



LAN-Designer:

A Software Tool to Enhance Learning and Teaching Server-Based LAN Design

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ABSTRACT

Until recently, it has been difficult to motivate students to learn about server-based local area network (LAN) design because students find the subject very technical, dry, and boring. A software tool (named LAN-Designer) has been developed at the Auckland University of Technology that gives students an interactive, hands-on experience in server-based LAN design. LAN-Designer is suitable for classroom use in introductory-level courses in server-based networking. This article describes LAN-Designer and its effectiveness as an aid to teaching and learning about LAN design. The effectiveness of LAN-Designer has been evaluated both formally by students (student evaluation forms) and informally through discussion within the teaching team. The conclusions drawn are based on survey data collected from students. The feedback from students indicates that the development and implementation of LAN-Designer were successful. The article concludes by discussing the strengths and weaknesses of LAN-Designer and its future development. The impact of LAN-Designer on students' performance is also discussed.

Keywords: access protocol; physical topology; server-based LAN; software tool; teaching and learning

INTRODUCTION

Local area networks (LANs) are often included as a topic in computer science, information technology, engineering, and business courses, as LANs are a fundamental component of computer net-

works today. It is believed that incorporating practical demonstrations into these courses, thereby illustrating theoretical concepts and providing opportunity for interactive hands-on experience, significantly enhances student learning about server-based LAN design. Yet very little

material designed to supplement the teaching of server-based LAN design is publicly available, as a search of the Computer Science Teaching Center (Grissom, Knox, Fox, & Heller, 2004) and SIGCSE Education Links (Anonymous, 2004) sites reveals.

We strongly believe, as do many others (Abe et al., 2004; Bhunia, Giri, Kar, Haldar, & Purkait, 2004; Cigas, 2003; Liebeherr & El Zarki, 2004; Richards & Waisbrot, 2002), that students learn more effectively from courses that provide for active involvement in hands-on learning activities.

Server-based LAN design is one of the most difficult topics to learn and teach in a meaningful way because students find the subject full of technical jargon, dry, and boring, more than other subjects. Researchers at the Auckland University of Technology (AUT) have developed LAN-Designer (prototype) in Authorware 6.X (Authorware, 2004) under MS Windows that gives students an interactive, hands-on learning experience in server-based LAN design. A teacher is able to use LAN-Designer in the classroom, as a demonstration, to enhance the traditional lecture environment at an introductory level, and students can use its tutorials on server-based networking, and to verify (interactively and visually) the results of in-class tasks and exercises on LAN design. LAN-Designer, as reported here, can be used either in the classroom or at home.

The main objective of this article is to describe LAN-Designer and its effectiveness as an aid to teaching and learning about LAN design. The article is orga-

nized as follows. First we examine various open source tools and network simulators. We then describe LAN-Designer and highlight its educational benefits in teaching and learning contexts. Test results, which verify the successful implementation of LAN-Designer, are presented. The effectiveness of LAN-Designer is evaluated and interpreted, followed by a brief discussion and conclusion.

RELATED WORK

A detailed discussion on LAN design, in general, can be found in many references (e.g., Dennis, 2002; Forouzan, 2003, 2004; Palmer & Sinclair, 2003; Stamper, 2001), and commercial LAN design and planning is described extensively in literature (e.g., Fitzgerald & Dennis, 2002). A number of open source and commercial network simulation tools exist for building a variety of network models (Chang, 1999; Garrison, 1991; Zheng & Ni, 2003). However, these powerful tools can have steep learning curves and, while excellent for doing in-depth performance modeling and evaluation of computer networks, often simulate a networking environment in far more detail than is necessary for a simple introduction to the subject.

"Netwire emulator" is a software tool which may be suitable for teaching and learning computer networks (Carniani & Davoli, 2001). But this tool is targeted for more advanced networking concepts such as data link layer protocols. 'EMPOWER' is another network animation tool that can be used to illustrate the con-

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