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NTENTS AT A GLANCE

ONTENTS

INTRODUCTION

Welcome to *Network+ Certification*. Through lectures, discussions, demonstrations, textbook exercises, and classroom labs, this course teaches you the skills and knowledge necessary to work as an entry-level administrator of a computer network. The 12 chapters in this book walk you through key concepts of networking theory and practice, including a study of protocols, operating systems, and troubleshooting.

TARGET AUDIENCE

This textbook was developed for beginning information technology (IT) students who want to learn to support and troubleshoot local area networks (LANs) and wide area networks (WANs) consisting of computers running Microsoft Windows and other operating systems. The target audience will provide direct, front-line user support, either at a help desk or call center, or they will use their knowledge to work in their own network support businesses.

PREREQUISITES

This textbook requires students to meet the following prerequisites:

- A working knowledge of the desktop PC running Microsoft Windows XP or Windows Server 2003
- Prerequisite knowledge and coursework as defined by the learning institution and the instructor

THE TEXTBOOK

The textbook content has been crafted to provide a meaningful learning experience to students in an academic classroom setting. Key features of the Microsoft Official Academic Course textbooks include the following:

- Learning objectives for each chapter that prepare the student for the topic areas covered in that chapter.

- Chapter introductions that explain why the information is important.
- An inviting design with screen shots, diagrams, tables, bulleted lists, and other graphical formats that makes the book easy to comprehend and supports a number of learning styles.
- Clear explanations of concepts and principles and frequent exposition of step-by-step procedures.
- A variety of reader aids that highlight a wealth of additional information, including:
  - **NOTE** Real-world application tips and alternative procedures and explanations of complex procedures and concepts
  - **CAUTION** Warnings about mistakes that can result in loss of data or are difficult to resolve
  - **IMPORTANT** Explanations of essential setup steps before a procedure and other critical instructions
  - **MORE INFO** Additional resources for students
- End-of-chapter review questions that assess knowledge and can serve as homework, quizzes, and review activities before or after lectures. (Answers to the textbook questions are available from the instructor.)
- Chapter summaries that distill the main ideas in a chapter and reinforce learning.
- Case scenarios, approximately two per chapter, that provide students with an opportunity to evaluate, analyze, synthesize, and apply information learned in the chapter.
- A comprehensive glossary that defines key terms introduced in the book.

SUPPLEMENTAL MATERIALS ON STUDENT CD

This book comes with a Student CD that contains supplemental materials, a variety of informational and learning aids that complement the textbook content.

- An electronic version of this textbook (eBook). For information about using the eBook, see the section "eBook Instructions" later in this introduction.
- An eBook of the *Microsoft Encyclopedia of Networking, Second Edition*.
- Microsoft PowerPoint slides based on textbook chapters, to assist with note-taking.
- Microsoft Word Viewer and Microsoft PowerPoint Viewer.

A second CD contains a 180-day evaluation edition of Windows Server 2003 Enterprise Edition.

The 180-day evaluation edition of Windows Server 2003 Enterprise Edition provided with this book is not the full retail product; it is provided only for the purposes of training and evaluation. Microsoft Technical Support does not support evaluation editions.

eBook Instructions

The eBook is in Portable Document Format (PDF) and must be viewed using Adobe Acrobat Reader.

1. Insert the Supplemental Course Materials Student CD into your CD-ROM drive.

   If AutoRun is disabled on your machine, refer to the Readme.txt file on the CD.

2. On the user interface menu, select Textbook eBook and follow the prompts. You also can review any of the other eBooks provided for your use.

   You must have the Student CD in your CD-ROM drive to run the eBook.

THE LAB MANUAL

The lab manual is designed for use in either a combined or separate lecture and lab. The exercises in the lab manual correspond to the textbook chapters and are for use in a classroom setting supervised by an instructor.

The lab manual presents a rich, hands-on learning experience that encourages practical solutions and strengthens critical problem-solving skills:

- Lab Exercises teach procedures by using a step-by-step format. Questions interspersed throughout Lab Exercises encourage reflection and critical thinking about the lab activity.
- Lab Review Questions appear at the end of each lab and ask questions about the lab. They are designed to promote critical reflection.
- Lab Challenges are review activities that ask students to perform a variation on a task they performed in the Lab Exercises but to do so without detailed instructions.

- Troubleshooting Labs, which appear after a number of regular labs and consist of mid-length review projects, are based on true-to-life scenarios. These labs challenge students to "think like an expert" to solve complex problems.
- Labs are based on realistic business settings and include an opening scenario and a list of learning objectives.

Students who successfully complete the Lab Exercises, Lab Review Questions, Lab Challenges, and Troubleshooting Labs in the lab manual will have a richer learning experience and deeper understanding of the concepts and methods covered in the course. They will be better able to answer and understand the test-bank questions, especially the knowledge application and knowledge synthesis questions. They will also be much better prepared to pass the associated certification exams if they choose to take them.

COVERAGE OF EXAM OBJECTIVES

This book is the foundation of a course that is structured around concepts and practical knowledge fundamental to this topic area. In doing so, it also addresses the tasks that are covered in the objectives for the CompTIA Network+ exam. The following table correlates the exam objectives with the textbook chapters and lab manual lab exercises. Students might find this table useful if they decide to take the certification exam.

> **NOTE** The Microsoft Learning Web site, *microsoft.com/learning/*, describes the various MCP certification exams and their corresponding courses. It provides up-to-date certification information and explains the certification process and the course options for MCP, as well as specific certifications offered by Microsoft.

Textbook and Lab Manual Coverage of Exam Objectives for CompTIA Network+

Objective	Textbook Chapter	Lab Manual Content
DOMAIN 1.0: Media and Topologies		
1.1 Recognize the following logical or physical network topologies given a schematic diagram or description: ■ Star ■ Bus ■ Mesh ■ Ring	Chapter 2	

Textbook and Lab Manual Coverage of Exam Objectives for CompTIA Network+

Objective	Textbook Chapter	Lab Manual Content
1.2 Specify the main features of 802.2 (Logical Link Control), 802.3 (Ethernet), 802.5 (Token Ring), 802.11 (wireless), and FDDI (Fiber Distributed Data Interface) networking technologies, including: ■ Speed ■ Access method (CSMA/CA [Carrier Sense Multiple Access with Collision Avoidance] and CSMA/CD [Carrier Sense Multiple Access with Collision Detection]) ■ Topology ■ Media	Chapter 4	Lab 4
1.3 Specify the characteristics (for example: speed, length, topology, and cable type) of the following cable standards: ■ 10Base-T and 10Base-FL ■ 100Base-TX and 100Base-FX ■ 1000Base-T, 1000Base-CX, 1000Base-SX, and 1000Base-LX ■ 10GBase-SR, 10GBase-LR, and 10GBase-ER	Chapter 4	Lab 4
1.4 Recognize the following media connectors or describe their uses, or both: ■ RJ-11 (Registered Jack) ■ RJ-45 (Registered Jack) ■ F-type ■ ST (straight tip) SC (subscriber connector or standard connector) ■ IEEE 1394 (FireWire) ■ Fiber LC (Local Connector) ■ MT-RJ (Mechanical Transfer Registered Jack) ■ USB (universal serial bus)	Chapter 2	Lab 2, Lab 3

Textbook and Lab Manual Coverage of Exam Objectives for CompTIA Network+

Objective	Textbook Chapter	Lab Manual Content
1.5 Recognize the following media types and describe their uses: ■ Category 3, 5, 5e, and 6 ■ UTP (unshielded twisted pair) ■ STP (shielded twisted pair) ■ Coaxial cable ■ SMF (Single Mode Fiber) optic cable ■ MMF (Multimode Fiber) optic cable	Chapter 2	Lab 2, Lab 3
1.6 Identify the purposes, features, and functions of the following network components: ■ Hubs ■ Switches ■ Bridges ■ Routers ■ Gateways ■ CSU/DSU (Channel Service Unit/ Data Service Unit) ■ NICs (network interface cards) ■ ISDN (Integrated Services Digital Network) adapters ■ WAPs (wireless access points) ■ Modems ■ Transceivers (media converters) ■ Firewalls	Chapter 2, Chapter 3, Chapter 9, Chapter 10	Lab 2, Lab 3
1.7 Specify the general characteristics (for example: carrier speed, frequency, transmission type, and topology) of the following wireless technologies: ■ 802.11 (Frequency hopping spread spectrum) ■ 802.11x (Direct sequence spread spectrum) ■ Infrared ■ Bluetooth	Chapter 4	

Textbook and Lab Manual Coverage of Exam Objectives for CompTIA Network+

Objective	Textbook Chapter	Lab Manual Content
1.8 Identify factors which affect the range and speed of wireless service (for example: interference, antenna type, and environmental factors).	Chapter 4	
DOMAIN 2.0: Protocols and Standards		
2.1 Identify a MAC (Media Access Control) address and its parts.	Chapter 4	Lab 4
2.2 Identify the seven layers of the OSI (Open Systems Interconnect) model and their functions.	Chapter 1	Lab 1
2.3 Identify the OSI layers at which the following network components operate: ■ Hubs ■ Switches ■ Bridges ■ Routers ■ NICs ■ WAPs	Chapter 3	
2.4 Differentiate between the following network protocols in terms of routing, addressing schemes, interoperability, and naming conventions: ■ IPX/SPX (Internetwork Packet Exchange/Sequence Packet Exchange) ■ NetBEUI (Network Basic Input/Output System Extended User Interface) ■ AppleTalk/AppleTalk over IP (Internet Protocol) ■ TCP/IP (Transmission Control Protocol/Internet Protocol)	Chapter 5	Lab 5
2.5 Identify the components and structure of IP addresses (IPv4, IPv6) and the required setting for connections across the Internet.	Chapter 5	Lab 5, Lab 6, Lab 7
2.6 Identify classful IP ranges and their subnet masks (for example: Class A, B, and C).	Chapter 5	Lab 5, Lab 6, Lab 7
2.7 Identify the purpose of subnetting.	Chapter 5, Chapter 7;	Lab 7, Lab 8

Textbook and Lab Manual Coverage of Exam Objectives for CompTIA Network+

Objective	Textbook Chapter	Lab Manual Content
2.8 Identify the differences between public and private network addressing schemes.	Chapter 5	
2.9 Identify and differentiate between the following IP addressing methods: ■ Static ■ Dynamic ■ Self-assigned (APIPA [Automatic Private IP Addressing])	Chapter 5, Chapter 8	Lab 8
2.10 Define the purpose, function and use of the following protocols used in the TCP/IP suite: ■ TCP (Transmission Control Protocol) ■ UDP (User Datagram Protocol) ■ FTP (File Transfer Protocol) ■ SFTP (Secure File Transfer Protocol) ■ TFTP (Trivial File Transfer Protocol) ■ SMTP (Simple Mail Transfer Protocol) ■ HTTP (Hypertext Transfer Protocol) ■ HTTPS (Hypertext Transfer Protocol Secure) ■ POP3/IMAP4 (Post Office Protocol version 3/Internet Message Access Protocol version 4) ■ Telnet ■ SSH (Secure Shell) ■ ICMP (Internet Control Message Protocol) ■ ARP/RARP (Address Resolution Protocol/Reverse Address Resolution Protocol) ■ NTP (Network Time Protocol) ■ NNTP (Network News Transport Protocol) ■ SCP (Secure Copy Protocol) ■ LDAP (Lightweight Directory Access Protocol) ■ IGMP (Internet Group Multicast Protocol) ■ LPR (Line Printer Remote)	Chapter 7	Lab 5, Lab 6, Lab 7, Lab 11

Textbook and Lab Manual Coverage of Exam Objectives for CompTIA Network+

Objective	Textbook Chapter	Lab Manual Content
2.11 Define the function of TCP/UDP (Transmission Control Protocol/User Datagram Protocol) ports.	Chapter 6	Lab 6
2.12 Identify the well-known ports associated with the following commonly used services and protocols: ■ 20 FTP ■ 21 FTP ■ 22 SSH ■ 23 Telnet ■ 25 SMTP ■ 53 DNS (Domain Name Service) ■ 69 TFTP ■ 80 HTTP ■ 110 POP3 ■ 119 NNTP ■ 123 NTP ■ 143 IMAP4 ■ 443 HTTPS	Chapter 6	
2.13 Identify the purpose of network services and protocols (for example: DNS, NAT [Network Address Translation], ICS [Internet Connection Sharing], WINS [Windows Internet Name Service], SNMP [Simple Network Management Protocol], NFS [Network File System], Zeroconf [Zero configuration], SMB [Server Message Block], AFP [Apple File Protocol], LPD [Line Printer Daemon], and Samba).	Chapter 8, Chapter 9	Lab 8, Lab 10

Textbook and Lab Manual Coverage of Exam Objectives for CompTIA Network+

Objective	Textbook Chapter	Lab Manual Content
2.14 Identify the basic characteristics (for example: speed, capacity, and media) of the following WAN technologies: Packet switching Circuit switching ■ ISDN ■ FDDI ■ T1 (T Carrier level 1)/E1/J1 ■ T3 (T Carrier level 3)/E3/J3 ■ OCx ■ X.25	Chapter 10	
2.15 Identify the basic characteristics of the following Internet access technologies: ■ xDSL (Digital Subscriber Line) ■ Broadband Cable (Cable modem) ■ POTS/PSTN (Plain Old Telephone Service/Public Switched Telephone Network) ■ Satellite ■ Wireless	Chapter 10	
2.16 Define the function of the following remote access protocols and services: ■ RAS (Remote Access Service) ■ PPP (Point-to-Point Protocol) ■ SLIP (Serial Line Internet Protocol) ■ PPPoE (Point-to-Point Protocol over Ethernet) ■ PPTP (Point-to-Point Tunneling Protocol) ■ VPN (virtual private network) ■ RDP (Remote Desktop Protocol)	Chapter 10	Lab 10

Textbook and Lab Manual Coverage of Exam Objectives for CompTIA Network+

Objective	Textbook Chapter	Lab Manual Content
2.17 Identify the following security protocols and describe their purpose and function: ■ IPSec (IP security) ■ L2TP (Layer 2 Tunneling Protocol) ■ SSL (Secure Sockets Layer) ■ WEP (Wired Equivalent Privacy) ■ WPA (Wi-Fi Protected Access) ■ 802.1x	Chapter 9	Lab 10
2.18 Identify authentication protocols (for example: CHAP [Challenge Handshake Authentication Protocol], MS-CHAP [Microsoft Challenge Handshake Authentication Protocol], PAP [Password Authentication Protocol], RADIUS [Remote Authentication Dial-In User Service], Kerberos, and EAP [Extensible Authentication Protocol]).	Chapter 10	
DOMAIN 3.0: Network Implementation		
3.1 Identify the basic capabilities (for example: client support, interoperability, authentication, file and print services, application support, and security) of the following server operating systems to access network resources: ■ UNIX/Linux/Mac OS X Server ■ NetWare ■ Windows ■ AppleShare IP	Chapter 8	Lab 8
3.2 Identify the basic capabilities needed for client workstations to connect to and use network resources (for example: media, network protocols, and peer and server services).	Chapter 8	Lab 8
3.3 Identify the appropriate tool for a given wiring task (for example: wire crimper, media tester/certifier, punchdown tool, or tone generator).	Chapter 2, Chapter 11	

Textbook and Lab Manual Coverage of Exam Objectives for CompTIA Network+

Objective	Textbook Chapter	Lab Manual Content
3.4 Given a remote connectivity scenario comprised of a protocol, an authentication scheme, and physical connectivity, configure the connection. Includes connection to the following servers: ■ UNIX/Linux/MAC OS X Server ■ NetWare ■ Windows ■ AppleShare IP	Chapter 10	Lab 10
3.5 Identify the purpose, benefits, and characteristics of using a firewall.	Chapter 9	Lab 9, Lab 10
3.6 Identify the purpose, benefits, and characteristics of using a proxy service.	Chapter 9	Lab 9
3.7 Given a connectivity scenario, determine the impact on network functionality of a particular security implementation (for example: port blocking/filtering, authentication, and encryption).	Chapter 9	Lab 9
3.8 Identify the main characteristics of VLANs (virtual local area networks).	Chapter 3	
3.9 Identify the main characteristics and purpose of extranets and intranets.	Chapter 1	
3.10 Identify the purpose, benefits, and characteristics of using antivirus software.	Chapter 9	
3.11 Identify the purpose and characteristics of fault tolerance: ■ Power ■ Link redundancy ■ Storage ■ Services	Chapter 9	
3.12 Identify the purpose and characteristics of disaster recovery: Backup/restore Offsite storage Hot and cold spares Hot, warm, and cold sites	Chapter 9	Lab 9

Textbook and Lab Manual Coverage of Exam Objectives for CompTIA Network+

Objective	Textbook Chapter	Lab Manual Content
DOMAIN 4.0: Network Support		
4.1 Given a troubleshooting scenario, select the appropriate network utility from among the following: • Tracert/traceroute • Ping • Arp • Netstat • Nbtstat • Ipconfig/ifconfig • Winipcfg • Nslookup/dig	Chapter 11	Lab 11
4.2 Given output from a network diagnostic utility (for example, those utilities listed in objective 4.1), identify the utility and interpret the output.	Chapter 11	Lab 11
4.3 Given a network scenario, interpret visual indicators (for example: link LEDs [light-emitting diodes] and collision LEDs to determine the nature of a stated problem.)	Chapter 11	
4.4 Given a troubleshooting scenario involving a client accessing remote network services, identify the cause of the problem (for example: file services, print services, authentication failure, protocol configuration, physical connectivity, and SOHO [Small Office/Home Office] router).	Chapter 12	Lab 10
4.5 Given a troubleshooting scenario between a client and the following server environments, identify the cause of a stated problem: • UNIX/Linux/Mac OS X Server • NetWare • Windows • AppleShare IP	Chapter 12	

Textbook and Lab Manual Coverage of Exam Objectives for CompTIA Network+

Objective	Textbook Chapter	Lab Manual Content
4.6 Given a scenario, determine the impact of modifying, adding, or removing network services (for example: DHCP [Dynamic Host Configuration Protocol], DNS, and WINS) for network resources and users.	Chapter 8	Lab 8
4.7 Given a troubleshooting scenario involving a network with a particular physical topology (for example: bus, star, mesh, or ring) and including a network diagram, identify the network area affected and the cause of the stated failure.	Chapter 12	Lab 12
4.8 Given a network troubleshooting scenario involving an infrastructure (for example: wired or wireless) problem, identify the cause of a stated problem (for example: bad media, interference, network hardware, or environment).	Chapter 12	Lab 12
4.9 Given a network problem scenario, select an appropriate course of action based on a logical troubleshooting strategy. This strategy can include the following steps: 1. Identify the symptoms and potential causes. 2. Identify the affected area. 3. Establish what has changed. 4. Select the most probable cause. 5. Implement an action plan and solution including potential effects. 6. Test the result. 7. Identify the results and effects of the solution. 8. Document the solution and process.	Chapter 12	Lab 12

MICROSOFT CERTIFIED PROFESSIONAL PROGRAM

The Microsoft Certified Professional (MCP) program is one way to prove your proficiency with current Microsoft products and technologies. These exams and corresponding certifications are developed to validate your mastery of critical competencies as you design and develop, or implement and support, solutions using Microsoft products and technologies. Computer professionals who become

Microsoft certified are recognized as experts and are sought after industry-wide. Certification brings a variety of benefits to the individual and to employers and organizations. For a full list of MCP benefits, go to *microsoft.com/learning/itpro/default.asp*.

Certifications

The MCP program offers multiple certifications, based on specific areas of technical expertise. The certifications offered are as follows:

- **Microsoft Certified Professional (MCP)** In-depth knowledge of at least one Windows operating system or architecturally significant platform. An MCP is qualified to implement a Microsoft product or technology as part of a business solution for an organization.
- **Microsoft Certified Systems Engineer (MCSE)** Qualified to effectively analyze the business requirements for business solutions and design and implement the infrastructure based on the Windows and Windows Server 2003 operating systems.
- **Microsoft Certified Systems Administrator (MCSA)** Qualified to manage and troubleshoot existing network and system environments based on the Windows and Windows Server 2003 operating systems.
- **Microsoft Certified Database Administrator (MCDBA)** Qualified to design, implement, and administer Microsoft SQL Server databases.
- **Microsoft Certified Desktop Support Technician (MCDST)** Qualified to support end users and to troubleshoot desktop environments on the Windows operating system.

MCP Requirements

Requirements differ for each certification and are specific to the products and job functions addressed by the certification. To become an MCP you must pass rigorous certification exams that provide a valid and reliable measure of technical proficiency and expertise. These exams are designed to test your expertise and ability to perform a role or task with a product, and they are developed with the input of industry professionals. Exam questions reflect how Microsoft products are used in actual organizations, giving them real-world relevance. The requirements for each certification are as follows:

- Microsoft Certified Professional (MCP) candidates are required to pass one current Microsoft certification exam. Candidates can pass additional Microsoft certification exams to validate their skills with other Microsoft products, development tools, or desktop applications.

- Microsoft Certified Systems Engineer (MCSE) candidates are required to pass five core exams and two elective exams.
- Microsoft Certified Systems Administrator (MCSA) candidates are required to pass three core exams and one elective exam.
- Microsoft Certified Database Administrator (MCDBA) candidates are required to pass three core exams and one elective exam.
- Microsoft Certified Desktop Support Technician (MCDST) candidates are required to pass two core exams.

ABOUT THE AUTHOR

Craig Zacker is a writer, editor, and networker whose computing experience began in the days of teletypes and paper tape. After making the move from minicomputers to PCs, he worked as an administrator of Novell NetWare networks and as a PC support technician while operating a freelance desktop publishing business. After earning a masters degree in English and American literature from New York University, Craig worked extensively on the integration of Microsoft Windows NT into existing internetworks, supported fleets of Windows workstations, and was employed as a technical writer, content provider, and Webmaster for the online services group of a large software company. Since devoting himself to writing and editing full-time, Craig has written or contributed to many books on networking topics, operating systems, and PC hardware, including *Microsoft Official Academic Course: Implementing and Administering Security in a Microsoft Windows Server 2003 Network (70-299)* and *Windows XP Pro: The Missing Manual*. He has also developed educational texts for college courses and online training courses for the Web and has published articles in top industry publications. For more information on Craig's books and other works, see *zacker.com*.

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