

Contents

| | | |
|----------|---|-----------|
| 1 | Network Communication Fundamentals | 1 |
| 1.1 | Communication and Networks | 1 |
| 1.1.1 | What Is Communication? | 1 |
| 1.1.2 | Courier Deliveries and Network Communications | 3 |
| 1.1.3 | Common Terminology | 3 |
| 1.1.4 | Review Questions | 3 |
| 1.2 | OSI Model and TCP/IP Model | 6 |
| 1.2.1 | Network Protocols and Standards Organizations | 7 |
| 1.2.2 | OSI Reference Model | 7 |
| 1.2.3 | TCP/IP Protocol Suite | 11 |
| 1.2.4 | Review Questions | 13 |
| 1.3 | Network Types | 14 |
| 1.3.1 | LAN and WAN | 15 |
| 1.3.2 | Forms of Network Topology | 17 |
| 1.3.3 | Review Questions | 18 |
| 1.4 | Transmission Media and Methods of Communication | 19 |
| 1.4.1 | Transmission Media | 20 |
| 1.4.2 | Methods of Communication | 25 |
| 1.4.3 | Review Questions | 27 |
| 2 | VRP Basics | 29 |
| 2.1 | Introduction to VRP | 29 |
| 2.2 | VRP Command Lines | 29 |
| 2.2.1 | Basic Concepts | 30 |
| 2.2.2 | Using Command Lines | 33 |
| 2.3 | Logging into a Device | 37 |
| 2.3.1 | Log into a Device Through a Console Port | 37 |
| 2.3.2 | Log into a Device Through a MiniUSB Port | 40 |
| 2.4 | Basic Configurations | 48 |
| 2.4.1 | Setting the Host Name | 49 |
| 2.4.2 | Setting the System Time | 49 |

| | | |
|----------|--|-----------|
| 2.4.3 | Configuring an IP Address for the Device | 49 |
| 2.4.4 | User Interface Configurations. | 50 |
| 2.5 | Configuration File Management | 53 |
| 2.5.1 | Basic Concepts | 54 |
| 2.5.2 | Saving the Current Configurations | 54 |
| 2.5.3 | Setting the Next Startup Configuration File | 55 |
| 2.6 | Remote Login Through Telnet. | 56 |
| 2.6.1 | Introduction to Telnet. | 57 |
| 2.6.2 | Logging into a Device Through Telnet | 57 |
| 2.7 | File Management | 57 |
| 2.7.1 | Basic Concepts | 58 |
| 2.7.2 | Backing up a Configuration File | 58 |
| 2.7.3 | Transferring Files. | 60 |
| 2.7.4 | Deleting a File. | 62 |
| 2.7.5 | Setting a System Startup File. | 63 |
| 2.8 | Basic Configuration Commands | 64 |
| 2.9 | Review Questions | 66 |
| 3 | Ethernet | 67 |
| 3.1 | Ethernet Cards. | 67 |
| 3.1.1 | Computer Network Cards | 67 |
| 3.1.2 | Switch Network Cards | 69 |
| 3.1.3 | Review Questions | 71 |
| 3.2 | Ethernet Frames. | 72 |
| 3.2.1 | MAC Addresses. | 72 |
| 3.2.2 | Ethernet Frame Formats | 74 |
| 3.2.3 | Review Questions | 75 |
| 3.3 | Ethernet Switches | 76 |
| 3.3.1 | Three Types of Forwarding Operations | 76 |
| 3.3.2 | Switch Operating Principle | 77 |
| 3.3.3 | Examples of Data Forwarding on a Single Switch | 78 |
| 3.3.4 | Examples of Data Forwarding Between Multiple Switches | 85 |
| 3.3.5 | MAC Address Table. | 91 |
| 3.3.6 | Review Questions | 92 |
| 3.4 | ARP. | 93 |
| 3.4.1 | Basic Principles of ARP | 94 |
| 3.4.2 | ARP Packet Format | 95 |
| 3.4.3 | Review Questions | 96 |
| 4 | STP. | 99 |
| 4.1 | Loops. | 99 |
| 4.2 | STP Tree Generation | 102 |
| 4.2.1 | Root Bridge Election | 103 |
| 4.2.2 | Root Port Election | 104 |

| | | |
|----------|--|------------|
| 4.2.3 | Designated Port Election | 105 |
| 4.2.4 | Alternate Port Blocking | 107 |
| 4.3 | STP Packet Format | 107 |
| 4.3.1 | Configuration BPDUs | 108 |
| 4.3.2 | TCN BPDUs | 109 |
| 4.4 | STP Port States | 110 |
| 4.5 | STP Improvements | 113 |
| 4.6 | Examples of STP Configurations | 114 |
| 4.7 | Review Questions | 116 |
| 5 | VLAN | 119 |
| 5.1 | VLAN Purposes | 119 |
| 5.2 | VLAN Scenario | 121 |
| 5.3 | 802.1Q Frame Structure | 127 |
| 5.4 | VLAN Types | 127 |
| 5.5 | Link Types and Port Types | 129 |
| 5.6 | VLAN Forwarding Examples | 131 |
| 5.7 | VLAN Configuration Example | 134 |
| 5.8 | GVRP | 137 |
| 5.8.1 | Dynamic VLAN Registration Process | 137 |
| 5.8.2 | Dynamic VLAN Deregistration Process | 139 |
| 5.9 | GVRP Configuration Example | 141 |
| 5.10 | Review Questions | 144 |
| 6 | IP Basics | 147 |
| 6.1 | Classful Addressing | 148 |
| 6.2 | Classless Addressing | 151 |
| 6.3 | Subnet Masks | 154 |
| 6.4 | Special IP Addresses | 155 |
| 6.5 | IP Forwarding | 157 |
| 6.6 | IP Packet Format | 163 |
| 6.7 | Review Questions | 165 |
| 7 | TCP and UDP | 167 |
| 7.1 | Connectionless and Connection-Oriented Communication | 167 |
| 7.2 | TCP | 169 |
| 7.2.1 | TCP Session Setup | 170 |
| 7.2.2 | TCP Session Termination | 171 |
| 7.2.3 | TCP Segment Structure | 172 |
| 7.2.4 | TCP Acknowledgement and Retransmission | 174 |
| 7.2.5 | Application Port | 176 |
| 7.3 | UDP | 176 |
| 7.4 | Review Questions | 177 |

| | | |
|----------|---|-----|
| 8 | Routing Protocol Basics | 179 |
| 8.1 | Routing | 179 |
| 8.1.1 | Routes and Routing Tables | 179 |
| 8.1.2 | Routing Information Source. | 180 |
| 8.1.3 | Route Preference | 183 |
| 8.1.4 | Route Cost | 184 |
| 8.1.5 | Default Route | 186 |
| 8.1.6 | Comparison Between Routing Tables on a Computer and Router | 186 |
| 8.1.7 | Static Route Configuration Example | 186 |
| 8.1.8 | Default Route Configuration Example. | 188 |
| 8.1.9 | Review Questions | 190 |
| 8.2 | RIP | 191 |
| 8.2.1 | Routing Protocols | 191 |
| 8.2.2 | Basic Principles of RIP. | 192 |
| 8.2.3 | RIP Routing Table | 193 |
| 8.2.4 | RIP Message Format | 194 |
| 8.2.5 | RIP-1 and RIP-2 | 197 |
| 8.2.6 | RIP Timers | 202 |
| 8.2.7 | Routing Loops. | 203 |
| 8.2.8 | RIP Configuration Example. | 206 |
| 8.2.9 | Review Questions | 209 |
| 8.3 | OSPF | 210 |
| 8.3.1 | Basic Principles of OSPF | 210 |
| 8.3.2 | Comparison Between OSPF and RIP | 211 |
| 8.3.3 | OSPF Areas | 212 |
| 8.3.4 | OSPF Network Types. | 213 |
| 8.3.5 | Link State and LSA | 213 |
| 8.3.6 | OSPF Packet Types | 215 |
| 8.3.7 | Single-Area OSPF Network. | 216 |
| 8.3.8 | Multi-area OSPF Network. | 219 |
| 8.3.9 | Neighbor Relationship and Adjacency | 219 |
| 8.3.10 | DR and BDR | 220 |
| 8.3.11 | OSPF Configuration Example | 222 |
| 8.3.12 | Review Questions | 226 |
| 9 | Inter-VLAN Layer 3 Communication | 229 |
| 9.1 | Inter-VLAN Layer 3 Communication via a Multi-armed Router | 229 |
| 9.2 | Inter-VLAN Layer 3 Communication via a One-Armed Router. | 232 |
| 9.3 | Inter-VLAN Layer 3 Communication via a Layer 3 Switch | 235 |
| 9.4 | VLANIF Configuration Example | 240 |
| 9.5 | Review Questions | 243 |

| | | |
|-----------|--|-----|
| 10 | Link Technologies | 245 |
| 10.1 | Link Aggregation | 245 |
| 10.1.1 | Background | 245 |
| 10.1.2 | Basic Concepts | 246 |
| 10.1.3 | Application Scenarios | 247 |
| 10.1.4 | Working Principles | 248 |
| 10.1.5 | LACP | 257 |
| 10.1.6 | Configuration Example | 257 |
| 10.2 | Smart Link | 260 |
| 10.2.1 | Working Principles | 260 |
| 10.2.2 | Configuration Example | 265 |
| 10.3 | Monitor Link | 268 |
| 10.3.1 | Working Principles | 268 |
| 10.3.2 | Configuration Example | 270 |
| 10.4 | Review Questions | 273 |
| 11 | DHCP and NAT | 275 |
| 11.1 | DHCP | 275 |
| 11.1.1 | Basic Concepts and Functions | 275 |
| 11.1.2 | Basic Operations | 277 |
| 11.1.3 | DHCP Relay Agent | 280 |
| 11.1.4 | DHCP Server Configuration Example | 282 |
| 11.1.5 | DHCP Relay Agent Configuration Example | 285 |
| 11.2 | NAT | 287 |
| 11.2.1 | Basic Concepts | 287 |
| 11.2.2 | Static NAT | 289 |
| 11.2.3 | Dynamic NAT | 291 |
| 11.2.4 | NAPT | 292 |
| 11.2.5 | Easy IP | 294 |
| 11.2.6 | Static NAT Configuration Example | 295 |
| 11.3 | Review Questions | 296 |
| 12 | PPP and PPPoE | 299 |
| 12.1 | PPP | 299 |
| 12.1.1 | Basic Concepts | 299 |
| 12.1.2 | PPP Frame Format | 300 |
| 12.1.3 | Phases in PPP | 302 |
| 12.1.4 | Link Establishment Phase | 303 |
| 12.1.5 | Authentication Phase | 307 |
| 12.1.6 | Network Layer Protocol Phase | 308 |
| 12.1.7 | Basic PPP Configuration Examples | 311 |

| | | |
|-----------|---|------------|
| 12.2 | PPPoE | 315 |
| 12.2.1 | Basic Concepts | 315 |
| 12.2.2 | PPPoE Packet Format. | 317 |
| 12.2.3 | Phases in PPPoE | 317 |
| 12.3 | Review Questions | 321 |
| 13 | Network Management and Security | 323 |
| 13.1 | Network Management. | 323 |
| 13.1.1 | Basic Concepts in Network Management | 323 |
| 13.1.2 | Network Management System | 324 |
| 13.1.3 | SMI | 325 |
| 13.1.4 | MIB | 326 |
| 13.1.5 | SNMP | 328 |
| 13.2 | Network Security | 330 |
| 13.2.1 | Access Control List Fundamentals | 330 |
| 13.2.2 | Basic ACL | 331 |
| 13.2.3 | Advanced ACL | 332 |
| 13.2.4 | Basic ACL Configuration Example. | 334 |
| 13.3 | Review Questions | 336 |
| 14 | Appendix-Answers to Review Questions | 339 |



<http://www.springer.com/978-981-10-1553-3>

HCNA Networking Study Guide

Huawei Technologies Co., Ltd. (Ed.)

2016, XXVI, 342 p. 242 illus., 168 illus. in color.,

Hardcover

ISBN: 978-981-10-1553-3