USE OF MOBILITY MODELING IN MANET'S & WIRELESS NETWORKS

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Abstract

Mobility modeling management is the cornerstone of wireless networks philosophy. Mobility analysis gives a deep insight on the impact of the terminal mobility on the cellular system performance. In third generation mobile communication systems, the influence of mobility on the network performance will be strengthened, mainly due to the huge number of mobile users in conjunction with the small cell size. In particular, the accuracy of mobility modeling becomes essential for the evaluation of system design alternatives and network implementation cost issues. Currently available mobility models tend to be either too simplifying or too sophisticated. For mobility modeling under realistic traffic and environmental conditions, this thesis introduces a novel representation technique which uses the distribution functions of street length, direction changes at crossroads, and terminal velocity. Other important factors influenced by user mobility concern the mobile user calling behavior expressed by the incoming/outgoing call arrival rate and average call duration. This is capable to describe the user behavior in detail, and is applied for the characterization of the traffic in individual single cells of the mobile network. The effect of mobility has been analyzed in terms of the local performance measures like *probability of handover* and *call blocking probability* (*for new and handover calls*). Additionally, this model has been used to calculate the *distribution of channel holding times*. The performances of new call handling algorithms are evaluated. The global performance criteria of interest are *call dropping probability for all calls*, call processing

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1.0 Introduction:

1.1 Overview of Mobile Ad-Hoc Networks (MANET):

A mobile ad hoc network (MANET), is a self-configuring infra structure less network of mobile devices connected by wireless links. In Latin ad-hoc means "for this purpose only".

Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Each must forward traffic unrelated to its own use, and therefore be a router. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic.

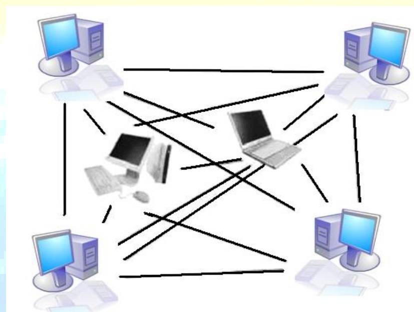

Figure 1.0 Mobile Ad-Hoc Network

1.2 Overview of Wireless Networks:

Wireless network have become increasingly popular in the computing industry since 1970. It is particularly true within the past decade, which has seen wireless networks being adapted to enable mobility. The area of wireless communication has been and is continuing to develop at a rapid pace over the years. The most Wireless network of today consists of cells. Each cell contains a base station, which is wired to a fixed wire network. The base stations interact with the portable handheld devices and provide these devices the wireless link to the network.

Figure 1.1: Internet at Mobile Handset

1.3 Overview of Mobility Model:

Mobility models are represented by the movement of mobile users, and they change their location, velocity and acceleration overtime. These models are used for simulation purpose. For mobility modeling, the activity of a movement of user can be described using both analytical and simulation models

When evaluating mobility models for wireless ad hoc networks with respect to performance or functional correctness, several assumptions have to be decided upon. Such assumptions may include the size and shape of the area used by the wireless devices, their transmission ranges and their movement pattern including allowed directional changes and speeds.

1.4 Study of Existing Mobility Model:

Mobility models represent the movement of mobile users and how their location, acceleration and velocity change over time. Such models are frequently used for simulation purpose when new communication techniques are investigated. Mobility management schemes for mobile communication systems make use of mobility models for future user positions.

For mobility modeling, the behavior of a user's movement can be described using both analytical and simulation models. The input to analytical mobility models are simplifying assumptions regarding the movement behaviors of users. Such models can provide performance parameters for simple cases through mathematical calculations.

1.5 Purpose of Mobility Model:

The purpose of mobility models is to describe typical terminal movement so that the analysis for these purposes can be made. Thus, the movement pattern of user plays an important role in performance analysis of mobile and wireless networks, especially in third-generation mobile communication (Jonahing Kim, 2005). One frequently used mobility; model in MANET simulations is the Random Waypoint Model (Broch et al., 1998), in which nodes move independently to a randomly chosen destination with a randomly selected velocity. The simplicity of Random Waypoint model may have been one reason for its widespread use in simulations. Hence, recent research has started to focus on the alternative mobility models with different mobility characterstics. In these models, the movement of a node is more or, less restricted by its history, or other nodes in the neighborhood or the environment.

1.6 Modification of Existing Mobility Model:

To produce a real-world environment within which an adhoc network formed among a set of nodes, there is a need for the modification of realistic, generic and comprehensive mobility models. Simulation environment is an important tool for the evaluation of new concepts in networking. Here we show the modified mobility model has a significant impact on network performance, especially when compared to other mobility models. The mobile adhoc networks depend on understanding protocols from simulations, before these protocols are implemented in a real world setting.

1.7 Category of Mobility Models:

There are two types of Mobility Models.

1.7.1 Traces Based Mobility Models

Traces are those mobility patterns that are observed in real-life systems. Traces provide accurate information, especially when they involve a large number of participants and an appropriately long observation period. However, new network environments (e.g., ad hoc networks) are not easily modeled if traces have not yet been created.

1.7.2 Synthetic Mobility Models

Synthetic models attempt to realistically represent the behaviors of MNs without the use of traces. Therefore, various researchers proposed different kinds of mobility models, attempting to capture various characteristics of mobility and represent mobility in a somewhat realistic fashion. Much of the current research has focused on the so-called synthetic mobility models (Camp *et al.*, 2002).

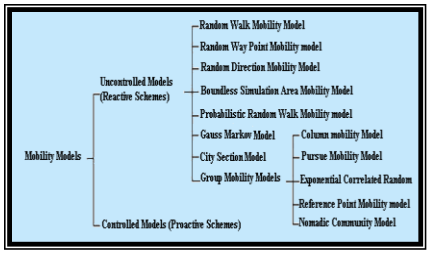

Figure 1.2: Classification of Mobility Models

2.0 Levels of Mobility

In static networks, the mobility of nodes, users, and the monitored phenomenon itself is minimal or ignored. For example, sun and temperature sensors in a sunroom may collect relevant information and use it to control motorized shades in order to maintain these parameters within preset limits. This static paradigm may be expanded by introducing mobility in one or more of the below-mentioned three levels of the ad hoc networks:

2.1 Node Level Mobility

The ad hoc nodes themselves may be moving. Examples include nodes mounted on moving cars or flying unmanned aerial vehicles, collecting information as their carriers constantly change their location and/or orientation.

2.2 Information Level Mobility

The event (source) monitored by or occurring in the network is mobile. For example, the smog generated by a poorly maintained truck is moving along with the truck. Another example may be the evolution of an oil spill that we try to model through measurements at distinct buoy locations.

2.3 User Level Mobility

Users (destination) accessing the information collected by the network may themselves be moving, and thus the information that is pertinent to them may change over time. For example, monitoring the traffic conditions on the way to the nearest hospital changes as the user is changing his/her position.

3.0 ADVANTAGES OF MOBILITY MODELS

3.1 Mobility Helps Security

Security and mobility seem to be at odds with each other. Security is usually enforced by a static, central authority that is generally in charge of securing the system under consideration, be it a communication network, an operating system, or the access system to the vault of a bank. In this case, because users are static as well, their locations are predictable, they are more likely to be available, and the system can more easily perform appropriate controls. However, this intuition can be misleading: mobility, far from being a hurdle, can be useful to establish the security associations between any two mobile nodes of a given network. The idea that mobility can help security is extremely straightforward, as it simply mimics human behavior: if people want to communicate securely, they just get close to each other in order to exchange information and to establish (or reinforce) mutual credentials. In spite of its simplicity, this idea is very powerful, as it can be applied to virtually any mobile ad hoc network at any layer (from the MAC up to the application layer).

3.2 Mobility Enlarges Node Coverage

Many works on the coverage of mobile node networks focus on algorithms to reposition nodes in order to achieve a static configuration with an enlarged covered area. As time goes by, a position is more likely to be covered; targets that might never be detected in a stationary node network can now be detected by moving nodes. The main metrics to measure node coverage could be the area coverage at specific time instants and during time intervals, as well as the time it takes to detect a randomly located stationary target. Exploiting mobility, both metrics can be improved.

3.3 Mobility Reduces Uncertainty

Uncertainty increases the transaction cost and decreases the acceptance of communication and cooperation. Our objective is to reduce the trustor's perceived uncertainty so that transaction cost is lowered and a long-term exchange relationship is sustained. One key way to efficiently reduce uncertainty is to exploit one important property of MANETs mobility. Node movement can increase the scope of direct interaction and recommendation propagation, hence speeding-up trust convergence. We study this effect under different mobility models and analyze several factors that will strongly influence the convergence speed and cost. We present a detailed design of a two-level Mobility-Assisted Uncertainty Reduction Scheme (MAURS). It exploits configurable level partition and movement schemes to provide a range of trade-offs between convergence time, cost, and uncertainty level.

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