

data communications &  
network security

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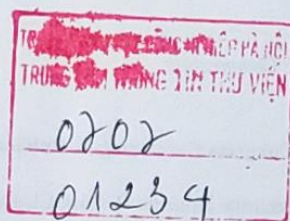
# Data Communications and Network Security

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## DATA COMMUNICATIONS AND NETWORK SECURITY

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This book is printed on acid-free paper.

1 2 3 4 5 6 7 8 9 0 QPD/QPD 0 9 8 7 6

ISBN-13: 978-0-07-297604-5

ISBN-10: 0-07-297604-7

**Editorial director:** Brent Gordon

**Executive editor:** Paul Ducham

**Executive marketing manager:** Rhonda Seelinger

**Project manager:** Bruce Gin

**Production supervisor:** Gina Hangos

**Designer:** Jillian Lindner

**Photo research coordinator:** Ira C. Roberts

**Cover design:** Jillian Lindner

**Typeface:** 10/12 Times New Roman

**Compositor:** International Typesetting & Composition

**Printer:** Quebecor World Dubuque Inc.

## Library of Congress Cataloging-in-Publication Data

Carr, Houston H., 1937—

Data communications and network security/ Houston H. Carr, Charles A. Snyder.—1st ed.  
p. cm.

ISBN-13: 978-0-07-297604-5 (alk. paper)

ISBN-10: 0-07-297604-7 (alk. paper)

1. Computer networks—Security measures. 2. Wireless communication system—Security measures. I. Snyder, Charles A. II. Title.

TK5105.59.C365 2007

005.8—dc22

2006043316

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Charles A. Snyder, Ph.D., BFA, MBA, MSEcon, has taught in colleges of business at the graduate and undergraduate levels for 27 years, teaching telecommunications 5 of these years. He has published over 65 research articles. He retired from 20 years' service in the USAF, with positions in operations, command, and staff. For eight years, he was in command, control, communications, and computing assignments.



## Part One. The Basics of Communications

This opening section discusses basic precepts of data communications: digital signals, digital representation of analog signals, circuit sharing, the various media employed, and the utility of architecture, nodes, and standards.

### Chapter 1. Basics of Communications Technology

This chapter explores the basis and underlying technology that make machine-to-machine communication and networking possible, without requiring a technical background. It discusses the basic models that provide an understanding of how voice and data communication work while differentiating between the analog and digital worlds.

### Chapter 2. Media and Their Applications

Channels are paths over which signals travel; media are the physical circuits on which channels reside. This chapter reviews wired and wireless media. Although wired media, in general, have greater bandwidth, the wireless domain is becoming a dominant form because it frees us to be more productive and competitive. Wireless covers the spectrum of radio, microwave, and satellite; GPS and infrared (IR); IEEE 802.11 and Bluetooth; fixed, movable, and moving.

### Chapter 3. Architecture, Models, and Standards

This chapter provides an important foundation for the provision of the systems that make both voice and data communications possible and coherent within an organization. Models show the separate systems' functional parts so that the resulting layers enable standards to be applied within the particular layer without impacting the other layers. Understanding these models and their interrelationship allows the reader to follow processes that occur within and across them.

## Part Two. Network Basics

Networks are classified by topology, protocol, forms of connectivity, reach, and the equipment components that make them work. While most of the network basics refer to wired networks, wireless technology is introduced.

### Chapter 4. Building a Network: Topology and Protocols

This chapter describes how networks are physically constructed, physically joined, and electronically connected. There are several equipment technologies that need to be understood while providing a vital resource for the organization.

### Chapter 5. Network Form and Function

This chapter describes the reach of networks, for example, how they extend from the local organization to the world. If these networks are to achieve the desired attributes of reliability, accessibility, performance, and security, they must have adequate error detection and electrical power. Synchronous and asynchronous communications are covered.

## Part Three. Wide Area Networks: The Internet

Wide area networks extend the reach of the organization from near to far. The Internet is the ultimate network and often connects and extends the organizational private networks.

### Chapter 6. From LANs to WANs: Broadband Technology

This chapter discusses higher bandwidth networks more in depth, moving from LANs to WANs, and the related issues, such as packet switching and other techniques for improving



bandwidth use. It examines larger, geographically dispersed, and more complex networks, networks of greater and greater bandwidth.

## **Chapter 7. The Internet, Intranets, and Extranets**

The Internet has evolved to be a major factor in the way people, businesses, and governments communicate. This chapter discusses Internet components and WWW technology so that future evolution may be comprehended adequately. Internal Internet, that is, intranets, and their extension, that is, extranets, complete the global reach of organizations and their partners. This chapter focuses on the technology of the Internet, the next chapter on its applications.

## **Chapter 8. Internet Applications**

The examination of the Internet, intranets, and extranets continues, focusing on how this technology is used in applications. The concepts of e-business, e-commerce, and common applications are explored, along with some issues of Internet usage.

## **Part Four. Wireless Networks**

This section addresses the basic technologies of the wireless (radiated) domain along with management and usage issues. The concerns of security are addressed in the next section.

## **Chapter 9. Wireless Networks: The Basics**

Wireless capabilities provide channels without need for right-of-way permissions and often give the user untethered mobility. This chapter discusses technologies of fixed, portable, and nomadic forms of wireless networks. Wireless communications is rapidly becoming the technology of choice.

## **Chapter 10. Wireless Networks: Issues and Management**

Wireless network management issues of interference and range, regulation, points of failure, total costs of ownership, maintenance, and support are discussed in this chapter. There should be an implementation plan that seeks logical integration with the organization's wired architecture.

## **Part Five. Security**

Security is the denial of unauthorized access (intrusion) and the protection of assets. Wired networks are inherently more secure than wireless as physical attachment is required for direct access. However, people and organizations must be able to provide a reasonable level of security for their facilities, systems, networks, and data no matter the connection. This section focuses on the idea that security is a combination of prevention, detection, and correction for any network system.

## **Chapter 11. Network Security**

In this chapter, overall security is the focus; concerns for wireless security are explored in the next chapter. Diverse threats and responses as well as prevention measures required to protect networks and their data are discussed. Security is the front line in the environment of information warfare.

## **Chapter 12. Wireless Network Security**

The special security issues and threats to wireless networks are the focus in this chapter. Wireless systems provide enhanced services to organizations but mean different media and very different modes of attack must be addressed.



## Part Six. Network Management and Control

The control and administration of data communications include the management concerns as well as the technology itself. Failing to consider the areas of monitoring performance, security, and new projects places the organization in jeopardy.

### Chapter 13. Monitoring and Control of Network Activity

This chapter addresses the management and technical aspects of control of the networks. Two primary objectives of network management are to (1) satisfy systems users and (2) provide cost-effective solutions to an organization's telecommunications requirements. Active management of all the network resources is required if the telecommunications infrastructure is to support the organization's purposes.

### Chapter 14. Network and Project Management

This chapter provides an outline of telecommunications systems analysis and design methodology to assist in developing, implementing, and operating data networks. The systems development life cycle (SDLC) approach is implemented.

### Appendix A. Analog Voice Capabilities

The plain old telephone systems (POTS) may seem like ancient history, but it connects most homes and offices in the industrial world, providing a channel for low-speed data communications as well as vital voice communications. This chapter is provided as a review of its capabilities.

### Appendix B. Epilogue: Emerging Technologies, Innovation, and Risks

This chapter presents three ideas, as a way to end the book: (1) What are the forces that support or constrain the adoption of technology, in general, and data communications, in particular? (2) What are some of the application trends in this field? (3) What should we learn from *Hurricane Katrina*?

## DISTINGUISHING FEATURES AND BENEFITS

Our book provides students and managers the following features and benefits:

- Data communications is a business resource and is at the heart of any organization's future.
  - Most business functions depend on data communications.
  - All organizational activities depend on security.
  - The management of telecommunications is a part of business strategy.
  - Telecommunications, properly utilized, can give a competitive advantage.
  - Telecommunications, like MIS, is vital to the conduct of business.
  - Telecommunications allows decentralization of the decision process.
  - Coverage is provided on management of telecommunications projects.
- Data communications means wired and wireless communications.
  - Wired and wireless communications offer different advantages.
  - Wired and wireless communications have different security concerns.
- Network security is a portion of risk assessment and disaster planning and recovery. Network security is like a three-legged stool:
  - It is composed of the *design of the data communications systems*,
  - The *technology* implemented to secure that system, and
  - The *management controls* put in place to ensure that policy is carried out.



## Implication

Adding data communications increases both costs and risks but not adding them has even greater risk.

The content of this book provides the basis for understanding the vitally important topic of data communications. As a way to aid the reader, several techniques are used. First, the OSI seven-layer model is presented in the Introduction and each chapter is related to that model or its heir-apparent, the TCP/IP five-layer model; *Clarification* boxes are included on pages to ensure that the text is clear; *Implication* boxes indicate organizational implications and considerations; *margin notes* show emphasis (but not duplication). Included at the end of each chapter are *discussion questions* that relate to the chapter material, *projects* that extend the material and include an *Internet project*, *recommended readings*, and *management and technology critical thinking* questions for graduate students and managers.

Since data communications (network administration) is now security administration, this text supplements the underpinning for the technology of data communications with two chapters on security, wired and wireless. It is vital to the health of the organization that students and managers understand the technology of data communications and the importance of incorporating security in design and usage. *Network security is like a three-legged stool*; it is composed of the design of the data communications system, the technology implemented to secure that system, and the management controls put in place to ensure that policy is carried out. This text leads the students and managers on the path toward a real understanding of this environment.

## Caveat

The field of data communications is dynamic and rapidly changing. It is doubtful if any one single entity has all the knowledge. In creating this document, the authors relied on sources from the Internet to ensure consistent knowledge. Specifically, the following sources were used and referenced at many times:

- <http://www.webopedia.com>
- <http://whatis.techtarget.com/>
- <http://searchsecurity.techtarget.com>
- [http://en.wikipedia.org/wiki/Main\\_Page](http://en.wikipedia.org/wiki/Main_Page)

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