**Learning Tips for Chapter 5**

This chapter begins by describing Internet architecture, ISPs, and the DNS system before it focuses on the Application, Transport, and Network layers of the TCP/IP model, which are most important for understanding how the Internet works.

It is valuable to understand that the Internet is a collection of autonomous systems (ASs), that ISPs are ASs, and that businesses connect to one or more ISPs. Considering the Internet from a big picture perspective makes it easier to appreciate the Domain Name System (DNS) and the other elements that make the Internet a network of networks.

The Application layer protocols introduced in the previous chapter rely on Transport layer protocols, primarily TCP and UDP. When focusing on TCP, it is most valuable to concentrate on the mechanisms that contribute to its reputation for reliable data transmission: end-to end connections (sessions), acknowledgements, and retransmissions.

UDP’s streamlined headers make it the Transport layer protocol of choice for time-sensitive applications such as DNS, DHCP, and streaming apps.

You should not overlook that IP at the Network layer cannot guarantee reliable data transfer; connection-oriented applications count on TCP to address IP’s inherent unreliability.

When considering IPv4, it is important to understand how VLSM and CIDR are related to subnets and supernetting; supernetting results in route summarization which is used in router tables.

It is also valuable to consider DHCP, private IPv4 addresses and NAT as mechanisms for overcoming IPv4 address space limits.

Both IPv4 and IPv6 are used in most networks. IPv6 addresses are typically mathematically derived from device MAC addresses rather than assigned by DHCP.

IPsec can be implemented at either the Network or Data Link layer, but Network layer deployments are most common. IPsec is built into IPv6 but is also widely used to provide IPv4 security.

This chapter provides the most extensive description of traditional routing on the Internet and routing protocols. It is important to understand these, but you should not overlook how traditional separation of routing decisions and forwarding processes provides a path to the clearer separation provided by SDN.

Interior gateway protocols (IGPs) are used for updating router tables within ASs; OSPF is very common. Exterior gateway protocols (EGPs) are used for updating routing tables in AS border router; BGP4 is the current standard for routing among ASs,

Intranets and extranets are secure private networks that use TCP/IP Application, Transport, and Network layer protocols. VPNs also provide secure, private connections over the Internet.

Encapsulation and decapsulation are important concepts. The contents of header fields caadded by senders at each layer inform receivers how to handle data at that layer.

The different types of addressing (port numbers, IP addresses, MAC addresses) are also important to understand.

Technologies map to specific TCP/IP and OSI layers. For example, routers are Layer 3 (Network layer) and switches are Layer 2 (Data Link). Associating a technology to its layer help you understand what it does.

Do not ignore the Key Concepts in Chapter 5 Presentation.

You are also encouraged to leverage the supplement videos and readings for this chapter.

Use the Chapter 5 Problems and Exercises tips to assist with any problems and exercises that you may be assigned.

The appendices for Chapter 5 provide additional information on numerous topics in this chapter.

**Especially Important Sections**

Section 5.1 and each of its subsections.

The discussion of HTTPS in section 5.2.1 and the discussion of FTP and SSH in section 5.2.2

Section 5.2.3 and each of its subsections

Section 5.3.1 and each of its subsections

Section 5.3.2

Section 5.4 and each of its subsections

**Especially Important Figures and Tables**

*Note:* It is important to read/study the discussion related to each figure and table that is identified.

Figure 5-2

Table 5-1 and Figures 5-3

Figure 5-4 and Table 5-2

Figures 5-5 and 5-6

Figure 5-7 and Table 5-3

Figure 5-8

Figure 5-10

Figure 5-12

Figure 5-13

Figure 5-14 and Table 5-5

Figure 5-15

Table 5-6

Figure 5-16

Figure 5-17

Figure 5-18

Table 5-9

Table 5-10

Figure 5-19

Figure 5-20

Table 5-11

Figure 5-21 and Table 5-12

Figure 5-22

Figure 5-23

Figure 5-24

**Especially Important Key Terms**

Autonomous system (AS)

Domain name server

Domain Name System

Dynamic routing

Exterior gateway protocols (EGPs)

Extranet

Interior gateway protocols (IGPs)

Internet exchange point (IXP)

Internet service provider (ISP)

Intranet

Router

Routing protocol

Routing table

Subnet

Subnetting

Supernetting

Variable length subnet mask (VLSM)

Virtual private network (VPN)

**Especially Important Review Questions**

Questions 1-9, 11-20, 22-27, 29

**Especially Valuable Problems and Exercises**

Exercises 5-1, 5-5, and 5-6