ABSTRACT

Realistic simulation scenarios are critical for correctly assessing the performance of mobile ad hoc networks. This paper presents a tool to generate realistic mobility traces for MANET simulations. A new mobility module called AMADEOS was developed as an extension for the CANUMobisim framework. AMADEOS makes it easy and fast to automatically generate realistic mobility. It allows editing spatial environments with polygonal obstacles to be used within simulations. It also allows visualizing an animation of the generated mobility traces. To model mobility for simulation environments, a new mobility model was created that takes into account obstacles. A new propagation model based on ray tracing was also implemented as part of AMADEOS. AMADEOS was used to re-evaluate the performance of the AODV routing protocol in some realistic scenarios.

Keywords: mobility models; Network Simulator-2; ray-tracing propagation; realistic scenarios

INTRODUCTION

Nearly all published works on MANETs (Mobile Ad hoc ) use simulations. However, simulation scenarios often make simplified assumptions about the mobile network. This is because most commonly used simulators, such as Network Simulator-2 (NS-2) (NS2, 2005) and GloMoSim (2005), do not include capabilities to easily create realistic scenarios. We mainly focus here on two important scenario parameters: nodes mobility and signal propagation.

It is well known that mobility plays an important role in assessing the performance of MANETs protocols during a simulation test. The work presented in this paper is aimed at facilitating realistic mobility modeling in MANETs simulations. The AMADEOS (Advanced Mobility Models for AD Hoc NEtwOrk Simulations) mod-
ule was developed as an extension of the CANUMMobisim framework (Stepanov, 2002), an existing tool for mobility generation. AMADEOS makes easier the usage of CANUMMobisim by allowing graphic creation and editing simulation environments and automatically generating corresponding configuration files. It extends the capabilities of CANUMMobisim by allowing model environments that also comprise obstacles. Furthermore, it allows the animation of the generated mobility traces in order to better visualize node movements in the mobility simulation scenarios. A second function of AMADEOS is to model a realistic radio propagation model. Current, existing propagation models in NS-2 and GloMoSim do not account for obstacles in the simulation environment and therefore do not use advanced signal propagation models. Also in this work, we have implemented a new wireless propagation model based on a ray-tracing method that is integrated after to NS-2 and GloMoSim simulation environments.

This paper is organized as follows: First, we review related works on realistic mobility modeling. Second, we present the extension we developed to facilitate the creation of realistic mobility traces. Third, we describe the new developed mobility model that takes into account obstacles. Fourth, we present our new propagation model based on ray tracing. Finally, we evaluate the performance of the AODV routing protocol (Perkins, 2001) in a realistic scenario.

**RELATED WORKS ON MOBILITY MODELING**

A survey of ad hoc mobility models like the random direction model, the random Gauss-Markov model and the Brownian walk can be found in Bentley (1979). The most widely used mobility model is the random way point mobility. Nevertheless, works such as the one described by Yoon, Liuet, & Noble (2003) state that “random waypoint is considered harmful” because it does not give a uniform distribution of nodes in a simulation environment, which in turn affects the connectivity graph on which depends the assessment of the simulated MANET protocols.

In order to make scenarios more realistic, some new mobility models have been proposed in the last five years. Amit (2002) mentioned the first obstacle mobility model for ad hoc scenarios simulation developed. In Ertico (2005), pathways were constructed by using a Voronoi diagram of the vertices of polygonal obstacles. In this last model, the mobility model becomes a simple mobility restricted on the created Voronoi graph. Stepanov, et al. (Bettstetter, 2001) proposed the graph-walk mobility model similar to the random waypoint model, with the difference that in their model the movement is restricted on a graph. After the graph-walk model (Bettstetter, 2001) developed the CANUMMobisim framework (Stepanov, 2002), a powerful realistic mobility trace generator.

**EXTENDING THE CANUMMOBISIM FRAMEWORK**

The CANUMMobisim framework (Stepanov, 2002) is a mobility generation tool, implemented in Java for the CANU (Communication in Ad-hoc Networks for Ubiquitous Computing) project at Stuttgart’s university in Germany.

**Overview of CANUMMobisim**

This tool can model many interesting mobility models, such as smooth mobility,