CCENT
Practice and Study Guide

Exercises, Activities, and Scenarios to Prepare for the ICND1 100-101 Certification Exam

Allan Johnson

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CCENT Practice and Study Guide: Exercises, Activities, and Scenarios to Prepare for the ICND1/CCENT Certification Exam

Allan Johnson

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Allan Johnson entered the academic world in 1999 after 10 years as a business owner/operator to dedicate his efforts to his passion for teaching. He holds both an MBA and an M.Ed in occupational training and development. He is an information technology instructor at Del Mar College in Corpus Christi, Texas. In 2003, Allan began to commit much of his time and energy to the CCNA Instructional Support Team, providing services to Networking Academy instructors worldwide and creating training materials. He now works full time for Cisco Networking Academy as a learning systems developer.

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Dedication

For my wife, Becky. Without the sacrifices you made during the project, this work would not have come to fruition. Thank you providing me the comfort and resting place only you can give.

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When I began to think of whom I would like to have as a technical editor for this work, Steve Stiles immediately came to mind. With his instructor and industry background, as well as his excellent work building activities for the new Cisco Networking Academy curriculum, he was an obvious choice. Thankfully, when Mary Beth Ray contacted him, he was willing and able to do the arduous review work necessary to make sure that you get a book that is both technically accurate and unambiguous.

The Cisco Network Academy authors for the online curriculum and series of Companion Guides take the reader deeper, past the CCENT exam topics, with the ultimate goal of not only preparing the student for CCENT certification, but also for more advanced college-level technology courses and degrees, as well. Thank you, especially to Amy Gerrie and her team of authors—Rick Graziani, Wayne Lewis, and Bob Vachon—for their excellent treatment of the material; it is reflected throughout this book.

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This is my fifth project with Christopher Cleveland as development editor. His dedication to perfection pays dividends in countless, unseen ways. Thank you again, Chris, for providing me with much-needed guidance and support. This book could not be a reality without your persistence.

Contents at a Glance

Part I: Introduction to Networks

Chapter 1 Exploring the Network 1

Chapter 2 Configuring a Network Operating System 13

Chapter 3 Network Protocols and Communications 19

Chapter 4 Network Access 29

Chapter 5 Ethernet 41

Chapter 6 Network Layer 53

Chapter 7 Transport Layer 65

Chapter 8 IP Addressing 71

Chapter 9 Subnetting IP Networks 85

Chapter 10 Application Layer 97

Chapter 11 It's a Network 105

Part II: Routing and Switching Essentials

Chapter 12 Introduction to Switched Networks 117

Chapter 13 Basic Switching Concepts and Configuration 125

Chapter 14 VLANs 135

Chapter 15 Routing Concepts 149

Chapter 16 Inter-VLAN Routing 171

Chapter 17 Static Routing 183

Chapter 18 Routing Dynamically 197

Chapter 19 Single-Area OSPF 221

Chapter 20 Access Control Lists 237

Chapter 21 DHCP 255

Chapter 22 Network Address Translation for IPv4 265

Contents

Part I: Introduction to Networks

CHAPTER 1 Exploring the Network 1

Globally Connected 1

Vocabulary Exercise: Matching 2
Completion Exercise 3

LANs, WANs, and the Internet 3

Completion Exercise 3
Classify and Identify Network Components 5
Compare LANs and WANs 6
Vocabulary Exercise: Matching 7

The Network as a Platform 8

Classify Network Architecture Requirements 8

The Changing Network Environment 10

Completion Exercise 10
Network Security Terminology 11

CHAPTER 2 Configuring a Network Operating System 13

IOS Bootcamp 13

Completion Exercise 13
Accessing a Cisco IOS Device 14
Navigating the IOS Matching Exercise 15

Basic Device Configuration 16

Applying a Basic Configuration 16

CHAPTER 3 Network Protocols and Communications 19

Rules of Communication 19

Vocabulary Exercise: Matching 20

Network Protocols and Standards 21

Protocol Definitions: Matching 21
Mapping the Protocols of the TCP/IP Suite 22
Explore the Purpose of Standards Organizations 22
OSI Reference Model Layers: Matching 24
TCP/IP Model Layers: Matching 24
Mapping the Layers of the OSI and TCP/IP Models 25

Moving Data in the Network 26

Data Encapsulation and the PDUs 26
The Role of Addressing in Network Communications 27

CHAPTER 4 Network Access 29

Physical Layer Protocols 29

Completion Exercise 29
Vocabulary Exercise: Matching 31

Network Media 32
Copper Cabling Completion Exercise 32
Compare UTP, STP, and Coaxial Characteristics 32
UTP Cabling Completion Exercise 33
UTP Cable Pinouts 34
Fiber-Optic Cabling Completion Exercise 34
Compare Single-Mode and Multimode Fiber 35
Wireless Media Completion Exercise 36
Data Link Layer Protocols 37
The Sublayers of the Data Link Layer 37
Label the Generic Frame Fields 37
Identify the Data Link Layer Standards Organization 37
Media Access Control 38
Topologies and Access Methods Completion Exercise 38
Label the Ethernet Frame Fields 39
Label the PPP Frame Fields 40
Label the 802.11 Wireless Frame Fields 40

CHAPTER 5 Ethernet 41
Ethernet Protocol 41
Ethernet Operation Completion Exercise 41
Identify the Ethernet Frame Attributes: Matching 42
Comparing Decimal, Binary, and Hexadecimal Digits 43
Address Resolution Protocol 43
Completion Exercise 43
Identify the MAC and IP Addresses 44
LAN Switches 45
Building the MAC Address Table 45
Switching Concepts Completion Exercise 46
Comparing Switch Forwarding Methods 47
Forward the Frame 47
Layer 3 Switching Concepts Completion Exercise 50
Layer 3 Switch Configuration 51

CHAPTER 6 Network Layer 53
Network Layer Protocols 53
The Processes of the Network Layer 53
Characteristics of the IP Protocol 53
Fields of the IPv4 Packet: Matching 55
Fields of the IPv6 Packet: Matching 55
Routing 56
How a Host Routes Packets Completion Exercise 56
Routing Table Entry: Matching 58

Routers 58

Identify Router Components 58

Router Boot Process Exercise 59

Interpreting the show version Command Exercise 60

Configuring a Cisco Router 60

Basic Router Configuration Exercise 60

Applying a Basic Configuration 62

Verifying Basic Router Configuration 63

CHAPTER 7 Transport Layer 65

Transport Layer Protocols 65

Transportation of Data Completion Exercise 65

Introducing TCP and UDP 66

TCP and UDP 66

TCP Communication 67

UDP Communication 69

TCP or UDP, That Is the Question 69

CHAPTER 8 IP Addressing 71

IPv4 Network Addresses 71

IPv4 Address Structure 71

IPv4 Subnet Mask 72

The Last Nonzero Octet 73

ANDing to Determine the Network Address 73

IPv4 Unicast, Broadcast, and Multicast 74

Types of IPv4 Addresses 74

IPv6 Network Addresses 75

Representing IPv6 Addresses 76

Identify IPv6 Address Types 77

IPv6 Unicast Addresses 80

The 3-1-4 Rule 80

Static Configuration of Global Unicast Addressing 81

Dynamic Configuration of Global Unicast Addressing 81

IPv6 Multicast Addresses 82

Connectivity Verification 83

ICMP Message Types 83

Testing the Path 83

CHAPTER 9 Subnetting IP Networks 85

Subnetting an IPv4 Network 85

Subnetting in Four Steps 85

Subnetting Example 85

Determine How Many Bits to Borrow 85

Determine the New Subnet Mask 86

Determine the Subnet Multiplier 86

List the Subnets, Host Ranges, and Broadcast Addresses 87

Subnetting Scenario 1 87
Subnetting Scenario 2 87
Subnetting Scenario 3 88

VLSM Addressing Schemes 88

VLSM Review 89
VLSM Addressing Design Exercises 90
Exercise 1 91
Exercise 2 92
Exercise 3 93
Exercise 4 93

Design Considerations for IPv6 94

Subnetting an IPv6 Network 95
IPv6 Subnetting Practice 95
IPv6 Subnetting Scenario 1 95
IPv6 Subnetting Scenario 2 96
IPv6 Subnetting Scenario 3 96

CHAPTER 10 Application Layer 97

Application Layer Protocols 97

OSI and TCP/IP Model Comparison 97
Application and Presentation Protocols and Standards 98
How Application Protocols Interact with End-User Applications 98

Well-Known Application Layer Protocols and Services 99

Web and Mail Services 99
IP Addressing Services 100
File Sharing Services 102

The Message Heard Around the World 103

CHAPTER 11 It's a Network 105

Create and Grow 105

Devices in a Small Network 105
Protocols in a Small Network 106
Growing to Larger Networks 107

Keeping the Network Safe 107

Network Device Security Measures 107
Vulnerabilities and Network Attacks 108
Mitigating Network Attacks 109
Securing Devices 110

Basic Network Performance 110

Using the ping Command 111
Tracing a Route 111
show Commands 112

Managing IOS Configuration Files 114

Integrated Routing Services 116

Part II: Routing and Switching Essentials

CHAPTER 12 Introduction to Switched Networks 117

LAN Design 117

LAN Design Principles 117

Selecting Switch Hardware 119

The Switched Environment 120

Frame Forwarding Methods and Terminology 120

Building the MAC Address Table 120

Collision and Broadcast Domains 122

CHAPTER 13 Basic Switching Concepts and Configuration 125

Basic Switch Configuration 125

Switch Boot Sequence 125

Half-Duplex, Full-Duplex, and Auto-MDIX 125

Configure a Switch with Initial Settings 126

Basic Configuration Tasks 127

Applying a Basic Configuration 127

Verifying Basic Switch Configuration 129

Switch Security: Management and Implementation 129

Configuring SSH 129

Common Security Attacks 131

Configuring Port Security 132

Configuring NTP 134

NTP Commands 134

CHAPTER 14 VLANs 135

VLAN Segmentation 135

Overview of VLANs 135

VLANs in a Multiswitched Environment 136

VLAN Implementations 137

VLAN Configuration Exercise 137

Practice VLAN Configuration 141

VLAN Trunk Configuration Exercise 141

Practice Trunk Configuration 142

Dynamic Trunking Protocol 143

Troubleshoot VLANs and Trunks 144

VLAN Security and Design 146

Switch Spoofing Attack 146

Double-Tagging Attack 147

PVLAN Edge 147

CHAPTER 15 Routing Concepts 149

Initial Configuration of a Router 149

Functions of a Router 149

External Router Features 152

Topology and Addressing Documentation 154
Configure and Verify Dual-Stack IPv4 and IPv6 Addressing 156

Routing Decisions 161
Path Determination 162
Concept of Administrative Distance Exercise 164
Switching Packets Between Networks 164

Router Operation 165
Analyze the Routing Table 165
Directly Connected, Static, and Dynamic Routes 167

CHAPTER 16 Inter-VLAN Routing 171

Inter-VLAN Routing Configuration 171
Types of Inter-VLAN Routing 171
Configuring Inter-VLAN Routing 172

Troubleshoot Inter-VLAN Routing 174
Inter-VLAN Troubleshooting Scenarios 174

Layer 3 Switching 176
Layer 3 Switching Operation 176
Configuring Static Routes on a Catalyst 2960 177
Layer 3 Switching Troubleshooting Scenarios 179

CHAPTER 17 Static Routing 183

Static Routing Implementation 183
Static Routing Overview 183
Identify Types of Static Routes 184

Configure Static and Default Routes 185
Configuring IPv4 Static and Default Routes 185
B1 and B2 Routing Strategy 186
Configuring IPv6 Static and Default Routes 187
B1 and B2 Routing Strategy 187

Review of CIDR and VLSM 188
Classful Addressing 189
CIDR and Route Summarization 189
Summary Route Calculation Scenario 1 190
Summary Route Calculation Scenario 2 191
Summary Route Calculation Scenario 3 191

Configure Summary and Floating Static Routes 191
Configure IPv4 Summary Routes 192
Configure IPv6 Summary Routes 192
Configure Floating Static Routes 194

Troubleshoot Static and Default Route Issues 195
IPv4 Static and Default Route Implementation 195
IPv6 Static and Default Route Implementation 195

CHAPTER 18 Routing Dynamically 197

Dynamic Routing Protocols 197

Dynamic Routing Protocol Operation 197
Compare Static and Dynamic Routing 197
From Cold Start to Convergence 198
Dynamic Routing Protocols Classification Chart 200
Routing Protocols Characteristics 201
Comparing Routing Protocol Characteristics 202

Distance Vector Dynamic Routing 202

Distance Vector Operation and Terminology 202
Comparing RIP and EIGRP 204

RIP and RIPng Routing 204

Configuring RIPv2 204
Configuring RIPng 206

Link-State Dynamic Routing 208

Link-State Routing Protocol Operation 208
Building the Link-State Database 210
Using Link-State Routing Protocols 214

The Routing Table 214

Identifying Elements of the Routing Table 214
Dynamically Learned IPv4 Routes 215
The IPv4 Route Lookup Process 217
Routing Table Lookup Chart 217
Routing Table Lookup Exercise 218
Analyze an IPv6 Routing Table 219

CHAPTER 19 Single-Area OSPF 221

Characteristics of OSPF 221

OSPF Terminology 222
OSPF Concepts 223
OSPF Operation 224

Configuring Single-Area OSPFv2 227

The Router ID 228
Single-Area OSPFv2 Basic Configuration Scenario 229
Adjusting OSPF Cost 231
The Reference Bandwidth 231
The Default Interface Bandwidth 232
Modifying the OSPF Cost Metric 232
Verify the OSPF Configuration 233

Configure Single-Area OSPFv3 233

Comparing OSPFv2 and OSPFv3 233
Configuring OSPFv3 234
Verifying OSPFv3 236

CHAPTER 20 Access Control Lists 237

IP ACL Operation 237

Standard Versus Extended IPv4 ACLs 237
Calculating Wildcard Masks 237
Wildcard Mask in Operation 238
Guidelines for ACL Creation 239
Guidelines for ACL Placement 240

Standard IPv4 ACLs 240

Configuring Standard IPv4 ACLs 241
Modifying IPv4 ACLs 244
Securing vty Ports with a Standard IPv4 ACL 245

Extended IPv4 ACLs 245

Configuring Extended IPv4 ACL Statements 245
Extended ACL Configuration Scenarios 246
Evaluating Extended IPv4 ACL Statements 247
Extended ACL Quiz 248

Troubleshoot ACLs 251

IPv6 ACLs 252

Comparing IPv4 and IPv6 ACLs 252
Configuring IPv6 ACLs 252

CHAPTER 21 DHCP 255

Dynamic Host Configuration Protocol v4 255

DHCPv4 Operation 255
Configuring a Cisco Device as a DHCPv4 Server 256
Configuring a Router to Relay DHCPv4 Requests 258
Configuring a Router as a DHCPv4 Client 259
Troubleshooting DHCPv4 259

Dynamic Host Configuration Protocol v6 260

SLAAC and DHCPv6 260
Configuring a Router as a Stateless DHCPv6 Server 262
Configuring a Router as a Stateful DHCPv6 Server 263

CHAPTER 22 Network Address Translation for IPv4 265

NAT Operation 265

NAT Characteristics 265

Configuring NAT 267

Configuring Static NAT 267
Configuring Dynamic NAT 268
Configuring Port Address Translation 269
A Word About Port Forwarding 272
Configuring NAT and IPv6 272
Troubleshooting NAT 273

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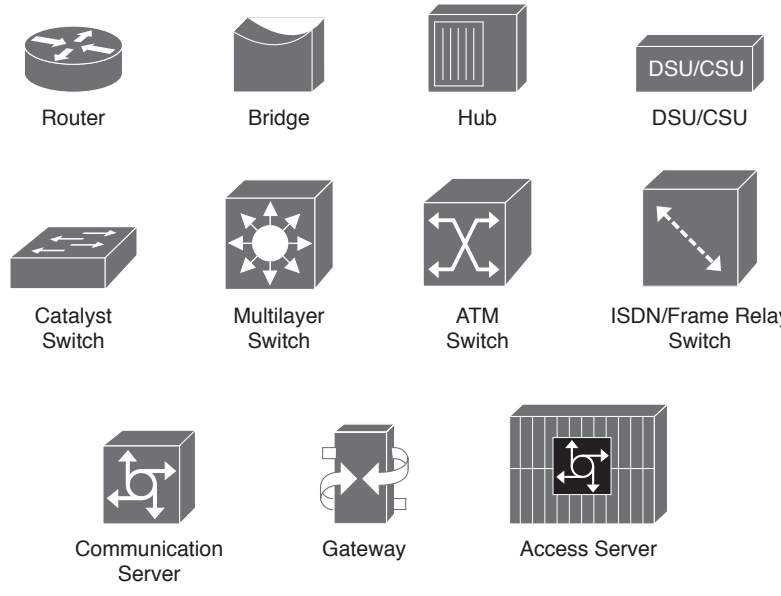

Command Syntax Conventions

The conventions used to present command syntax in this book are the same conventions used in the IOS Command Reference. The Command Reference describes these conventions as follows:

- **Boldface** indicates commands and keywords that are entered literally as shown. In actual configuration examples and output (not general command syntax), boldface indicates commands that are manually input by the user (such as a **show** command).
- *Italics* indicate arguments for which you supply actual values.
- Vertical bars (|) separate alternative, mutually exclusive elements.
- Square brackets [ ] indicate optional elements.
- Braces { } indicate a required choice.
- Braces within brackets [{ }] indicate a required choice within an optional element.

Introduction

The purpose of this book is to provide you with an extra resource for studying the exam topics of the Interconnecting Cisco Networking Devices Part 1 (ICND1) exam that leads to Cisco Certified Networking Entry Technician (CCENT) certification. This book maps to the first two Cisco Networking Academy courses in the CCNA Routing and Switching curricula: *Introduction to Networks* (ITN) and *Routing and Switching Essentials* (RSE). ITN introduces basic concepts of computer networks including deep dives into the seven layers of the OSI model, IP addressing, and the fundamentals of Ethernet. Successfully completing the course means that you should be able to build small LANs and implement basic addressing and configurations on routers and switches. RSE expands on ITN, taking the student further into basic router and switch configuration. Successfully completing the course means that you should be able to configure and troubleshoot routers and switches using a variety of technologies including RIPv2, single-area OSPF, VLANs, and inter-VLAN routing for both IPv4 and IPv6 networks. To learn more about CCNA Routing and Switching courses and to find an Academy near you, visit http://www.netacad.com (http://www.cisco.com/web/learning/netacad/index.html).

However, if you are not an Academy student but would like to benefit from the extensive authoring done for these courses, you can buy any or all of CCNA Routing and Switching Companion Guides (CG) and Lab Manuals (LM) of the Academy's popular online curriculum. Although you will not have access to the Packet Tracer network simulator software, you will have access to the tireless work of an outstanding team of Cisco Academy instructors dedicated to providing students with comprehensive and engaging CCNA Routing and Switching preparation course material. The titles and ISBNs for the first two courses of the CCNA Routing and Switching CGs and LMs are as follows:

- *Introduction to Networks Companion Guide* (ISBN: 9781587133169)
- *Introduction to Networks Lab Manual* (ISBN: 9781587133121)
- *Routing and Switching Essentials Companion Guide* (ISBN: 9781587133183)
- *Routing and Switching Essentials Lab Manual* (ISBN: 9781587133206)

Goals and Methods

The most important goal of this book is to help you pass the 100-101 Interconnecting Cisco Networking Devices Part 1 (ICND1) exam, which is associated with the Cisco Certified Entry Network Technician (CCENT) certification. Passing the CCENT exam means that you have the knowledge and skills required to successfully install, operate, and troubleshoot a small branch office network. You can view the detailed exam topics any time at http://learningnetwork.cisco.com. They are divided into seven broad categories:

- Operation of IP Data Networks
- LAN Switching Technologies
- IP Addressing for IPv4 and IPv6
- IP Routing Technologies
- IP Services
- Network Device Security
- Troubleshooting

This book offers exercises that help you learn the concepts, configurations, and troubleshooting skills crucial to your success as a CCENT exam candidate. Each chapter differs slightly and includes some or all of the following types of practice:

- Vocabulary Matching Exercises
- Concept Questions Exercises
- Skill-Building Activities and Scenarios
- Configuration Scenarios
- Troubleshooting Scenarios

Audience for This Book

This book's main audience is anyone taking the CCNA Routing and Switching courses of the Cisco Networking Academy curriculum. Many Academies use this Practice Study Guide as a required tool in the course, whereas other Academies recommend the Practice Study Guide as an additional resource to prepare for class exams and the CCENT certification.

The secondary audiences for this book include people taking CCENT-related classes from professional training organizations. This book can also be used for college- and university-level networking courses, as well as anyone wanting to gain a detailed understanding of routing.

How This Book Is Organized

Because the content of the *Introduction to Networks Companion Guide*, the *Routing Switching Essentials Companion Guide*, and the online curriculum is sequential, you should work through this Practice Study Guide in order beginning with Chapter 1.

The book covers the major topic headings in the same sequence as the online curriculum. This book has 22 chapters, with the same names as the online course chapters. However, the numbering is sequential in this book, progressing from Chapter 1 to Chapter 22. The online curriculum starts over at Chapter 1 in Routing and Switching Essentials.

Most of the configuration chapters use a single topology where appropriate. This allows for better continuity and easier understanding of routing and switching commands, operations, and outputs. However, the topology differs from the one used in the online curriculum and the Companion Guide. A different topology affords you the opportunity to practice your knowledge and skills without just simply recording the information you find in the text.

Lab, Packet Tracer, and Video Demonstration Activities

Throughout the book, you will find references to Lab, Packet Tracer, and Video Demonstration activities. These references are provided so that you can, at that point, complete those activities. The Packet Tracer and Video Demonstration activities are only accessible if you have access to the online curriculum. However, the Labs are available in the Lab Manuals previously cited.

Part I: Introduction to Networks

- **Chapter 1, "Exploring the Network":** This chapter provides vocabulary and concept exercises to reinforce your understanding of network components, LANs, WANs, and the Internet. You will also practice classifying network architecture requirements.
- **Chapter 2, "Configuring a Network Operating System":** The exercises in the first part of this chapter are devoted to accessing Cisco devices, navigating the IOS, and learning about command structure. In the second half, you practice configuring and verifying a switch for basic connectivity.
- **Chapter 3, "Network Protocols and Communications":** This chapter's exercises are devoted to protocols, standards, and the two main reference models we use in networking: TCP/IP and OSI. You will also complete activities which focus on data encapsulation and addressing as information moves across a network.
- **Chapter 4, "Network Access":** This chapter is all about how computing devices physically connect to the network. You will complete exercises that focus on physical access including copper, fiber, and wireless media. Then, moving up the OSI model to Layer 2, you will engage in activities that focus on the data link layer protocols and concepts.
- **Chapter 5, "Ethernet":** This chapter continues with the data link layer with exercises devoted to Ethernet concepts and operation, including the Ethernet frame, the MAC address, and ARP. In addition, you will complete activities focused on the operation of the main Layer 2 device: the switch.
- **Chapter 6, "Network Layer":** This chapter starts off with exercises for understanding the operation of the Internet Protocol, both version 4 and version 6. Then the activities move on to routing operations, including how hosts determine a gateway of last resort, and identifying the parts of a routing table. Next, you will engage in exercises that focus on router components and the boot-up process. Finally, you will practice basic router configuration and verification.
- **Chapter 7, "Transport Layer":** Continuing the journey up the OSI model, this chapter's activities focus on the operation of the transport layer, including TCP, UDP, and the three-way TCP handshake.
- **Chapter 8, "IP Addressing":** With the growing adoption of IPv6, networking students now need to be competent in both IPv4 and IPv6. The activities in this chapter focus on the operation, configuration, and verification versions of the Internet Protocol.
- **Chapter 9, "Subnetting IP Networks":** Segmenting IP addresses into logical subnets is the focus of the exercises, activities, and scenarios in this chapter. You will practice subnetting for fixed-length and variable-length subnet masks. In addition, you will practice subnetting IPv6 addresses.
- **Chapter 10, "Application Layer":** This chapter focuses on the layer at which the end user interacts with the network. Exercises are devoted to reinforcing your understanding of common application layer protocols.
- **Chapter 11, "It's a Network":** In this chapter, we step back and see how to assemble these elements together in a functioning network that can be maintained. Activities include small network design considerations, network security concerns, securing remote access with SSH, and verifying basic network performance.

Part II: Routing and Switching Essentials

- **Chapter 12, "Introduction to Switched Networks":** Part II starts off with an introduction to LAN design concepts and a the operation of switches. Exercises focus on identifying network design principles, selecting switch hardware, switch forwarding methods, and the MAC address table.
- **Chapter 13, "Basic Switching Concepts and Configuration":** This chapter is a bit of a review of the content in Part I. Activities focus on the switch boot sequence, configuration, and verification. New activities for Part II include switch port security configuration and verification.
- **Chapter 14, "VLANs":** This chapter focuses on VLAN concepts and configuration. Exercises include VLAN segmentation concepts and implementations. Also, you will practice trunk configuration and complete activities devoted to understanding DTP. The chapter wraps up with activities on VLAN security.
- **Chapter 15, "Routing Concepts":** In this chapter, it's all about the router. Exercises focus on router functions, components, and configuration. You will practice configuring a dual-stack IPv4 and IPv6 one-router, two-PC topology. Then, activities focus on routing decisions, including path determination, administrative distance, switching packets from hop to hop, and analyzing the routing table.
- **Chapter 16, "Inter-VLAN Routing":** This chapter introduces inter-VLAN routing and Layer 3 switching. After an exercise on comparing types of inter-VLAN routing, the bulk of the chapter is devoted to practicing inter-VLAN routing configuration and troubleshooting. The chapter ends with a look at Layer 3 switching concepts, configuration, and troubleshooting.
- **Chapter 17, "Static Routing":** This chapter focuses on manual route configuration using static routes. Exercises focus on comparing static and dynamic routing and the types of static routes. Practice activities focus on configuring and troubleshooting static, default, summary, and floating static routes for both IPv4 and IPv6.
- **Chapter 18, "Routing Dynamically":** To route dynamically, a router needs a routing protocol. The exercises in this chapter are devoted to all the basic routing protocol concepts, including protocol operation and characteristics, how a router learns about networks, and deep dives into distance vector and link-state routing protocols.
- **Chapter 19, "Single-Area OSPF":** This chapter introduces OSPF with exercises for reinforcing your understanding of OSPF operations. In addition, activities allow you to practice configuration and troubleshooting for both single-area OSPFv2 and OSPFv3.
- **Chapter 20, "Access Control Lists":** Understanding and correctly configuring ACLs is one of the most important skills a network administrator can master. Therefore, the exercises and activities in this chapter focus on ACL concepts, configuration, and troubleshooting IPv4 ACLs. There is also a brief section devoted to IPv6 ACL configuration practice.
- **Chapter 21, "DHCP":** When a device boots, it needs IP addressing. Although you can manually configure addressing, most devices obtain addressing dynamically through DHCP. Exercises focus on DHCP concepts, and practice activities focus on DHCP configurations, for both IPv4 and IPv6.

- **Chapter 22, "Network Address Translation for IPv4":** NAT was created to provide a temporary solution to the limited address space in IPv4. Just about every router connected to the network uses NAT or forwards traffic to a NAT-enabled device for address translation. This chapter focuses on exercises to reinforce your understanding of NAT operation and characteristics. Practice activities include configuring, verifying, and troubleshooting static NAT, dynamic NAT, and PAT.

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CHAPTER 1

Exploring the Network

Globally Connected

In today's world, we are connected like never before. People with ideas can communicate instantly with others—next door or halfway around the world. Networks are rapidly transforming our planet into a global village.

Vocabulary Exercise: Matching

Match the definition on the left with a term on the right. This exercise is a one-to-one matching.

Definitions

a. Gives anyone a means to communicate their thoughts to a global audience without technical knowledge of web design.

b. Enable instant real-time communication between two or more people.

c. Web pages that groups of people can edit and view together.

d. Enables people to share files with each other without having to store and download them from a central server.

e. Interactive websites where people and communities create and share user-generated content.

f. Allows people to deliver their recordings to a wide audience.

g. Gives people the opportunity to work together without the constraints of location or time zone, often across real-time interactive video.

Terms

____ collaboration tools

____ social media

____ blogs

____ P2P file sharing

____ podcasting

____ IM/texting

____ wikis

Completion Exercise

_____ come in all sizes. They can range from simple configurations consisting of two computers to complex topologies connecting millions of devices. Simple networks installed in _____ enable sharing of resources, such as printers, documents, pictures, and music between a few local computers.

In businesses and large organizations, networks can be used to provide access to information centrally located on network _____. In addition to the many internal organizational benefits, companies often use their networks to provide products and services to customers through their connection to the Internet. The _____ is the largest network in existence and means a "network of networks."

All computers connected to a network that participate directly in network communication are classified as _____ or end _____. They can act as a _____, a _____, or both. The software installed on the computer determines which role the computer plays. _____ are hosts that have software installed that enable them to provide information, like email or web pages, to other hosts on the network. _____ are computer hosts that have software installed that enable them to request and display the information obtained from servers.

The simplest peer-to-peer network consists of _____ using a wired or wireless connection. Multiple PCs can also be connected to create a larger peer-to-peer network, but this requires a network device, such as a ___, to interconnect the computers.

In Table 1-1, list the advantages and disadvantages of peer-to-peer networking.

Table 1-1 Advantages and Disadvantages of Peer-to-Peer Networking

Advantages	Disadvantages

Lab - Researching Network Collaboration Tools

LANs, WANs, and the Internet

The path that a message takes from source to destination can be as simple as a single cable connecting one computer to another or as complex as a network that literally spans the globe. LANs, WANs, and the Internet provide the basic framework for that interconnectedness.

Completion Exercise

The network infrastructure contains three categories of network components: devices, media, and services. _____ and _____ are the physical elements, or hardware, of the network. Hardware is often the visible components of the network platform. Some components may not be so visible, such as _____ media. _____ are the communication programs, called software, that run on the networked devices.

The network devices that people are most familiar with are called ___ _____, or ____. These devices form the interface between users and the underlying communication network.

List at least five examples of end devices:

A host device is either the _____ or destination of a message transmitted over the network. Each host on a network is identified by an _____.

_____ devices interconnect end devices and can connect multiple individual networks to form an _____. These devices use the destination host _____ to determine the path that messages should take through the network.

List three examples of intermediary network devices:

List at least three of the main functions of intermediary devices:

Communication across a network is carried on a _____ (singular form of the word media), which provides the channel over which the message travels from source to _____.

List the three types of media used to interconnect devices:

On metallic wires, the data is encoded into _____ _____ that match specific patterns. Fiber-optic transmissions rely on _____. In a wireless transmission, patterns of _____ depict the various bit values.

List the four criteria for choosing network media:

When conveying complex information such as displaying all the devices and medium in a large internetwork, it is helpful to use visual representations known as _____ diagrams. They provide visual maps of how the network is connected.

There are two types of _____ diagrams:

_____ identify the physical location of intermediary devices, configured ports, and cable installation.

_____ identify devices, ports, and IP addressing schemes.

Classify and Identify Network Components

In Figure 1-1, label the three major classifications of network components. Then, underneath each icon, label the network component.

Figure 1-1 Common Network Component Icons

Compare LANs and WANs

In Table 1-2, indicate whether the feature is a LAN feature or a WAN feature by marking the appropriate column.

Table 1-2 LAN and WAN Features

LANs	WANs	LAN or WAN Feature
		Interconnect end devices in a limited area such as a home, a school, an office building, or a campus
		Typically provide slower speed links between networks
		Provide high-speed bandwidth to internal end devices and intermediary devices
		Interconnect networks over wide geographic areas such as between cities, states, provinces, countries, or continents
		Usually administered by multiple service providers
		Usually administered by a single organization or individual

Vocabulary Exercise: Matching

Match the definition on the left with a term on the right. This exercise is a one-to-one matching.

Definitions

a. Similar to a LAN but wirelessly interconnects users and end points in a small geographic area.

b. Requires a clear line of sight, installation costs can be high, and connections tend to be slower and less reliable than its terrestrial competition.

c. Also called a LAN adapter, it provides the physical connection to the network at the PC or other host device.

d. Available from a provider to the customer premise over a dedicated copper or fiber connection providing bandwidth speeds of 10 Mbps to 10 Gbps.

e. The availability of this type of Internet access is a real benefit in those areas that would otherwise have no Internet connectivity at all, or for those constantly on the go.

f. Provide the interface between users and the underlying communication network.

g. A network infrastructure that provides access to users and end devices in a small geographic area.

These devices interconnect end devices.

h. Reserved circuits that connect geographically separated offices for private voice and/or data networking. In North America, circuits include T1 (1.54 Mbps) and T3 (44.7 Mbps); in other parts of the world, they are available in E1 (2 Mbps) and E3 (34 Mbps).

i. A private connection of LANs and WANs that belongs to an organization—basically an internetwork that is usually only accessible from within the organization.

j. An inexpensive, very low-bandwidth option to connect to the ISP and should only be considered as a backup to other higher-speed connection options.

k. Data signal is carried on the same coaxial media that delivers the television signal. It provides a high-bandwidth, always-on connection to the Internet.

l. Provides secure and safe access to individuals who work for a different organizations but require access to the company's data.

m. A network infrastructure that is larger than a LAN but smaller than a WAN and are usually operated by a single organization.

n. Provides the channel over which the message travels from source to destination.

o. A network infrastructure that provides access to other networks over a wide geographic area.

p. Provides a high-bandwidth, always-on connection that runs over a telephone line, with the line split into three channels.

q. A network infrastructure designed to support file servers and provide data storage, retrieval, and replication.

Terms

____ DSL

____ medium

____ metropolitan-area network (MAN)

____ network interface card

____ Metro Ethernet

____ wireless LAN (WLAN)

____ dedicated leased line

____ satellite

____ wide-area network (WAN)

____ intranet

____ storage-area network (SAN)

____ cellular

____ dial-up telephone

____ cable

____ local-area network (LAN)

____ end devices

____ intermediary devices

____ extranet

Lab - Researching Converged Network Services (ITN 1.2.3.3/NB 1.2.1.3)

Packet Tracer Activity

Packet Tracer - Network Representation (ITN 1.2.4.4/NB 1.3.4.4)

The Network as a Platform

The converged network is capable of delivering voice, video streams, text, and graphics between many different types of devices over the same communication channel and network structure. This platform provides access to a wide range of alternative and new communication methods that enable people to interact directly with each other almost instantaneously.

The converged network must support a wide range of applications and services, and must operate over many different types of cables and devices that make up the physical infrastructure. As networks evolve, we are discovering that the underlying architectures need to address four basic characteristics to meet user expectations:

- Fault tolerance
- Scalability
- Quality of service (QoS)
- Security

Classify Network Architecture Requirements

In Table 1-3, select the appropriate column to classify each of the network architecture requirements.

Table 1-3 Reliable Network Features

	Characteristic			
Requirement	**Fault Tolerance**	**Scalability**	**Quality of Service**	**Security**
Many tools and procedures are being implemented to address the need to exchange confidential and business-critical information.				
Common network standards allow hardware and software vendors to focus on product improvements and services.				
Different types of Internet service providers can affect the quality of network data delivery.				
Networks can grow or expand with minimal impact on performance.				

	Characteristic			
Requirement	**Fault Tolerance**	**Scalability**	**Quality of Service**	**Security**
Types of network equipment, how they are identified (IP address/MAC address), and how they are named can have an impact on the growth of a network.				
Networks should always be available.				
Compromising the integrity of crucial business and personal assets could have serious repercussions.				
Types of network connectivity can affect delivery of information.				
Business and personal network equipment must be protected.				
Traffic delay and data loss should be considered when setting up delivery through priority queuing.				
Priority queues are implemented when demand for network bandwidth exceeds supply.				
Full memory queues mean packets must be dropped.				
Data can travel through more than one route for delivery from a remote source.				
Priority for queuing packets is based on the type of data sent and how important it may be.				
Developing a plan for priority queuing is a strategy for quality delivery of information.				
Business and personal data must be protected.				

Lab - Mapping the Internet (ITN 1.3.1.3/NB 1.3.3.3)

The Changing Network Environment

Before the Internet became so widely available, businesses largely relied on print marketing to make consumers aware of their products. Compare that to how consumers are reached today. Most businesses have an Internet presence where consumers can learn about their products, read reviews from other customers, and order products directly from the website. As new technologies and end-user devices come to market, businesses and consumers must continue to adjust to this ever-changing environment.

Completion Exercise

The concept of any device, to any content, in any way is a major global trend that requires significant changes to the way devices are used. This trend is known as _____ _____.

_____ tools give employees, students, teachers, customers, and partners a way to instantly connect, interact, and conduct business, through whatever communications channels they prefer, and achieve their objectives.

_____ calls and _____ conferencing are proving particularly powerful for sales processes and for doing business.

_____ computing is the use of computing resources (hardware and software) that are delivered as a service over a network. A company uses the hardware and software in the _____, and a service fee is charged.

List at least four major components associated with data centers:

_____ networking is not designed to be a substitute for dedicated cabling for data networks. However, it is an alternative when data network cables or wireless communications are not a viable option.

Although many homes connect to the Internet either through a cable or DSL service provider, wireless is another option. Briefly describe two types of wireless (not satellite) options for the home:

1.

2.

Network Security Terminology

Provide the security term that matches the definition.

_____ refers to a network attack triggered by date.

_____ is arbitrary code running on user devices.

_____ block unauthorized access to your network.

_____ is an attack that slows down or crashes equipment and programs.

_____ filter network access and data traffic.

Lab - Researching IT and Networking Job Opportunities (ITN 1.4.4.3/NB 1.4.3.6)

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CHAPTER 2

Configuring a Network Operating System

The Cisco Internetwork Operating System (IOS) is a generic term for the collection of network operating systems used on Cisco networking devices. Cisco IOS is used for most Cisco devices regardless of the type or size of the device. This chapter focuses on gaining proficiency using basic IOS commands and configuring switches.

IOS Bootcamp

The user can interact with the shell of an operating system using either the command-line interface (CLI) or graphical user interface (GUI).

Completion Exercise

When a computer is powered on, it loads the operating system into _____ (acronym). When using the ___ (acronym), the user interacts directly with the system in a text-based environment by entering commands on the keyboard at a command prompt. The ____ (acronym) allows the user to interact with the system in an environment that uses graphical images, multimedia, and text.

In Table 2-1, identify the term for the description of each part of an operating system.

Table 2-1 Three Major Parts of an Operating System

Term	Description
	Communicates between the hardware and software and manages how hardware resources are used to meet software requirements
	The user interface that allows users to request specific tasks for the OS, either through the CLI or GUI
	The physical part of the computer including underlying electronics

The operating system on home routers is usually called ____ware. The most common method for configuring a home router is using a _____ to access an easy-to-use ____ (acronym).

The network operating system used on Cisco devices is called the Cisco _____ (___). The most common method of accessing these devices is using a _____ (acronym).

The IOS file itself is several megabytes in size and is stored in a semi-permanent memory area called _____, which provides nonvolatile storage. When referring to memory, what does the term *nonvolatile* mean?

_____

In many Cisco devices, the IOS is copied from flash into _____ (_____) when the device is powered on. RAM is considered _____ memory because data is lost during a power cycle.

Cisco IOS routers and switches perform functions that network professionals depend upon to make their networks operate as expected. List at least four major functions performed or enabled by Cisco routers and switches.

Video Demonstration

Video Demonstration - CCO Accounts and IOS Image Exploration (ITN 2.1.1.5/NB 2.1.1.4)

Accessing a Cisco IOS Device

You can access the CLI environment on a Cisco IOS device in several ways. In Table 2-2, indicate which access method is most appropriate for the given scenario.

Table 2-2 Methods for Accessing a Cisco IOS Device

Console	Telnet/SSH	AUX	Scenario
			You call your manager to tell him you cannot access your switch or router in another city over the Internet. He provides you with the information to access the switch through a telephone connection.
			You physically cable access to the switch, are not prompted for a password, and can access the IOS. This is the default operation.
			You are on vacation and need to check on one of your switches. The only access you have is your cellular phone.
			The password for a device was changed. No one knows what the new password is, and you need to reset a new password.
			Your manager gives you a rollover cable and tells you to use it to configure the switch.
			The device you are configuring cannot be accessed by cable because you are not in the building. You use a telephone to dial in to it.
			You are in the equipment room with a new switch that needs to be configured.
			You access the IOS by using another intermediary device over a network connection.
			You do not need remote-access services to the networking device to configure it because the device is physically accessible to you.
			You use a password-encrypted connection to remotely access a device over a network.

Navigating the IOS Matching Exercise

Match the definition on the left with a term on the right. This exercise is a one-to-one matching. Each definition has exactly one matching term.

Definitions

a. Scrolls down through the commands in the history buffer.

b. Privileged EXEC mode.

c. Moves the cursor to the beginning of the command line.

d. Interface Configuration mode.

e. Has the same effect as using the key combination Ctrl+Z.

f. When in any configuration mode, ends the configuration mode and returns to privileged EXEC mode.

g. User EXEC mode.

h. Returns the user to the previous configuration mode. Can also end the console session.

i. Moves the cursor to the end of the command line.

j. All-purpose break sequence. Use to abort DNS lookups.

k. Completes a partial command name entry.

l. Global configuration mode.

m. Scrolls up through the commands in the history buffer.

Terms

____ Switch>

____ up arrow

____ down arrow

____ Ctrl+A

____ Switch(config-if)#

____ end

____ Ctrl+Shift+6

____ Tab

____ exit

____ Router(config)#

____ Ctrl+E

____ Ctrl+Z

____ Router#

Lab - Establishing a Console Session with Tera Term (ITN/NB 2.1.4.9)

Packet Tracer Activity

Packet Tracer - Navigating the IOS (ITN/NB 2.1.4.8)

Video Demonstration

Video Demonstration - Navigating the IOS (ITN/NB 2.1.3.6)

Basic Device Configuration

Now that we reviewed accessing and navigating the IOS, we are ready to review initial switch configuration, including setting a name for the switch, limiting access to the device configuration, configuring banner messages, and saving the configuration. We will also review configuring the switch for remote management by adding IP addressing and default gateway.

Applying a Basic Configuration

The following exercise walks you through a basic configuration.

First, enter global configuration mode for the switch:

```
Switch#
```

Next, apply a unique hostname to the switch. Use S1 for this example:

```
Switch(config)#
```

Now, configure the encrypted password that is to be used to enter privileged EXEC mode. Use class as the password:

```
S1 (config)#
```

Next, configure the console and vty lines with the password cisco. The console commands follow:

```
S1(config)#
S1(config-line)#
S1(config-line)#
```

The vty lines use similar commands:

```
S1(config-line)#
S1(config-line)#
S1(config-line)#
```

Return to global configuration mode:

```
S1(config-line)#
```

From global configuration mode, configure the message-of-the-day banner. Use the following text: Authorized Access Only. A delimiting character such as a # is used at the beginning and at the end of the message:

```
S1(config)#
```

What is the purpose of the message of the day?

_____

_____

What is the command to enter VLAN interface configuration mode for S1?

```
S1(config)#
```

Enter the command to configure the IP address 10.1.1.11 and subnet mask 255.255.255.0:

```
S1(config-if)#
```

Enter the command to activate the VLAN interface:

```
S1(config-if)#
```

Configure S1 with the default gateway address 10.1.1.1:

```
S1(config)#
```

Return to the privileged EXEC prompt:

```
S1(config)#
```

What command saves the current configuration?

```
S1#
```

What command displays the current configuration?

```
S1#
```

Lab - Building a Simple Network (ITN/NB 2.3.3.4)

Lab - Configuring a Switch Management Address (ITN/NB 2.3.3.5)

Packet Tracer Activity

Packet Tracer - Implementing Basic Connectivity (ITN/NB 2.3.2.5)

Packet Tracer - Skills Integration Challenge (ITN/NB 2.4.1.2)

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CHAPTER 3

Network Protocols and Communications

The network industry has adopted a framework that provides a common language for understanding current network platforms as well as facilitates the development of new technologies. Central to this framework is the use of generally accepted models that describe network rules and functions.

Rules of Communication

Networks can vary in size, shape, and function. However, simply having the physical connection between end devices is not enough to enable communication. For communication to occur, devices must follow precise rules.

Vocabulary Exercise: Matching

Match the definition on the left with a term on the right. This exercise is a one-to-one matching. Each definition has exactly one matching term.

Definitions

a. Used by source and destination to negotiate correct timing for successful communication.

b. One-to-many delivery of a message.

c. The size restrictions of frames require the source host to break a long message into individual pieces that meet both the minimum and maximum size requirements.

d. The format each computer message is encapsulated in before it is sent over the network.

e. When this occurs, hosts on the network have rules that specify what action to take if no reply is received.

f. The process of converting information into another, acceptable form, for transmission.

g. The process of converting transmitted information into an understandable form.

h. One-to-all delivery of a message.

i. Needed by hosts on the network to know when to begin sending messages and how to respond when errors occur.

j. The process of placing one message format inside another message format.

k. One-to-one delivery of a message.

Terms

____ broadcast

____ frame

____ segmentation

____ unicast

____ encoding

____ multicast

____ decoding

____ response timeout

____ flow control

____ encapsulation

____ access method

Network Protocols and Standards

For networked devices to successfully communicate, a network protocol suite must describe precise requirements and interactions. Networking protocols define a common format and set of rules for exchanging messages between devices. A group of interrelated protocols necessary to perform a communication function is called a protocol suite. In this section, we review the TCP/IP protocol suite, investigate standards organizations, and compare the OSI and TCP/IP models.

Protocol Definitions: Matching

Match the definition on the left with a protocol acronym on the right. This exercise is a one-to-one matching. Each definition has exactly one matching protocol.

Definitions

a. Dynamically assigns IP addresses to client stations at startup

b. Translates domain names, such as cisco.com, into IP addresses

c. Uses composite metric based on bandwidth, delay, load, and reliability

d. Does not confirm successful datagram transmission

e. Enables clients to send email to a mail server

f. Set of rules for exchanging text, graphic images, sound, video, and other multimedia files on the World Wide Web

g. Enables clients to retrieve email from a mail server

h. Translates IP addresses from a private network into globally unique public IP addresses

i. Addresses packets for end-to-end delivery over an Internetwork

j. Provides dynamic address mapping between an IP address and a hardware address

k. Link-state routing protocol

l. A reliable, connection-oriented, and acknowledged file delivery protocol

m. Reliable, acknowledged transmissions that confirm successful delivery

n. Provides feedback from a destination host to a source host about errors in packet delivery

Terms

____ TCP

____ ICMP

____ FTP

____ EIGRP

____ ARP

____ UDP

____ POP

____ HTTP

____ NAT

____ DHCP

____ IP

____ SMTP

____ DNS

____ OSPF

Mapping the Protocols of the TCP/IP Suite

In Table 3-1, indicate the layer to which each protocol belongs.

Table 3-1 Protocols of the TCP/IP Suite

Protocol	Application	Transport	Internet	Network Access
POP				
PPP				
FTP				
DHCP				
IMAP				
IP				
TCP				
ICMP				
ARP				
HTTP				
TFTP				
Ethernet				
Interface drivers				
OSPF				
UDP				
DNS				
EIGRP				
SMTP				

Explore the Purpose of Standards Organizations

The following six standards organizations are responsible for creating, developing, and monitoring many of the protocols and standards used in today's communications networks:

- IANA: http://www.iana.org/
- ICANN: http://www.icann.org/en/about/welcome
- IEEE: http://standards.ieee.org/develop/index.html
- IETF: http://www.ietf.org/newcomers.html#whither
- ITU: http://www.itu.int/en/about/Pages/whatwedo.aspx
- TIA: http://www.tiaonline.org/standards/strategic-initiatives

Investigate each organization's website at the address listed next to the acronym. Read the information provided. In Table 3-2, match the standards organization to its description.

Note: Web addresses can often change. If the above links are broken, try using your favorite search engine to find the information.

Table 3-2 Standards Organization Descriptions

Description	IANA	ICANN	IEEE	IETF	ITU	TIA
Uses communications standards to predict famines and global climate changes.						
Manages the DNS root zone standards and the .int registry.						
Coordinates unique international Internet addresses for site names and IP addresses.						
Develops standards for homeland security/emergency response teams.						
Standards are developed using a six-stage lifecycle diagram.						
Provides a space where Internet protocols are set and maintained.						
"Makes the Internet work better," using an engineering approach.						
Serves as the central repository for protocol name and number registries.						
Creates standards for worldwide cabling infrastructure.						
Provides wireless standards for IPTV.						
Official standards products are RFC documents, published free of charge.						
Defines policies describing how "names and numbers" of the Internet operate.						
Supports "bridge the digital divide" initiatives.						
Manages the DNS, IP addresses, and protocol identifier assignments.						
Offers online tools and resources for standards and developers.						
Creates standards for wired and wireless technologies .						
Develops standards/protocols affecting cloud computing.						
Supports navigation and online maps via radio/satellite transmissions.						
Standardizes the IP to applications' protocol layers.						

Lab - Researching Networking Standards (ITN 3.2.3.6/NB 3.1.3.6)

OSI Reference Model Layers: Matching

Match the definition on the left with layer on the right. This exercise is a one-to-one matching. Each definition has exactly one matching layer.

Definitions

a. Provides services to exchange the individual pieces of data over the network between identified end devices

b. Describes methods for exchanging data frames between devices over a common media

c. Provides for common representation of the data transferred between application layer services

d. Describe the mechanical, electrical, functional, and procedural means to activate, maintain, and deactivate physical connections for bit transmission to and from a network device

e. Provides services to the presentation layer to organize its dialogue and to manage data exchange

f. Defines services to segment, transfer, and reassemble the data for individual communications between the end devices

g. Provides the means for end-to-end connectivity between individuals in the human network using data networks

Layers

____ presentation

____ transport

____ network

____ application

____ session

____ physical

____ data link

TCP/IP Model Layers: Matching

Match the definition on the left with layer on the right. This exercise is a one-to-one matching. Each definition has exactly one matching layer.

Definitions

a. Determines the best path through the network

b. Represents data to the user, plus encoding and dialog control

c. Controls the hardware devices and media that make up the network

d. Supports communications between diverse devices across diverse networks

Layers

____ transport

____ network access

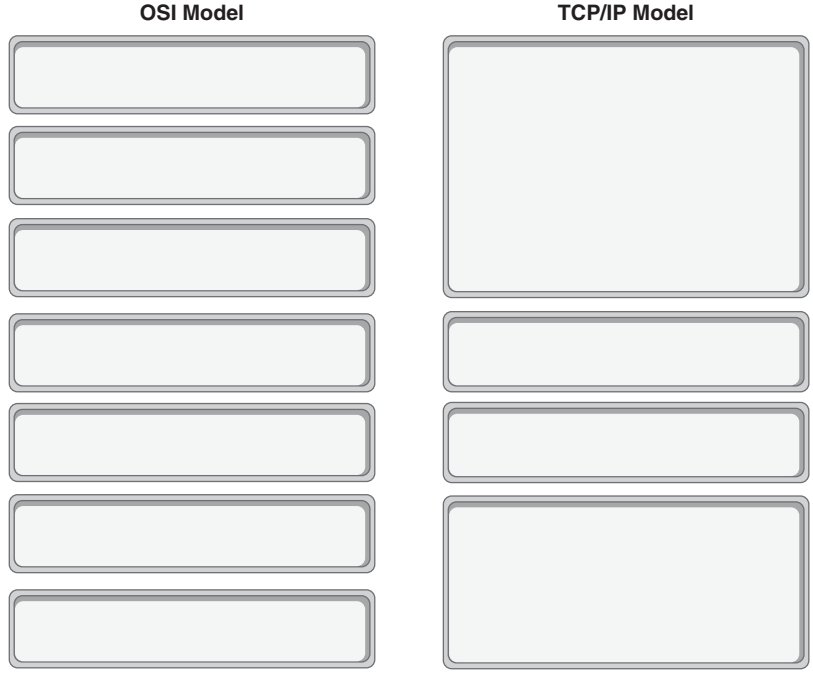
____ application

____ Internet

Mapping the Layers of the OSI and TCP/IP Models

In Figure 3-1, label the layers for each model.

Figure 3-1 The Layers of the OSI and TCP/IP Model



Packet Tracer Activity

Packet Tracer - Investigating the TCP/IP and OSI Models in Action (ITN 3.2.4.6/NB 3.1.4.6)

Lab - Researching RFCs (ITN 3.2.4.7/NB 3.2.2.3)

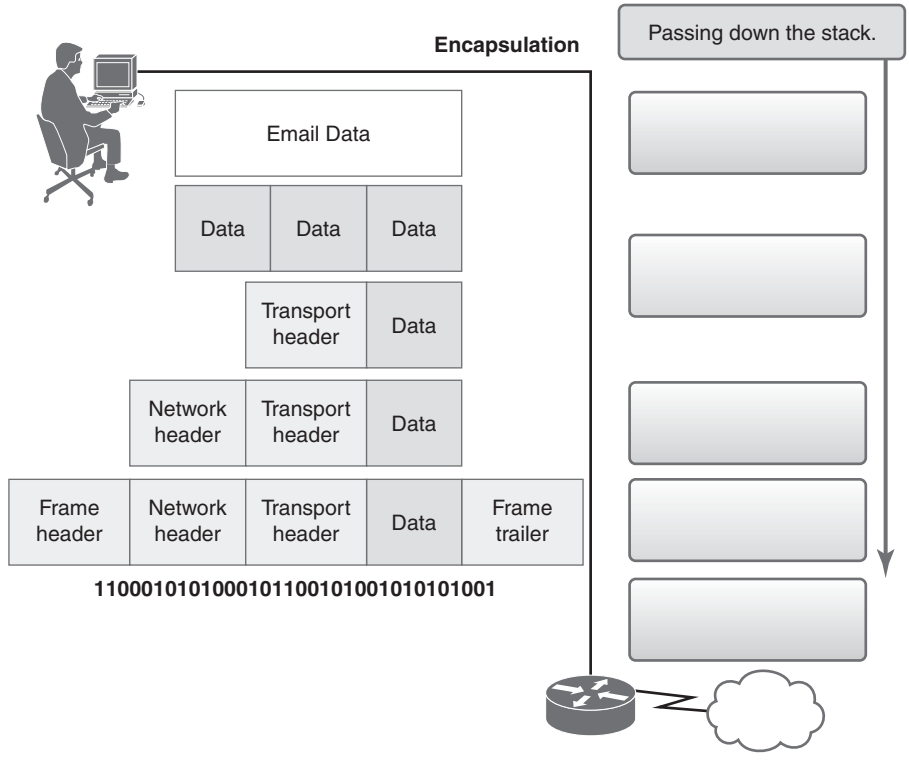
Moving Data in the Network

The data for one transmission—a file, a text, a picture, a video—does not travel from source to destination in one massive, uninterrupted stream of bits. In this section, we review protocol data units (PDUs), encapsulation, and the addressing that makes segmentation of a transmission possible.

Data Encapsulation and the PDUs

In Figure 3-2, label the PDUs at each layer as a message is sent "down the stack" in preparation for transmission.

Figure 3-2 The PDUs Used During Encapsulation



The Role of Addressing in Network Communications

Briefly describe the role of Layer 3 IP addresses.

Briefly describe the purpose of Layer 2 MAC addresses.

Briefly describe the purpose of the default gateway.

Lab - Using Wireshark to View Network Traffic (ITN/NB 3.3.3.4)

Packet Tracer Activity

Packet Tracer - Explore a Network (ITN/NB 3.3.3.3)

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