ABSTRACT

A network whose interconnections between nodes are implemented without using wires is referred to as wireless network and is usually related to a telecommunication network. As related to wired local area network, wireless channels are error-prone. Performance study and optimization of Wireless Local Area Network (WLAN) becomes more essential as its gaining popularity. For performance modelling and evaluation of wireless networks, computer simulation has become one of most widespread tools. While numerous network simulators exist for building a variety of network models, selecting a good network simulator tool is vital in modelling and performance study of wireless networks. Optimized Network Engineering Tools (OPNET) Modeller available to academic institutions at no cost is becoming one of the most widespread network simulators. In this study, the authors used OPNET Modeller 14.5 simulator tool to develop and validate a model for campus based WLAN. The results are expected to display that OPNET Modeller offers credible simulation outcomes close to a genuine system. The effect of network parameters such as the processing time on the performance metrics such as delay and throughput of the various scenarios in the entire network was investigated. The analysis of the results from the simulations carried out can assist the management of computer centre that manages the network in identifying the bottleneck node on the network and for future network capacity building. However, this wireless network involves too many numbers of users which OPNET is not capable to simulate; the authors limited the network to only users in the computer building.

Keywords: Network Simulation, Simulator Tools, Performance Modelling, Wireless Local Area Network, OPNET

1. INTRODUCTION

The use of computer simulated model to study complex systems has grown significantly over the past several decades. This is particularly true with regard to computer networks, where simulation has become a widespread tool used in academic, commercial and military applications. Computer model representations of communication protocol stacks are used to imitate and predict the behaviour of real world counterparts to solve a variety of prob-
lems. Performance study and improvement of WLAN becomes more essential as its gaining popularity. Hence, as related to wired LAN, wireless channels are erring. Wireless network is referred to a network whose interconnections between nodes are implemented without using wires, i.e., communicates by using wireless technologies (Stallings, 2002; Coleman & Westcott, 2009). Webster dictionary referees to a wireless as a concept of “relating to data communications using radio waves; operating by means of transmitted electromagnetic waves”. The implementation takes place at the physical layer (Ezreik & Gheryani, 2012). Transmission of information from one place to another without the use of cables is also known as wireless network. This communication, may be one-way communication as in distributed system (radio and television), or two-way communication as in mobile phones. The transfer of data via air which signifies a media or its carrier is by means of the radio waves. The beam of connections among two nodes in a wireless network is not noticeable by human eyes because wireless network operates at a radio frequency which modulated air by set of waves (Alberto & Sebastian, 2009). Due to the tense of wireless technology in the past decades that witness essential phases of advancement, the technology might be considered as emerging branch of networking. The send and receive are the two main activities principle and regulation which varies through-out the period of transmission by making used of radio waves or radio frequency that belong to spread spectrum of electromagnetic waves.

Nowadays, there are many reasons for schools, organization, etc., to consider the usage of wireless networking technologies. The reasons that speak in favour are the practical use and benefit of wireless network to it users like; cost-effectiveness of deployments a network, mobility and its application to environments where wiring is not possible and its preferable solution compared with wired networks. Wireless network assist people to exchange messages and have access to applications and info without the connection of cables which offers advantages of movement and capability to spread applications to dissimilar areas of the building, city, or anywhere in the globe. Therefore, when designing wireless networks and/or studying their behaviours under various conditions, software simulation tools are often used. Simplification of propagation measurement outcomes and verification of analytical models is frequently done via simulation. Even though full integrity for performance analysis and expectation is allowed by a genuine network test-bed, it is more cost-effective to use simulation for analysis performance studies. Moreover, simulation can assist in the designing process and can be performed in the initial stage of the system design. However, there are basic drawbacks that network researchers or developers supposed to bear in mind when using network simulators since simulation can never be as accurate as a genuine system. When selecting a network simulation package for simulation studies, a number of issues need to be considered. For instance, using reliable pseudo-random number generators, an accurate method for analysis of simulation output data, and statistical correctness of the simulation outcomes. Therefore, foremost network researchers (Law & Kelton, 2000; Pawlikowski, Jeong, and Lee, 2002; Sarkar & Halim, 2008; Sarkar & McHaney, 2012) recommended these aspects of credible simulation studies.

The logical architecture of campus wireless LAN is not a complete design as compare to its wired network. The WLAN in campus is connected to two controllers: Cisco wireless controller (comprises of three controllers) and Aruba wireless controller (comprises of two controllers) and are currently installed in campus. The number of wireless access points (AP) are 368 (Cisco) and 708 (Aruba). In this study, we choose OPNET Modeller 14.5 simulation tool to study the performance of campus wireless networks that operates on a frequency of 2.5 and 5 GHz band of IEEE 802.11 WLAN technology. The purpose of a simulation is to try to get an indication of how a given system will behave in a range of different scenarios. Our motivation for using OPNET Modeller 14.5 is
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