Preface

Declaration

This book is the study guide for Huawei HCNA certification. It is crafted to help understand the principles of network technologies. Apart from the knowledge offered in this book, HCNA also covers other knowledge, such as RSTP, MSTP, DNS, FTP, VRRP, NAC, 802.1x, SSH, xDSL, HDLC, FR, GRE, IPSec, WLAN, VoIP, data center, cloud computing, 3G/4G, and IPv6. If you want a solid foundation for preparing for the HCNA exam, you will also have to learn those concepts.

Organization of This Book

This book is divided up into 14 chapters. Chapters 1 and 2 are preparations for the network technologies discussed in Chaps. 3–13. The last chapter, Chap. 14, is the Appendix and provides answers to all review questions contained in the preceding chapters.

Chapter 1 Network Communication Fundamentals

The OSI and TCP/IP models are vital to understanding network communication. This chapter describes and compares the two models. It further introduces and describes typical network topologies, LAN and WAN, transmission media, and methods of communication.

Chapter 2 VRP Basics

VRP is Huawei's network operating system that runs on network devices such as routers and switches. Knowledge of VRP is essential to understanding Huawei products and technologies, and many of the configuration examples provided in this book are based on VRP. This chapter systematically introduces how to use VRP.

Chapter 3 Ethernet

Ethernet is the most widely used type of LAN today, and as a result, the terms Ethernet and LAN are almost synonymous. We start this chapter by introducing Ethernet network interface cards on computers and switches and the differences between them. We then discuss MAC addresses, Ethernet frames, switch forwarding principles, MAC address tables, and ARP operating principles.

Chapter 4 STP

Layer 2 loops are a major problem on Ethernet networks covering both computers and switches. Loop prevention protocols, such as STP, RSTP, and MSTP, can be used on switches to prevent such loops. This chapter provides background information about STP and describes how STP is used to prevent Layer 2 loops.

Chapter 5 VLAN

Another problem showing on Ethernet networks is how to flexibly and efficiently classify Layer 2 broadcast domains. The solution to this problem is to use VLAN. This chapter describes the VLAN principles, the format and forwarding process of VLAN frames, and the link and port types used in VLAN. It also describes the functions of GVRP.

Chapter 6 IP Basics

Chapters 3–5 focus on the data link layer. Chapter 6 describes IP basics, including IP addressing, IP packet format, and IP forwarding. This chapter also addresses the concepts of Layer 2 communication, Layer 3 communication, and the Internet.

Chapter 7 TCP and UDP

This chapter introduces the two transport layer protocols: TCP and UDP. It focuses on the differences between connectionless and connection-oriented communication. It also demonstrates how a TCP session is created and terminated, and presents the acknowledgment and retransmission mechanisms of TCP.

Chapter 8 Routing Protocol Basics

Knowledge of routing and routing protocols is the basis to understand networking and its technologies. This chapter starts by introducing basic concepts, such as a route's composition, static and dynamic routes, and routing tables. It then describes RIP, the simplest routing protocol. This chapter also introduces the concepts of OSPF.

Chapter 9 Inter-VLAN Layer 3 Communication

Computers on different VLANs cannot communicate over Layer 2, but they can communicate over Layer 3. This chapter describes the working principles of inter-VLAN Layer 3 communication through a one-armed router, a multi-armed router, and a Layer 3 switch. It covers the contents of how a Layer 3 switch, a Layer 2 switch, and a conventional router forward data.

Chapter 10 Link Technologies

Link aggregation is a commonly used link technology that can flexibly increase bandwidth and improve connecting reliability among various network devices. This chapter includes the basic concepts, application scenarios, and working principles of link aggregation. It also involves two Huawei proprietary link technologies that can improve network link reliability: Smart Link and Monitor Link.

Chapter 11 DHCP and NAT

This chapter describes the basic concepts and working process of DHCP as well as DHCP relay. It also introduces the basic concepts, principles, and application scenarios of NAT.

Chapter 12 PPP and PPPoE

This chapter describes the basic concepts and working process of PPP, the format of PPP frames, and the different phases involved in PPP. It further elaborates the combination between PPP and Ethernet, known as PPPoE.

Chapter 13 Network Management and Security

Management and security are vital concerns in today's networks. This chapter concentrates on SMI, MIB, and SNMP used in network management and ACL used in network security.

Chapter 14 Appendix—Answers to Review Questions

Many sections in each chapter of this book include review questions for the readers to oversee the contents they have studied. The suggested answers to these review questions are provided throughly in this chapter.

Target Audience

This book is targeted to the readers preparing for Huawei HCNA certification. It covers the detailed basis of routing and switching technologies, which also makes it a valuable resource for ICT practitioners, university students, and network technology fans.

Important Notes

While reading this book, please be aware of the following:

1. This book may refer to some concepts which are beyond its scope. We advise you to research these concepts for the better understanding but doing so is not a requirement.
2. The Ethernet mentioned in this book only refers to the star-type Ethernet networks. This book does not include bus-type Ethernet or such related concepts as CSMA/CD and collision domain. Many resources are available to be traced by most of the search engines if you are interested in Ethernet's history and its development.
3. Unless otherwise specifically explained, IP in this book refers to IPv4. IPv6 is not covered in this book.
4. This book presents two data link layer technologies, Ethernet and PPP. Unless otherwise stated, network interface cards, network interfaces, interfaces, and ports specifically stand for Ethernet network interface cards, Ethernet network interfaces, Ethernet interfaces, and Ethernet ports, respectively, and frames refer to Ethernet frames.
5. In this book, the network interfaces on routers and computers are noted as interfaces and the network interfaces on switches are noted as ports.
6. Unless otherwise stated, switches in this book refer to Layer 2 Ethernet switches that do not support Layer 3 forwarding.
7. In Sect. 8.1.2, we state that the cost of a static route can be set to 0 or any desired value. This is true theoretically, but most network device vendors require the cost of a static route to be only 0 and do not allow it to be configured or changed. In addition, many such vendors set the minimum number of RIP hops as 0, meaning that there is no hop from a RIP router to its directly connected network. However, the Routing Information Protocol itself stipulates that there be a minimum of 1 hop from a RIP router to its directly connected network. This difference exists due to historical factors, but does not affect the deployment and functions of RIP. In Sects. 8.2.1–8.2.7, the minimum number of RIP hops is thus defined as 1. In Sect. 8.2.8, the minimum number of RIP hops is defined as 0.
8. If you have any feedback or suggestions regarding this book, please e-mail Huawei at Learning@huawei.com.

Icons in This Book

Router

Access switch

Aggregation switch

Core switch

Server

PC

IP-DSLAM

HG

Network cloud

Internet

Ethernet or PPP link (Ethernet by default)