Book Reviews

Thomas M. Chen, Stephen S. Liu

ATM Switching Systems

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We are living in interesting times. The entire landscape of telecommunications — services, technologies, regulations and competition — is fluid and changing daily. In this milieu, asynchronous transfer mode (ATM) made a splash in 1988 and has rolled like a tsunami. But, as promising as ATM is, it has yet to deliver on a large scale outside research labs and field trials. Although the future of ATM appears increasingly secure, large-scale deployment is fraught with a degree of risk and uncertainty.

A number of books on ATM networks have already been reviewed in the past few issues of CIT. The book *ATM Switching Systems*, to be reviewed in the following, concentrates on switching systems issues encountered in practically realizing feasible ATM networks. ATM switches are much more than a switching fabric that transfers cell from its inputs to its outputs. This book examines ATM switches as systems (in which the fabric is one component) containing control and management functions. The relationship between ATM switching and network control has not been examined in depth previously. The objective of this monograph is to relate the two areas in a common theoretical framework by developing a general ATM switching system model.

The book is organized into two parts. The first part, consisting of Chapters 1 through 4, provides the relevant technical background information on ATM. These chapters lay the necessary foundation for construction of the switch model in the second part. Readers can skip the first part of the book and go directly to the second part, which consists of Chapters 5 through 10, if they are already familiar with ATM and just want to learn about the construction of the ATM switch.

Chapter 1 is intended for those readers who are interested in an overview of the asynchronous transfer mode (ATM) concept. It begins with a brief history of the public telephone network and packet-switched data networks. The latter part of the chapter introduces the notion of an integrated services digital network (ISDN) and presents a vision of the future public broadband network.

Readers interested specifically in ATM may wish to proceed to the introduction to the ATM concept in Chapter 2. The chapter summarizes the basic functions of the ATM layer specified in international standards and industry agreements. ATM switching systems are viewed as network elements that route, buffer, and process the information flows in the ATM layer.

Chapter 3 covers the layered structure of the B-ISDN protocol reference model as a representation of different types of information flows (ATM cells) in ATM networks: user data (transparent to the network), signaling information for call/connection control, and management information for the efficient operation of the network. Each type of information flow is described in detail. This background material is essential because the main function of ATM switching systems is to store, process, and forward these information flows.

Chapter 4 is an overview of traffic control and resource management principles. The early part of the chapter discusses the objectives and general principles, and the latter part covers the basic mechanisms of resource management, connection admission control (CAC), usage/network parameter control,

and congestion control. Traffic control is a practical issue arising in the implementation of ATM. Traffic-control mechanisms must be implemented within the switching systems and higher network protocol layers. Much of this chapter is based on ITU-T recommendation I.371 and current ATM Forum specifications.

Beginning the second part of the book, Chapter 5 applies the background information from the previous chapters to the development of a general functional architecture model of an ATM switching system. The chapter outlines five major functional blocks in the model: input modules, output modules, cell switch fabric, CAC, and system management. It provides a high-level guide to the remaining chapters, which are devoted to the details in each functional block.

The input module (IM) is the subject of Chapter 6. This chapter presents a functional overview of the IM. The input module is especially important because it is the entry point of traffic into an ATM switching system. The basic function of the IM is extraction of ATM cells from the physical layer signal, which is presumed to be SONET/SDH, and processing of the cell headers in preparation for routing through the switch fabric.

Closely tied with Chapter 6, Chapter 7 investigates the output module. The output module performs many of the reverse functions of the input module. The primary responsibility of the output module is to receive cells from the cell switch fabric and prepare them for physical transmission on the output links. The output module may contain some distributed CAC and system-management functions. It is simpler than the input module, however, because the ATM-layer processing in the input module is more complicated.

Chapter 8 is devoted to the cell switch fabric, which performs the essential buffering and routing functions in the switch. Cell switch fabric is the central functional block in the ATM switching system. General design principles are illustrated through four prototypical approaches. Other functions of the cell switch fabric are concentration, expansion, copying, and multicasting. In addition, the cell switch fabric needs buffer management, which consists of space/time priorities to allow sensitivity to traffic with different cell delay and cell loss requirements.

Chapter 9 examines the functional block for CAC. This handles the exchange and processing of signaling messages with users and other switches following high-layer signaling protocols. This chapter first describes the signaling protocols and then the decisions made by the network on the allocation of resources for connections.

Functional block for system management is the subject of Chapter 10. System management is a complex but important functional block. It is generally responsible for managing the internal operation of the switching system and supporting the network-wide management activities.

Description of different types of ATM adaptation layers (AAL) is located in appendices and a large number of references are provided at the end of each chapter. The glossary of frequently used terms and an index are included, too.

In summary, this book is nicely written and highly recommendable for anyone who is interested in ATM networks. It is written in such a way that both beginning and sophisticated readers will greatly benefit from reading it. *ATM Switching Systems* will serve as a valuable guide to systems engineers, network planners and researchers interested in understanding the key issues involved in the design and implementation of ATM networks.

Mladen Kos
Faculty of Electrical Engineering
and Computing
University of Zagreb
Zagreb, Croatia

Jerry FitzGerald, Allan Dennis

Business Data Communications
Fifth Edition

John Wiley & Sons, Inc., 1996, pp. xx, 562, ISBN 0–471–12365–X

Both authors have a considerable experience in the field of management information systems. The first of them — Jerry FitzGerald — runs a company a score of years already, is a faculty

member of several Californian universities, a consultant at SRI International, a Certified Information Systems Auditor (CISA), as well as a prolific book and article author, specializing in risk analysis, computer security, audit and control of computerised systems, data communications, networks and systems analysis. The second — Alan Dennis — is an Associate Professor of Management Information Systems in the Terry College of Business at The University of Georgia, who also served as a consultant to BellSouth, Boeing, IBM, Ventana, the U.S. Department of Defence, and the Australian Army, having published more than 60 business and research articles. The book *Business Data Communications* comes more as a product of their involvement and participation in the events in the field than to a mere exposure to facts, thus giving it a particular flavour.

The book consists of fourteen chapters divided into four parts. Part I explains the purpose of the book, and gives an introduction to data communications including components of a communication network and future trends in communications and networking (Chapter 1). Network applications such as groupware, teleconferencing, WWW or doing business on the Internet, which are driving the development of data communications systems, are described in the second chapter.

Part II consists of the next four chapters and deals with fundamentals of data communications and networking. Chapter 3 gives a thorough insight in telephone communications hardware, while the data communications hardware is systematically sorted out in the fourth chapter. Various methods of data transmission (analog transmission of digital data, digital transmission of digital data, digital transmission of analog data, . . .) are described in Chapter 5, while Chapter 6 deals with the data link layer including media access protocols, error control, data link protocols, and transmission efficiency.

The third part is also made out of four chapters giving insight into the topology, routing, standards and protocols of the network layer (Chapter 7), local area networks (Chapter 8), metropolitan and wide area networks (Chapter 9), and backbone networks (Chapter 10).

Part IV is dedicated to network management. It includes Chapter 11 with its structured approach to network design and implementation,

Chapter 12 concerning network management, and Chapter 13 on network security. Chapter 14, although not necessarily belonging here, gives an overview of Novell NetWare network operating system (versions 3.X and 4.X).

Every chapter is accompanied with a summary, key term list, selected references and questions and problems.

It should be noted that the authors included some very interesting pedagogical aids into their book. There is an extensive case study about the fictitious company Next Day Air Service given in the Appendix. What is so interesting there is that this case study is divided into fourteen chapters, in the same manner as the text of the book. It requires the reader to complete the tasks related to topics covered in each corresponding chapter of the text. Each chapter in the Appendix contains the case narrative, related figures, and a set of questions and problems. These do not have a unique solution because there are too many alternatives, so allowing for a reader to experiment with its own solutions.

To highlight key issues throughout the book the authors used special frames which they named "focus boxes". There are two types of these frames: "Management Focus" and "Technology Focus". The former boxes describe how networks are actually being used today, or bring some side information, as e.g. a list of major public data networks. The latter ones highlight some technical issues and give more detailed information such as, for example, modem commands.

The text is richly illustrated with numerous figures, diagrams and some photos. The book is accompanied with a detailed instructors' manual (not being available to the reviewer) providing additional background information, teaching tips and sources of material for student exercises, assignments and exams. At the end there is a glossary with acronyms, and a well compiled index.

While reading this book I was at first unsatisfied with the depth of technical details given to some issues. Then, after I learned the authors' background, I realised that the book is intended to be read by the people who will plan, purchase and manage communications systems, and not the people who will design and build the components. In this light I began to recognise the

wealth of this text, in its structured and systematic coverage of the vast field of data communications. But, being a seasoned technician, as well as an incurable critic, I cannot refrain from making some remarks. I might accept that datacom managers among themselves use terms like TRIB (Transmission Rate of Information Bits), whereas we with "engineering lump" are talking about throughput; moreover, I could even stand an explanation about DDD (Direct Distance Dialing) in which users dial a host using a modem ... (rings a bell?). But having alternating current defined as "the electrical current used to power computers" calls for a quick revision. (You should bear in mind that the reviewer lives in the country which gave birth to Nikola Tesla, the inventor of alternating current!)

Well, if quick revisions are possible to any book, then it certainly is this book. If you have access to the Internet, point your WWW browser to the following site: `http://tcbworks.cba.uga.edu /adennis/`. There you will find an extension to *Business Data Communications and Networking*, full with updates, new information and links to other sites of interest. Instructors can download a network game which is not just a kind of adventure game played on the network. The purpose of this game is to help students better understand the way messages are transmitted in computer networks. Students are organised into four-person teams, each of them assuming the role of one layer in a communication network (e.g., data link layer) and working with the others to send messages through it.

I found *Business Data Communications and Networking* by Jerry FitzGerald and Allan Dennis a highly recommendable literature for any professional in the field. Students will find it very instructive while instructors will benefit from the authors' rich experience and especially from their continuing help through the above Web page. I will surely keep the book handy, and visit its Web page regularly.

Dragutin Vuković
MicroLAB Computer Consulting &
Engineering
Zagreb, Croatia

M. Ajmone Marsan, G. Balbo, G. Konte, S. Donatelli and G. Franceschinis

Modelling with Generalized Stochastic Petri Nets

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Petri nets are one of the few paradigms allowing the integration of the description of complex systems and performance analysis concepts. Petri nets can be effectively applied in a diverse variety of fields, ranging from computer architecture to flexible manufacturing, control systems, transportation, banking, and organization of work. This book covers the application of Petri nets for performance evaluation of distributed systems. Examples are taken from the computing, communications and flexible manufacturing.

As it is already known, Carl Adam Petri introduced Petri nets in his 1962 doctoral thesis *Communication with Automata* to describe concurrent systems. The concept of time was not included in his model. Several years later temporal concepts were introduced into Petri nets (in the works of C. Ramchandani, P. M. Merlin and D. J. Faber, and J. Sifakis). The models are mostly based on the use of deterministic timing. The first definitions of Petri nets with stochastic timing were proposed by F. Symons, G. Florin, S. Natkin and M. Molloy. Such models are today collectively named Stochastic Petri nets. Specifically M. Molloy proposed a model of Petri nets where stochastic timing is mixed with deterministic null delays, and the model can describe both the temporal and the logic evaluation of a complex system; this model is named Generalized Stochastic Petri nets (GSPNs). The book under review presents a unified theory of GSPNs.

The book can be divided into two parts. Part 1 comprises Chapters 1–6, and summarizes the main results in GSPNs theory, while Part 2 (Chapters 7–11) presents examples of applications of GSPNs. The book is organized as follows:

Chapter 1 contains an informal introduction to Petri nets and is mainly intended for readers who have no previous experience with Petri nets. Chapter 2 named *Petri Nets and Their Prop-*

erties introduces definitions, concepts and analysis methods for untimed Petri nets. Chapter 3: *Time in Petri Nets* deals with the introduction of temporal concepts into a Petri net model. The concept of time is introduced by timed transitions and by immediate transitions, respectively. The presence of both timed and immediate transitions in the same timed Petri net model leads to the concept of priority. The problem of priority in Petri nets is addressed in Chapter 4. Chapter 5: *GSPNs Basic* provides an intuitive explanation of the characteristics and dynamics of Petri net models obtained by associating random, exponentially distributed firing delays with time transitions. The Stochastic Petri nets (SPNs) and GSPNs are defined. Chapter 6: *Analysis of GSPN Models* illustrates techniques for the analysis of SPN and GSPN models. The chapter contains illustrative examples to help the reader understand the concepts and techniques.

Chapter 7, titled *GSPN Representation of Phase —type Distributions*, shows how a GSPN model can account for activities with generally distributed durations. The classical central server model is used as an example. An approach to performance analysis of flexible manufacturing system modelled by the use of GSPN is described in Chapter 8. Chapter 9: *Compact Models of Random Polling Systems* illustrates the construction of GSPN models for polling system. Chapter 10 provides an example of the way GSPNs can be used to evaluate concurrent programs. Performance evaluation of the MIMD computer architecture by using the GSPN-based model is shown in Chapter 11.

The book is complemented by two appendices. Appendix A contains some of the results of the theory of stochastic processes. Appendix B contains a glossary with most of the notations used throughout the book.

The book is addressed to beginners rather than experts in the field of Petri net applications to performance analysis, but it can be very useful as a text for graduate and postgraduate courses on modelling and performance evaluation of computer and communication systems.

Slobodan Ribarić
Faculty of Electrical Engineering
and Computing
University of Zagreb
Zagreb, Croatia

Gary W. Sabot, Ed.

High Performance Computing. Problem Solving With Parallel And Vector Architectures

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The book describes how to create efficient programs that solve complex scientific problems on parallel and vector computers. The problems are taken from a variety of domains — from weather prediction, and dynamic tree searching to mortgage-backed financing and scalable programming. The case studies explain and illustrate the process of mapping problems from the domains into concrete solutions that execute on target machines. The target machines are SIMD and MIMD parallel computers, vector machines, superscalar, superpipelined machines and networks of workstations.

Each chapter describes some technical and/or engineering problem, the algorithm and its implementation for the target machine. The structure of each chapter is as follows: introduction, application, target machine, data representation, algorithm, effects of architecture, optimization, tuning and tradeoffs. Special attention is paid to the evaluation of the resulting implementations.

The book is organized into eight chapters. Chapter 1: *Structured Grid Application* describes several algorithms centered around uniform, structured cartesian grids. Target machine, high-level language, Fortran 90, CM Fortran array features are topics of the chapter.

Chapter 2: *Block Grid Application* describes different approaches to handling structured grids. The chapter deals with techniques for load balancing grid decomposition, problem of required memory and technique for writing portable code. The target machines are MIMD message-passing systems. The chapter describes a PCTH algorithm which solves explicit finite difference or finite volume equations representing the principles of conserving of mass, momentum and energy for solid or gaseous objects interacting at high velocities

and/or pressures. The performance results for PCTH, using different machines, are shown at the end of the chapter.

Chapter 3 describes a weather model application. The APRs (Advanced Regional Prediction System) model was evaluated on several parallel architectures (Cray Z- MAP/C-90 (16 processors, Cray Y–MP8/64, CM–2, Convex C3 and others).

Chapter 4: *Libraries for Linear Algebra* describes efficient libraries LINPAC, LAPACK, LANPACK and BLAS that are used with virtually all high performance computers.

Dynamic Tree Searching is the title of the fifth chapter. The chapter presents algorithms used to write a parallel program to play chess.

Chapter 6 discusses graphs and how they can be mapped onto parallel computers. This chapter describes how a single abstract graph algorithm, called Connected Components Algorithm, can be implemented on a variety of target machines.

Chapter 7: *Mathematical Programming and Modeling* surveys a broad subject area and shows different techniques used for solving a variety of application problems on parallel machines. As a case study, parallel computing in mortgage-backed financing is selected.

The final chapter in the book is titled *Scalable Programming in Fortran*. This chapter explains what scalable programming is, and describes how to write software designed from the start to execute on wide range of high performance target machines.

The book is intended for a variety of readers — with backgrounds ranging from computer science to physics, but they should all have some programming experience in a language like Fortran and/or C, and some familiarity with computing of complex engineering and scientific problems. The knowledge of some parallel architecture is welcome. The book can be useful for postgraduate students in courses on advanced computing.

Slobodan Ribarić
Faculty of Electrical Engineering
and Computing
University of Zagreb
Zagreb, Croatia

Allen G. Taylor

dBASE for Windows Solutions

dBASE is a well known data base software with wide population of users both in DOS and Windows environments. This Solutions book is a complete reference to dBASE for Windows. It is written in such a way, that you can easily find complete answers to all your questions and problems.

At the front of the book you have an extra 8-page Troubleshooting guide. It is an index of common dBASE operations and problems with a pointer to the page where you can find the answer to the problem. If you just need a quick reminder, not a complete explanation, you can use the shortcut column of the same troubleshooting guide.

The book consists of fifteen chapters and an index. The chapters are clearly organized and cover all important issues. They consist of a set of related tasks. Each of them is briefly and clearly explained, and a list of Assumptions and Exceptions is given. It tells you how to set up your computer and software in order to complete the task successfully. After that, step by step instructions are given to guide you right to the solution. In case there are specific problems, What To Do If section tells you how to fix them.

Chapter 1 is an introductory chapter. It gives an overview of dBASE for Windows, its advantages compared to the DOS version of dBASE and a short overview of all software components. The next chapter presents the Navigator: a tool which enables you to quickly make your way among the files in your system. Chapters 3 and 4 deal with tables, and tell you how to create and edit them. Through Chapters 5, 6 and 7 you can learn how to create a database, how to sort and index it and how to move the data into and out of tables. The next two chapters deal with questions related to queries. In the last six chapters you can learn how to create forms, menus, buttons and SpeedBars, as well

as how to build reports and how to put images and sounds in your applications.

This Solutions book doesn't just tell you the mechanics of using dBASE for Windows, it also gives you tips on savvy things to do with the software, such as how to locate your data quickly, how to produce reports with the minimum of fuss, and how to customize dBASE for Windows to work the way you want it to. It can be recommended both to novice and experienced users.

Josip Jurić
Faculty of Electrical Engineering
and Computing
University of Zagreb
Zagreb, Croatia