Chapter 22
SimuMANET: An Open-Source Based Remote Tool in the Lab

Ana Vazquez Alejos
University of Vigo, Spain

Paula Gómez Pérez
University of Vigo, Spain

Manuel Garcia Sanchez
University of Vigo, Spain

Muhammad Dawood
New Mexico State University, USA

ABSTRACT

Simulation software in MANET research is vital. Such a tool provides a versatile mechanism to understand all the involved aspects of these particular systems, from the radio interface to the last communication layer. In this chapter, the authors present the SimuMANET project, a tool for both simulation and field tests purpose. It allows the deployment of wireless reconfigurable ad-hoc networks and MANETs, assisted by a real-time graphical user interface (GUI) for network traffic monitoring and management of radio electric features of the links established between the active network nodes. Due to a set of functionalities, such as GUI, network topology visualization, traffic and motion pattern configuration, and real-time network status analysis, the simulator introduced here becomes a valid tool for both research and education targets. Two scenarios with different types of motion and traffic are simulated using the SimuMANET tool, and the results are shown and commented to illustrate some capabilities of this software.

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INTRODUCTION

The SimuMANET tool was developed as the central part of two Master Thesis (MT) realized with two main goals:

1. Firstly, an educational objective leaded to the realization of MTs by means of implementing collaborative strategies between students. The project was divided in tasks, mapping the different program modules.

   The individual tasks were assigned to two students of such way that the realization of the modules was interleaved: the module \( n+1 \) to be implemented by the student A depends on the module \( n \) to be implemented by the student B. By this way we achieved a work division that required team work and, at the same time, it allowed the development of the professional responsibility sense in the student.

2. The technical objective of the project consisted on the development of a tool for both simulator and field tests. It allows the deployment of wireless reconfigurable ad-hoc networks and MANETs, assisted by a real-time graphical interface for network traffic monitoring and management of radio electric features of the links established between the active network nodes. The obstacle presence has also been considered to provide realistic and accurate propagation conditions.

   The project start point consisted of a collection of software tools in form of scripts or pieces of non-executable programs, freely distributed and provided by the US Navy Research Lab (NRL). This available open source code was oriented to Linux operating systems, in this case Fedora 5.

   These tools provided a set of individual source code that should be analyzed, corrected and updated to be able to start it up. Moreover, it was also necessary to perform changes in the source, according to the project needs to achieve module interoperability. One main script would act as dispatcher of the updated modules, and other many were exclusively developed to reach the required specifications. Finally, another open source code was used for designing the graphical interface, based on the Qt library.

   The purpose of this chapter is to introduce developed tool. For that, firstly we discuss the requirements of a MANET to be simulated. Later, we describe the background software used in the SimuMANET tool. After that, we detail two implemented case studies. Conclusions close this chapter with an overall evaluation.

BACKGROUND

A Mobile Ad hoc Network can be considered as an autonomous distributed system that consists of a set of identical mobile nodes that move arbitrarily and use wireless links to communicate with other nodes that reside within its transmission range.

   Variable link conditions are intrinsic characteristics in most mobile ad hoc networks. Rerouting among mobile nodes causes network topology and traffic load conditions to change dynamically. Given the nature of a MANET, it is difficult to support real-time applications with appropriate quality of service (QoS). In some cases, it may be impossible to guarantee strict QoS requirements. However, at the same time, QoS is a truly important feature in MANETs since it can improve performance and enable critical information to flow even under difficult conditions.

   There exist several approaches to operate a MANET, each one providing different advantages. Regarding QoS and MANETs, the lack of centralized entities and the constraints introduced by the own nature of MANETs, such as changes in network topology, power consumption and noise interferences, emphasizes the need to achieve optimized results in all the aspects involved in MANET management. In the next points, some important issues regarding MANETs and QoS are presented: