Intelligent Mobility Model with a New Optimistic Clustering Approach for MANETs

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Abstract--- Mobile Ad-Hoc Networks (MANETs) permit users to access and transfer information irrespective of their geographic location or proximity to infrastructure. In contradiction to the infrastructure networks, the entire nodes in MANETs are mobile and their bonds are dynamic. In order to increase the probability of the path availability, a cluster based scheme is utilized. There is a requirement for the development of realistic, wide-ranging mobility models. In this paper, a mobility model is proposed which has a considerable impact on network performance, particularly when compared to other mobility models. In this paper, an intelligent mobility model is presented with a new optimistic clustering scheme which can be more receptive and effective when mobility rates are extremely low and more efficient when mobility rates are high. It is also observed that the performance of MANET protocols is affected when different mobility scenarios are utilized.

Keywords--- Ad-hoc, Mobility Model, Clustering.

I. INTRODUCTION

A Mobile Ad hoc Network (MANET) is a collection of wireless mobile nodes forming a network without using any existing infrastructure. MANETs are frequently changing networks. Here partitioning or breakage in nodes are of common thing. All mobile nodes function as mobile routers that discover and maintain routes to other mobile nodes of the network and therefore, can be connected dynamically in an arbitrary manner. The mobility attribute of MANETs is a very significant one. The mobile nodes may follow different mobility patterns that may affect connectivity, and in turn protocol mechanisms and performance. Mobility prediction may positively affect the service oriented aspects as well as the application-oriented aspects of ad hoc networking. At the network level, accurate node mobility prediction may be critical to tasks such as call admission control, reservation of network resources, pre-configuration of services and QoS provisioning. At the application level, user mobility prediction in combination with user's profile may provide the user with enhanced location-based wireless services, such as route guidance, local traffic information and on-line advertising. In this chapter we present the most important mobility prediction schemes for MANETs in the literature, focusing on their main design principles and characteristics. Mobility models are represented by the movement of mobile users, and they change their location, velocity and acceleration over time. These models are used for simulation purposes. For mobility

modeling, the activity of a movement of user can be described using both analytical and simulation models.

II. AD HOC NETWORKS

Ad Hoc is often used to describe solutions that are developed on the fly for a specific purpose. An ad hoc network refers to a network connection established for a single session and does not require a wireless base station such as router. Basically, it is a temporary network connection created for a specific purpose (such as transferring data from one computer to another).

Figure 1: Adhoc Network

Infrastructure based networks pass information through a central information hub which can be a hardware device or software on a computer. An ad hoc network is infrastructure less network that is one where there are no access points passing information between participants. It can be thought of as a peer-to-peer network for the wireless age. Peer-to-peer or workgroup style networks were used to create a network environment for early Windows computers.

Figure 2: Movement in Adhoc Network

This allowed these early computers to connect to each other to exchange information, usually in a smaller office environment without the need for domains and the additional management.

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III. EXISTING MOBILITY MODELS

A Mobile Ad hoc NETWORK (MANET) is a collection of wireless mobile nodes forming a self-configuring network without using any existing infrastructure. Since MANETs are not currently deployed on a large scale, research in this area is mostly simulation based. Among other simulation parameters, the mobility model plays a very important role in determining the protocol performance in MANET. Thus, it is essential to study and analyze various mobility models and their effect on MANET protocols. In this chapter, we survey and examine different mobility models proposed in the recent research literature. Beside the commonly used Random Waypoint model and its variants, we also discuss various models that exhibit the characteristics of temporal dependency, spatial dependency and geographic constraint. Hence, we attempt to provide an overview of the current research status of mobility modeling and analysis.

A. Random Mobility Model

In random-based mobility models, the mobile nodes move randomly and freely without restrictions. To be more specific, the destination, speed and direction are all chosen randomly and independently of other nodes. This kind of model has been used in many simulation studies.

Figure 3: The Categories of Mobility Models in Mobile Ad Hoc Network

B. Random Waypoint Mobility Model

The Random Waypoint Model was first proposed by Johnson and Maltz[5]. Soon, it became a 'benchmark' mobility model to evaluate the MANET routing protocols, because of its simplicity and wide availability. To generate the node trace of the Random Waypoint model the setdest tool from the CMU Monarch group may be used. This tool is included in the widely used network simulator ns-2.

C. Random Walk Model

The Random Walk model was originally proposed to emulate the unpredictable movement of particles in physics. It is also referred to as the Brownian Motion. Because some mobile nodes are believed to move in an unexpected way, Random Walk mobility model is proposed to mimic their movement behavior[2]. The Random Walk model has similarities with the Random Waypoint model because the node movement has strong randomness in both models. We can think the Random Walk model as the specific Random Waypoint model with zero pause time.

However, in the Random Walk model, the nodes change their speed and direction at each time interval.

D. A Probabilistic Version of the Random Mobility Model

It is a model that utilizes a probability matrix to determine the next position of an MN

E. Constant Velocity Random Direction Mobility Model

It is a revised version of the Random Mobility Model.

F. City Area, Area Zone, and Street Unit Mobility Models

These models describing simulation areas representing different granular scales of a city

IV. PROPOSED INTELLIGENT MOBILITY MODEL

This Mobility Model is based on the following real-life observations. First, people move towards specific destinations rather than randomly choosing some destinations. Second, there are obstacles in the real world. These obstacles, most commonly the buildings block people's movements as well hinder signal propagation. Third, people do not walk along random trajectories; they usually move along pathways and select shortest paths.

Figure 4: Example for Intelligent Mobility Model

The developed new obstacle mobility model does not rely on a graph. To move from a source location to a destination one, each node has to find its appropriate pathway through the environment. In order to allow nodes not to pass through obstacles, we implemented a path finding algorithm. This algorithm uses a ray launching technique coupled with an optimized sweep line algorithm for the fast ray intersection search computation.

An Algorithm

A path is a set of location points which form adjacent segments and no segment intersects with an obstacle in the environment.

The algorithm is as follows.

Step 1: Initialize the starting and ending point.

Step 2: Draw ray between these two points.

Step 3: is first object hit? If yes go to step 4, otherwise go to step 7.

Step 4: draw ray from hit position to destination position.

Step 5: Now check first edge of obstacle hit. If it is then go to step 6 otherwise go to step 3.

Step 6: add hit position to path. Go to step 4.

Step 7: add destination position to path. Go to step 8.

Step 8: stop

At the beginning, the start position and the actual position are the same. We launch a ray from source to destination and at the beginning, the start position and the actual position are the same. We launch a ray from source to destination and search for the first obstacle hit by this ray. Now we add the first hit point to the path and try to border this first obstacle. For do this, we search for the first edge hit in this obstacle. If an edge is hit, the actual position moves to the intersection point on this edge. We choose the nearest side of the hit edge in order to minimize the final path length. We repeat until the obstacle is encountered. This means that the ray from the node position to destination does not hit any edge of this obstacle

V. CONCLUSION

Mobility models play an important role in the evaluation of wireless network protocols. Wireless ad hoc simulation models need to approximate accurately common real world environments in order for the simulations to assess conveniently any studied ad hoc communication protocol. The work presented in this paper introduced a new tool for facilitating the generation of realistic mobility models that include obstacles for ad hoc mobile networks. We implemented a path finding algorithm. This algorithm uses a ray launching technique coupled with an optimized sweep line algorithm for the fast ray intersection search computation. We can summarize this algorithm as follows. When a node needs to move from its location to a chosen destination location, a ray is launched from its actual position towards the destination position. We repeat this operation each time we want to find the next position to be added to a mobile node pathway towards its destination location.

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