proportion of bandwidth, we can use weighted fair queuing or deficit round robin. The data queue of the class C_i maintains data packets whose number of remaining hops to traverse is i. When the number of remaining hops of a data packet is greater than n (the number of data queues), the data packet is classified as C_n. For example, if the remaining number of hops of a data packet is 2, it belongs to C_2. The data queue of the class C_i receives weight$(1 <i< n)$.

Round Robin Scheduling

Round robin scheduling maintains per-flow queues. We identify each flow by a source and destination (IP address, port number) pair. In Figure 3.2, each C_i is equal to a flow. In round robin scheduling, each flow queue is allowed to send one packet at a time in round robin fashion. We evaluate round robin scheduling to see the effect on performance of having an equal service chance among flows.

Greedy Scheduling

In the greedy scheduling scheme, each node sends its own data packets (packets it has generated) before forwarding those of other nodes. The other nodes' data packets are serviced in FIFO order.

Greedy algorithm

A greedy algorithm is any algorithm that follows the problem solving metaheuristic of making the locally optimum choice at each stage with the hope of finding the global optimum.

Specifics

In general, greedy algorithms have five steps:

Step 1: A candidate set, from which a solution is created

Step 2: A selection function, which chooses the best candidate to be added to the solution

Step 3: A feasibility function that is used to determine if a candidate can be used to contribute to a solution.

Step 4: An objective function, which assigns a value to a solution, or a partial solution, and

Step 5: A solution function, which will indicate when we have discovered a complete solution

Greedy algorithms produce good solutions on some mathematical problems, but not on others. Most problems for which they work well have two properties:

Greedy choice property

Whatever choice seems best at the moment and then solve the subproblems that arise later. The choice made by a greedy algorithm may depend on choices made so far but not on future choices or all the solutions to the subproblem. It iteratively makes one greedy choice after another, reducing each given problem into a smaller one. In other words, a greedy algorithm never reconsiders its choices. This is the main difference from dynamic programming, which is exhaustive and is guaranteed to find the solution. After every stage, dynamic programming makes decisions based on all the decisions made in the previous stage, and may reconsider the previous stage's algorithmic path to solution.

Comparison And Recommedations

Using the above specified algorithms we determine the effective packet travelling algorithm. We measure the performance characteristics in terms of the percentage of blocked and dropped calls, packet loss, and packet delay. Comparing the results we obtain the effective algorithm and recommend it for Quality of Service.

The comparison based on two ways :

1. The distance between the source and designated mobile object
2. The weighted calculation of HLR and VLR object and its total communication cost weight value to be calculated

IX. CONCLUSION

The above specified algorithms are used for determination of path in the cluster. The traveling and scheduling process are implemented with the construction of Adjacent matrix and the reference of weighted matrix. The determined cluster property aid to determine the Single link and K-Means algorithms used to execute the packet traveling process. The determined path traveling process can be effectively scheduled using Weighted-hop Scheduling, Weighted-distance Scheduling, Round Robin Scheduling and Greedy scheduling. The identified algorithms to be executed in the specified environment and optimization to be carried out for the effective and Quality of Service in a Mobile ad-hoc network.

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