Tools for Teaching Computer Networking and Hardware Concepts
(Book Review)

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Introduction

This book introduces the innovative tools for teaching and learning computer networking and hardware. These tools assist teachers to overcome the cost problem and space constraints in teaching networking and hardware concepts and enhance students' participation in flexible learning activities. The book is organized in 18 chapters divided into 5 sections. It starts in Section I with an introduction and a presentation of the basic concepts necessary for a good understanding of computer networking and hardware. Section II provides an in-depth treatment of the software and hardware tools and lab activities designed to enhance teaching and learning various aspects of computer networking. Afterward Section III illustrates wireless networking concepts and information security risk analysis. Section IV describes the computer hardware concepts and tools, including processor simulator and lab activities. Finally, Section V discusses detailed coverage of learning tools and techniques related to data communication protocols.

Teaching and Learning Computer Networking

This section includes six chapters covering wired and wireless LAN design, communication networks and protocols. Chapter II introduces a Web-based tool called WebLan-Designer for class demonstration as well as modeling LAN design. The tool provides students an interactive and flexible learning experience in designing wired and wireless LAN and improves students' participation in learning activities. Chapter III describes another interactive learning tool called iNetwork that allows students to experiment with difference network configurations or build custom networks without the need for expensive equipments. The authors illustrate laboratory exercises with detailed process to demonstrate the usefulness of the tool in reinforcing and extending students' understanding of network topics.

Following computer networking concepts, chapter IV presents the use of a network simulator called Packet Tracer in practical exercises to encourage independent and analytical processes and facilitate deeper learning. The simulation tool provides visualization, animation and meaningful intrinsic feedback features which engage students during the practical concentration and interest. Chapter V describes the architecture of a protocol animation tool called JASPER that provides a graphical and dynamic learning environment in communication protocols. This tool animates well-known protocols and allows students to add new protocols. Students can gain real insight into protocol design, analysis and operation using the JASPER protocol animator.

It is often difficult to motivate students to learn computer networking due to its dry and boring theories. Therefore, chapter VI presents a framework based on a set of learning activities for enhancing teaching and learning various aspects of packet-forwarding theories and concepts. Through the framework and laboratory activities, teachers are

able to liven-up lecture environment and students can gain insights into the concepts of packet-forwarding theories. Chapter VII emphasizes that students can view the abstract protocols as real artifacts that can captured and examined by using open source software called Ethereal. The proposed approach involves five activities, such as instruction, directed task, independent activity, novel situation and reinforcement. According to students' feedback, the tool gives students the ability to develop a better understanding of network protocols and problem-solving skills.

Wireless Networking and Information Security

This section focuses on wireless communication and networking technologies and consists of three chapters. In chapter VIII, the authors introduce a set of new projects in order to support teaching wireless networking and provide students hands-on practical work. A series of interesting wireless projects engage students to actively learn wireless communication and network fundamentals and reinforce their comprehension. Chapter IX provides a tutorial on the architecture of Wi-Fi networks, the evolution of IEEE 802.11 standards and radio propagation measurements using available wireless equipments (limited hardware and software resources). Through a series of experiments and measurements of the Wi-Fi projects, students indicated that they had learned a great deal about Wi-Fi fundamentals. Chapter X highlights a teaching hospital model developed for information assurance training in the context of information security risk analysis. The authors consider the difficulty in crystallizing theoretical knowledge into fled knowledge. Therefore, they propose the teaching hospital approach which involves incorporating real cases to supplement existing curriculum, keeps teaching material relevant over time through infusion of current research problems and creates a rich learning environment to support students to gain a deeper knowledge.

Teaching and Learning Computer Hardware

This section offers six chapters covering computer software and hardware tools. Chapter XI discusses the issues surrounding the communication between a processor, bus and external I/O devices. The author describes the organization of external I/O devices in detail. The practical operation explains how operating systems use I/O to access a computer's resources is presented along with some tools. Chapter XII presents the effectiveness of new PIC-based projects that facilitate an interactive, hands-on introduction to traditional computer hardware concepts. Students learn a great deal about hardware fundamentals by participating in the PIC projects and demonstration activities.

To provide suitable teaching suggestions to instructors in teaching computer hardware fundamentals, chapter XIII describes a novel assistant tool based on problem-based learning (PBL) theory. Through students' discussion about the brainstorm maps, the tool can construct the concept maps to assist teachers in knowing the concepts students lacked and the appropriate teaching sequence. Chapter XIV presents a useful processor simulator designed as an aim to teaching and learning the architecture of modern high-performance processors. The simulator written in Java is highly modular, and thus enables students to model individual processor modules on demand.

Chapter XV discusses the development and usefulness of a remotely accessible embedded systems laboratory that uses a small number of 32-bit development systems and can be accessed from any location with Internet. The proposed system provides students to learn in a convenient and secure way and makes distance education more practical. Additionally, chapter XVI shows a user-friendly tool named LOGIC-Minimister in enhancing teaching and learning minimization of Boolean expressions. The tool facilitates an interactive introduction on Boolean algebra, minimization of Boolean expressions, and logic gates and provides an opportunity for hands-on experience.

Data Communication Protocols and Learning Tools

This section consists of two chapters and provides learning tools designed to assist teachers and learners in teaching and learning the concepts of data communication protocols. Chapter XVII describes a practical introduction about the components of a serial protocol and explains how to use a protocol analyzer to examine any packet or frame. The proposed tool called Packeryzer not only promotes learners for the basic understanding of serial communication, but also enables network administrators to verify or evaluate the performance of a network. Chapter XVIII presents

VMware as a learning tool that emulates a hardware environment to transcend the traditional constraints of hardware solutions. The authors outline the feature sets of benefit for employing the tool and demonstrate the effectiveness through practical projects.

Summary

Although computer communication networking and hardware concepts are very important topics in computer education around the globe, many students appear to think the subject rather technical and tedious. Thus, it is necessary to liven up learning environment and guide students in exactly grasping these fundamental theoretical concepts. This book aims to establish a bridge between theory and practice in the fields of computer networking and hardware by adopting various learning tools. Not only does it cover a broad range of knowledge about wired and wireless networking, hardware, and protocols, but it emphasizes interactive hands-on exercises in order to motivate students to learning theoretical knowledge.

This book is a well organized and contains 5 sections and 18 chapters with detailed context. Each chapter includes learning objectives, figures and illustrations, key terms, real-world examples as well as review questions, all of which provide readers a useful conceptual resource. In summary, this book is really able to engage readers' full attention for the following reasons.

➢ It has a realistic objective that makes teaching and learning of computer networking and hardware a more active process by using these proposed methods and interactive tools.
➢ It was written as a unified whole in which each chapter relates its content to the introduction of concepts and is, in turn, related to the laboratory activities.
➢ Topics are reinforced by presenting the actual practices and the application of tools.
➢ It offers various learning tools that enable students to develop a better understanding of theoretical concepts and translate the abstract knowledge from the literature into a real-work situation.
➢ It includes many practical examples that support teachers to acquire more knowledge in how to apply software and Internet technology in inspiring students to learn computer networking and hardware fundamentals.

I deeply appreciate the precious experience of these authors in the areas of teaching and learning computer networking and hardware. Especially, I am interested in chapter IX titled "Teaching and Learning Wi-Fi Networking Fundamentals Using Limited Resources". The authors present complete teaching process including introducing basic concepts, designing an experiment, illustrating the software, evaluating the experiment result and student feedback. Through the integration between theory and practice, I believe surface learning is reduced and deep learning is increased. In addition, these proposed methods in this book have a positive effect on the teaching environment and are received favorably by students. Students become increasingly motivated to learn more about computer networking and hardware concepts and also realize how to apply their acquired knowledge to solve real-world problems.