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网络基础（第 3 版）

（影印版）

MCSE Training Kit Networking Essentials Plus

Third Edition

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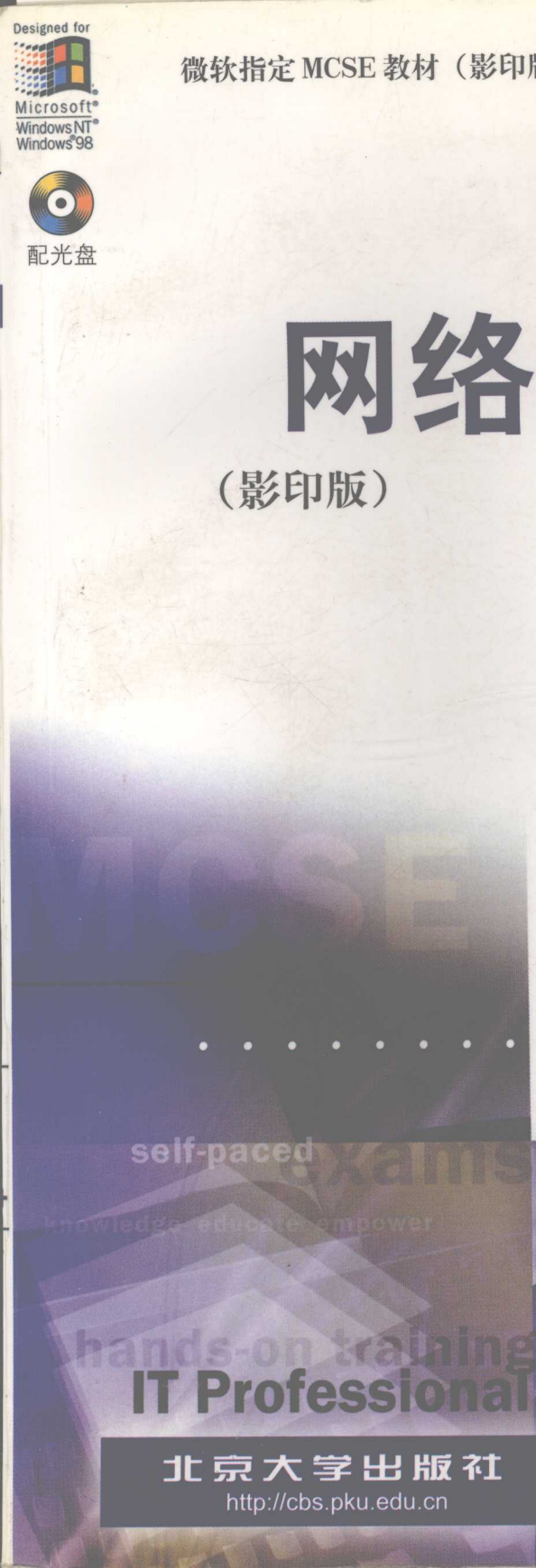

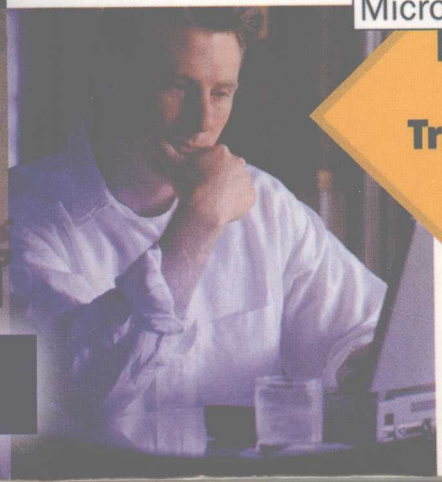

Microsoft Certified Professional

MCSE Training for Exam 70-058

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内 容 简 介

本书是《微软指定 MCSE 教材（影印版）》丛书之一，面向 MCP 70-058 和 CompTIA Network+认证考试，讲述网络支持基本技能，内容包括概念及术语、物理网络设计、网络操作系统的选择、传输媒体的选择、网络协议、网络资源管理、安全性、系统升级、性能监视、故障排除等。

本书由 Microsoft 公司组织专家编写，具有极高的技术权威性和参考价值，适合作为中、高级系统管理人员的技术参考书和 MCSE 考试的专用教材

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出 版 前 言

如果用一个成语来概括国内计算机图书市场的现状，当谓之“汗牛充栋”。然而，如果您是一位从事计算机应用系统开发或管理的中、高级专业人士，很可能发现这貌似种类齐全的计算机图书中，为您量身定做的并不多见。

依据多年从事计算机图书工作所积累的经验，以及与 IT 领域广泛而深入的接触所获取的信息，我们认识到，具有相当的专业深度和技术前沿性的图书，是计算机专业人员的迫切需要，当然，也是我们从事计算机图书工作、服务专业领域的一大着眼点。

基于这一点，2000 年元月，我们与微软出版社(Microsoft Press)达成合作协议，成立微软图书影印中心，独家代理微软出版社图书影印版在中国大陆的出版、发行，为 IT 业界提供及时的专业技术服务。选题和策划上的匠心独运，使得我们的影印书成为计算机图书中的标新立异者。这里，有四大特色值得读者朋友予以关注：

首先，这是微软出版社第一次授权在中国大陆影印、发行它的版权书。在选题上，可以说独辟蹊径。在内容上，立足技术广度和深度，系统推介微软产品。所有这些，都是目前国内一般计算机图书所无法比拟的。

其次，我们的理念是为国内计算机专业人员学习前沿性的微软技术提供服务。为此，我们不但与微软公司紧密协作与沟通，及时掌握微软最新技术动向，而且组织了精干的工作人员，倾力于微软影印书的出版和发行。

再者，微软影印书主要面向中、高级专业人员，印量有限。这类书的读者对象有较强的针对性，一般来说，包括 IT 决策人员，中、高级开发人员，以及中、高级系统管理人员。因而，我们将每套书的印数控制在 1000~2000 册之间。

最后，微软图书影印版几乎与原版书保持同步发行，最大限度地满足了国内读者跟踪微软最新技术的需求。软件升级越来越快，新软件令人目不暇接。作为技术载体之一的图书，只有迅速作出反应，把新软件介绍给读者，才能赢得他们的青睐。总之，兵贵神速，这是我们的目标。

正应验了前人的预言，21 世纪是一个信息时代。软件作为信息系统的神经，在我们生活的这个时代里发挥着举足轻重的作用，而微软公司和它推出的各种软件，更是令世人为之瞩目。我们将立足图书，继续并扩大与微软公司的合作，在中国信息产业的发展道路上留下自己的足迹。

出版者

2000 年 10 月

About This Book

Welcome to the MCSE Training Kit *Networking Essentials Plus, Third Edition.* This training kit will guide you through the fundamentals of current networking technology. As an interactive self-study kit, this book is designed to meet three primary goals:

1. To serve as a general introduction to the full range of computer networking, from local-area network to wide-area network technology.
2. To prepare Microsoft Certified Professional (MCP) program candidates to successfully complete the MCSE *Networking Essentials* examination.
3. To prepare CompTIA certification candidates to successfully complete the CompTIA *Network+* examination.

Note For more information on how to become a Microsoft Certified Systems Engineer (MCSE), refer to the section titled "The Microsoft Certified Professional Program" later in this chapter. For more information on the CompTIA *Network+* certification program, see the section entitled "The *Network+* Certification Program" later in this chapter.

Intended Audience

This book was developed for information system (IS) professionals who need to design, plan, implement, and support computer networks or who plan to take the related Microsoft Certified Professional exam 70-058, *Networking Essentials,* or the CompTIA *Network+* exam. The book is intended to reach a broad audience, encompassing readers who are relatively new to networking as well as more experienced computer professionals. For tips on how to customize the course to meet your needs, see the section "Finding the Best Starting Point for You" later in this chapter.

Prerequisites

Readers need not have completed any computer courses prior to working through this self-paced training kit. Anyone who wishes to do so is eligible to take the *Networking Essentials* and *Network+* exams. The *Network+* exam is targeted to computer service technicians with at least 18 to 24 months on-the-job experience, although no specific requirements are set out.

The "Getting Started" section later in this chapter describes the hardware and software you will need in order to complete the exercises and view the demonstration files that are a part of this course. Read through that section carefully before you start the lessons.

About the CD-ROM

The Supplemental Course Material compact disc contains informational aids that can be used throughout this book. These include multimedia presentations and demonstrations designed to supplement some of the key concepts covered here. You should view these presentations when suggested, then use them as review tools while you work through the material. The presentations and demonstrations are stored as .ASF files. If your machine has standard multimedia support, such as Windows Media Player, you can view these demonstrations by double-clicking on them. See the Readme.txt file on the CD for more information about viewing the demonstration videos.

A complete electronic version of this book is also available on the CD. The electronic version features hot links, full search capabilities, and an index. For information about using the electronic book, see the section "About the Electronic Book" later in this introduction, or see the Readme.txt file on the CD.

Features of This Book

- Each chapter opens with a section titled "Before You Begin" that prepares you for completing the chapter.
- At the beginning of each lesson, you will find an estimate of how long it will take to complete that lesson. While actual times will vary with readers, these estimates can give you a general idea of how much time you'll need to set aside for completion of the lesson at hand.
- In each chapter, procedures, exercises, and lesson review questions are included to give you an opportunity to apply the knowledge and skills being presented.
- At the end of each lesson, the "Lesson Summary" section reviews the concepts covered in that lesson. At the end of each chapter, the "Chapter Review" section allows you to test what you have learned in the entire chapter.
- Appendix A, "Questions and Answers," contains each review and exercise question for every chapter, along with corresponding answers.
- The Glossary defines key computer-networking and relevant scientific terms used in the book.

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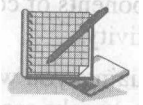
Notes

Notes appear throughout the lessons.

- Notes marked **Tip** contain explanations of possible results or alternative methods.
- Notes marked **Important** contain information that is essential to completing a task.
- Notes marked **Note** contain supplemental information.
- Notes marked **Caution** contain warnings about possible loss of data or other hazards.

Icons

Icons represent specific sections in the book as follows:

Icon	Represents
	A multimedia presentation. You will find the applicable multimedia presentation on the Supplemental Course Material compact disc.
	A hands-on exercise. You should perform the exercise to give yourself an opportunity to use the skills being presented in the lesson.
	Lesson Checkup and Chapter Review questions. These questions appear at the end of many lessons and of each chapter, giving you the opportunity to test what you learned in the lessons. You will find the answers to these questions in Appendix A, "Questions and Answers," at the back of the book.

Chapter and Appendix Overview

This self-paced training course combines notes, hands-on procedures, multimedia presentations, and review questions to teach you the essentials of computer networking. The course is designed to be completed in sequence, from beginning to end, but you can also choose a customized track and complete only the sections that interest you. (See the next section, "Finding the Best Starting Point for You," for more information.) If you choose the customized-track option, check the "Before You Begin" section in each chapter before you begin to read it; these sections describe any prerequisite text that readers are expected to have read before beginning the new chapter.

The book is divided into the following parts and chapters:

- The section you are reading, "About This Book," contains a self-paced training overview and introduces the components of this training. Reading this section thoroughly will help you get the most educational value from this self-paced training and plan which lessons you will complete.
- Part I, "Networking Fundamentals," introduces, in seven chapters, the basic concepts and principles that underlie computer networking. It presents an overview of networking terminology, examines different network topologies and architectures, discusses the physical components of computer networks, and reviews the principles of network connectivity.
- Chapter 1, "Introduction to Networking," acquaints you with some of the fundamental concepts upon which computer networks are built. The chapter discusses advantages and effects of networking computers—whether to create a local area network (LAN), such as a corporate intranet, or a wide area network (WAN), such as the Internet. It also gives an overview of how an organization's information needs help to determine its optimal network configuration.
- Chapter 2, "Basic Network Media," looks deeper into how networks are physically assembled and discusses the cables and circuitry that connect one computer to another. The chapter examines the construction, features, and operation of the primary cable types, citing the advantages and disadvantages of each. It explores the different types of network interface cards (NICs)—the components that provide the interface between cables and computers—as well as the various connectors used to attach the cards to the cables, and looks at how their performance affects a network. It also presents an overview of wireless-network technology.
- Chapter 3, "Understanding Network Architecture," explores the three principal access methods used to convey data onto network cables: contention, token passing, and demand priority. This chapter also advances the discussion of network architecture by examining the data itself and how it is put together before it is sent on its way. Last, this chapter examines the most common network architectures (Ethernet, Token Ring, AppleTalk, and ArcNet).

- Chapter 4, "Survey of Network Operating Systems," outlines various network operating systems (NOSs), focusing primarily on Novell and Microsoft network operating systems, but also including AppleTalk, UNIX, and Banyan Vines. The chapter briefly surveys peer-to-peer LANs, including systems running Microsoft Windows for Workgroups, Windows 95 and 98, and IBM's OS/2.
- Chapter 5, "Introducing Network Standards," describes the Open Systems Interconnection (OSI) reference model standards that provide for how data is packaged and transmitted from a sending application through the physical cables to a receiving application. The text goes on to discuss the 802 project, enhancements to the OSI model specific to NICs and cabling, developed by the Institute of Electrical and Electronics Engineers (IEEE). This chapter also looks at device drivers and how they relate to the OSI model.
- Chapter 6, "Defining Network Protocols," discusses the prominent protocols used with networks and defines the relationship of each protocol to the OSI reference model, including Transmission Control Protocol/Internet Protocol (TCP/IP), an industry-standard suite of protocols that provide communications in a heterogeneous environment. This chapter also explores the protocols used by Novell NetWare, as well as several of the lesser, yet most commonly used, protocols and how they relate to the OSI model.
- Chapter 7, "Elements of Network Connectivity," explores the devices and technologies available to expand networks beyond the scope of LANs. The discussion begins with modems, moves on to repeaters, bridges, routers, brouters, and gateways, and concludes with a look at remote-access computing.
- Part II, "Implementing a Network," chapters 8–13, shifts the focus from general networking principles to implementation. Integrating elements from Part I, the emphasis now is on the nuts and bolts of designing and rolling out a complete network: choosing a network type (peer-to-peer or server-based), selecting hardware and software for installation, and choosing and establishing security through setting up shares and accounts. Part II examines environmental impacts on networks, as well as how to administer, upgrade, and relocate networks, and concludes with tips for troubleshooting problems and where to find helpful resources.
- Chapter 8, "Designing and Installing a Network," expands the reader's knowledge of networking hardware. How to take a detailed inventory of network hardware and software is described. By creating a simple networking plan for a fictitious company and exploring how to install and configure networking hardware for it, readers have the opportunity to design a network. The chapter concludes by taking a look at some related hardware-compatibility issues.

- Chapter 9, "Establishing Network Shares and Accounts," describes the process of establishing sharing on a peer-to-peer network, including how to make directories or printers available to other network users. For server-based networks, readers are shown how accounts are used to establish who can access which files, directories, and printers. This chapter explores the differences between shares and accounts and demonstrates how to use each appropriately.
- Chapter 10, "Ensuring Network Security," revisits some of the ways to enable sharing on a network that were covered in Chapter 9. Here, the focus shifts away from sharing procedures; instead, the chapter discusses sharing from the perspective of how to establish and maintain network and data security. Security is more than preventing unauthorized access to computers and their data; it includes maintaining the proper physical environment to permit the network to function effectively. Special attention is paid to preventive maintenance and how to take steps to prevent data loss and minimize network failures, whether from human or other causes, such as natural disasters.
- Chapter 11, "Printing on a Network," covers one of the fundamental reasons for networking: to be able to share printers among workstations. Network printers are expensive and draw extensively on electrical resources; however, a single user is likely to require a printer only intermittently. By sharing the printer among many users, considerable savings in cost and energy are achieved. This chapter covers the devices and management of network printers and takes a look at fax modems.
- Chapter 12, "Administering Change," discusses how to document a running network and how to develop a baseline by carefully recording network performance and components. This baseline can be referred to later when assessing network performance issues. When and how to upgrade network components and confirm that the upgrading was successful are also discussed. The chapter concludes with a look at how to physically relocate a network installation.
- Chapter 13, "Troubleshooting a Network," surveys the process of troubleshooting a network. It begins by exploring how to get to the bottom of network problems, then looks at the various hardware and software tools that can help in troubleshooting. A point usually comes when outside expertise is needed. What resources are available, what they can do, and how to access them round out this chapter.
- Appendix A, "Questions and Answers," lists each lesson-checkup question, review question, and exercise sequentially for every chapter, referencing the page number where the question appears in the text. In Appendix A, suggested answers are also provided for each question and exercise.
- Appendix B, "Common Network Standards and Specifications," contains a summary of standards, specifications, and a description of standard-setting organizations that preside over aspects of computer networking.
- The Glossary includes definitions of key networking and relevant scientific terms used in the book.

Finding the Best Starting Point for You

Because this book has been designed to be self-paced, you can skip some lessons and revisit them later. Use the following table to determine the best starting point for you:

If...	Follow this learning path
You are preparing to take the Microsoft Certified Professional exam 70-058, *Networking Essentials*...	Read the "Getting Started" section of this chapter. Be sure to focus on the exam objectives as presented in the "Networking Essentials" portion of the "Where to Find Specific Skills in This Book" section. Work through the remaining chapters in any order you prefer.
You are preparing to take the *Network+* exam...	Read the "Getting Started" section of this chapter. Be sure to focus on the exam objectives as presented in the "*Network+*" portion of the "Where to Find Specific Skills in This Book" section. Work through the remaining chapters in any order you prefer.
You'd like to review information about specific topics for either of the exams...	Use the "Where to Find Specific Skills in This Book" section that follows this table.

Where to Find Specific Skills in This Book

The following tables provide a list of the skills measured on the Microsoft certification exam 70-058, *Networking Essentials,* and on the CompTIA *Network+* certification exam. The tables describe each skill and where in this book you will find the lesson relating to that skill.

Note Microsoft Certified Professional exam skills are subject to change without prior notice and at the sole discretion of Microsoft. CompTIA *Network+* exam skills are subject to change without prior notice and at the sole discretion of CompTIA.

Networking Essentials

Standards and Terminology

Skill Being Measured	Location in Book
Define common networking terms for LANs and WANs.	Chapter 1, Lesson 1; Chapter 2, Lesson 1
Compare a file and print server with an application server.	Chapter 1, Lesson 2; Chapter 4, Lesson 1; Chapter 6, Lesson 3
Compare user-level security with access permissions assigned to a shared directory on a server.	Chapter 9, Lesson 1; Chapter 10, Lesson 1
Compare a server-based network to a peer-to-peer network.	Chapter 1, Lesson 2; Chapter 8, Lesson 1; Chapter 9, Lesson 1
Compare connection-based communications with connectionless communications.	Chapter 2, Lesson 3; Chapter 7, Lesson 2
Distinguish whether SLIP or PPP is used as the communications protocol for various situations.	Chapter 7, Lesson 2
Define the communication devices that communicate at each level of the OSI reference model.	Chapter 5, all lessons; Chapter 6, Lesson 2
Describe the characteristics and purpose of the media used in IEEE 802.3 and IEEE 802.5 standards.	Chapter 3, Lesson 1; Chapter 6, Lesson 3; Chapter 7, Lesson 1
Explain the purposes of NDIS and Novell ODI network standards.	Chapter 5, Lesson 3

Planning

Skill Being Measured	Location in Book
Select the appropriate media (including twisted-pair cable, coaxial cable, fiber-optic cable, wireless technology) considering various situational elements including cost, distance limitations, and number of nodes.	Chapter 2, Lesson 1; Chapter 12, Lesson 2
Define the limitations of media.	Chapter 2, Lesson 1
Select the appropriate topology for various token-ring and Ethernet networks.	Chapter 2, Lesson 1; Chapter 3, Lessons 3 and 4; Chapter 7, Lesson 2
Understand network and transport protocols.	Chapter 6, all lessons
Describe connectivity for Token Ring and Ethernet (repeaters, bridges, routers, and so on).	Chapter 3, Lessons 3 and 4; Chapter 7, Lessons 1 and 2
Define characteristics of WAN connections (X.25, ISDN, frame relay, and ATM).	Chapter 7, Lesson 2

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Implementation

Skill Being Measured	Location in Book
Create an administrative plan for performance, accounts, and security.	Chapter 9, Lessons 1 and 2; Chapter 10, Lesson 1
Design a disaster recovery plan.	Chapter 10, Lesson 3
Install and configure network hardware.	Chapter 8, Lessons 3 and 4; Chapter 12, Lesson 2
Implement NetBIOS.	Chapter 6, Lesson 4
Describe hardware and software monitoring tools.	Chapter 12, Lesson 1; Chapter 13, Lesson 2

Troubleshooting

Skill Being Measured	Location in Book
Identify common errors associated with communication components.	Chapter 13, Lesson 1
Diagnose and resolve connectivity problems with cards, cables, and related hardware.	Chapter 12, Lesson 2; Chapter 13, all lessons
Resolve broadcast storms.	Chapter 7, Lesson 1
Identify and resolve network performance problems.	Chapter 12, Lesson 2; Chapter 13, all lessons

Network+

The *Network+* exam objectives are divided into two broad categories: Knowledge of Networking Technology and Knowledge of Networking Practices.

Knowledge of Networking Technology

Basic Knowledge

Skill Being Measured	Location in Book
Understand network structure.	Chapter 1, Lesson 3; Chapter 2, Lesson 1
Describe network operating systems, clients, and directory services.	Chapter 1, Lesson 2; Chapter 3, Lesson 3; Chapter 4, Lessons 1, 2, 3, and 4; Chapter 8, Lesson 1
Define IPX, IP, and Net BEUI.	Chapter 5, Lesson 1; Chapter 6, Lessons 1 and 4; Chapter 7, Lesson 2;
Describe fault tolerance and its implementation methods.	Chapter 10, Lesson 3
Describe the OSI reference model and identify the protocols, services, and functions that relate to each layer.	Chapter 5, all lessons
Recognize and describe types and characteristics of network media (coaxial, fiber-optic, UTP, STP, 10BaseT, 100Base, VGAnyLan, RJ24, BNC, and so on).	Chapter 2, Lesson 1; Chapter 3, Lesson 3; Chapter 8, Lesson 1
Describe the basic attributes, purposes, and functions of such network elements as:	
Full and half duplexing.	Chapter 2, Lesson 1
WANs and LANs.	Chapter 1, Lesson 1
Servers, workstations, and hosts.	Chapter 2, Lesson 2
Server-based and peer-to-peer networking.	Chapter 1, Lesson 2; Chapter 8, Lesson 1
Cabling, NICs, and routers.	Chapter 2, Lessons 1 and 2
Broadband and baseband transmission.	Chapter 2, Lesson 1
Use of gateways as default IP routers and the means by which to connect dissimilar systems or protocols.	Chapter 4, Lessons 2 and 5; Chapter 7, Lesson 1

Physical Layer

Skill Being Measured	Location in Book
Configure and troubleshoot network interface cards.	Chapter 2, Lesson 2; Chapter 12, Lesson 2; Chapter 13, Lesson 1
Describe and differentiate the following network components:	
Hubs.	Chapter 1, Lesson 3; Chapter 2, Lesson 1
MAUs.	Chapter 3, Lessons 1 and 4
Transceivers.	Chapter 2, Lesson 2
Repeaters.	Chapter 1, Lesson 3; Chapter 7, Lesson 1

Data-Link Layer

Skill Being Measured	Location in Book
Define bridges and why they are used.	Chapter 2, Lesson 3; Chapter 3, Lesson 3; Chapter 5, Lesson 1; Chapter 7, Lesson 1; Chapter 8, Lesson 3
Explain the IEEE Project 802 specifications, including 802.2, 802.3, and 802.5.	Chapter 5, Lesson 2
Describe the function and characteristics of MAC addresses.	Chapter 5, Lesson 2

Network Layer

Skill Being Measured	Location in Book
Define the following routing and network-layer concepts:	
Routing, including the difference between static and dynamic routing.	Chapter 7, Lesson 1
The difference between a router and a brouter.	Chapter 7, Lesson 1
The difference between routable and nonroutable protocols	Chapter 6, Lesson 4
Default gateways and subnetworks.	Chapter 6, Lesson 2
The reason for employing unique network IDs.	Chapter 2, Lesson 2; Chapter 13, Lesson 3

Transport Layer

Skill Being Measured	Location in Book
Describe the purpose of name resolution.	Chapter 5, Lessons 1 and 3; Chapter 6, Lesson 1
Describe the difference between connection and connectionless transport.	Chapter 2, Lesson 3; Chapter 7, Lesson 2

TCP/IP Fundamentals

Skill Being Measured	Location in Book
Demonstrate knowledge of the following TCP/IP fundamentals:	
IP default gateways.	Chapter 6, Lesson 2
DHCP, DNS, WINS, and host files.	Chapter 13, Lesson 3
Main TCP/IP protocols, including TCP, UDP, POP3, SMTP, SNMP, FTP, HTTP, and IP.	Chapter 6, Lesson 2
Broad acceptance of TCP/IP by operating systems and hosts worldwide.	Chapter 6, Lesson 2
Internet domain-name server hierarchies.	Chapter 13, Lesson 3
TCP/IP addressing, including the A, B, and C classes of IP addresses and the use of port numbers (HTTP, FTP, SMTP) and the port numbers commonly assigned to a given service.	Chapter 5, Lesson 2; Chapter 6, Lesson 1
TCP/IP configuration concepts, including IP proxy and the identity of the normal configuration parameters for a workstation, including IP address, DNS, IP proxy configuration, WINS, DHCP, host name, and Internet domain name.	Chapter 10, Lesson 1; Chapter 13, Lesson 3

TCP/IP Utilities

Skill Being Measured	Location in Book
Explain how and when to use each of the following TCP/IP utilities to test, validate, and troubleshoot IP connectivity:	
ARP	Chapter 6, Lesson 2
Telnet	Chapter 6, Lesson 1; Chapter 13, Lesson 3
NBSTAT	Chapter 12, Lesson 1
Tracert	Chapter 12, Lesson 1
NETSTAT	Chapter 12, Lesson 1
Ipconfig/winipcfg	Chapter 6, Lesson 4
FTP	Chapter 13, Lesson 3
Ping	Chapter 12, Lesson 1

Remote Connectivity

Skill Being Measured	Location in Book
Describe PPP and SLIP.	Chapter 7, Lesson 2
Describe PPTP.	Chapter 7, Lesson 2
Explain the attributes, advantages, and disadvantages of ISDN and PSTN (POTS).	Chapter 7, Lesson 2; Chapter 13, Lesson 3
Describe modem configurations, including serial port IRQ, I/O address, and maximum port speed.	Chapter 7, Lesson 1; Chapter 11, Lesson 3
Specify the requirements for a remote connection.	Chapter 7, Lesson 2

Security

Skill Being Measured	Location in Book
Describe issues to consider when selecting a security model, including user and share level.	Chapter 9, Lessons 1 and 2; Chapter 10, Lesson 1
Describe standard password practices and procedures.	Chapter 10, Lesson 1
Explain the need to employ data encryption to protect network data.	Chapter 10, Lesson 1
Explain the purpose of a firewall.	Chapter 10, Lesson 1

Knowledge of Networking Practices

Implementing and Installing the Network

Skill Being Measured	Location in Book
Describe accounts and their role in a network.	Chapter 9, Lessons 1 and 2; Chapter 10, Lesson 1
Demonstrate awareness that administrative and test accounts, passwords, IP addresses, IP configurations, relevant SOPs, and so on must be obtained prior to network implementation.	Chapter 9, Lesson 2; Chapter 10, Lesson 1
Evaluate environmental factors that affect networks.	Chapter 10, Lesson 2
Recognize common peripheral ports and external SCSI devices (especially DB-25 connectors).	Chapter 2, Lesson 2
Identify common network components, including:	
Print servers.	Chapter 1, Lesson 2; Chapter 11, Lesson 1
Peripherals.	Chapter 1, Lessons 1 and 2; Chapter 4, Lesson 1
Hubs.	Chapter 1, Lesson 3
Routers.	Chapter 1, Lesson 3
Brouters.	Chapter 1, Lesson 3
Bridges.	Chapter 1, Lesson 3
Patch panels.	Chapter 2, Lesson 1; Chapter 3, Lesson 1; Chapter 8, Lesson 1
UPSs.	Chapter 10, Lesson 3
NICs.	Chapter 2, Lesson 2
Token Ring media filters.	Chapter 3, Lesson 4
Demonstrate awareness of such compatibility and cabling issues as trying to install an analog modem in a digital jack, variations in the use of RJ-45 connectors depending on cabling, and implications of using patch cables.	Chapter 2, Lesson 2; Chapter 3, Lesson 1; Chapter 8, Lessons 3 and 4; Chapter 13, Lessons 1 and 2

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