CHAPTER 9 (corrisponde al cap. 8 italiano)

Using Telephone and Cable Networks

Solutions to Review Questions and Exercises

Review Questions

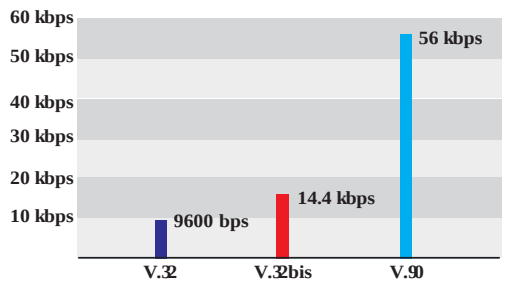
1. The telephone network is made of three major components: ***local loops***, ***trunks***, and ***switching offices***.
2. The telephone network has several levels of switching offices such as ***end offices***, ***tandem offices***, and ***regional offices***.
3. A ***LATA*** is a small or large metropolitan area that according to the divestiture of 1984 was under the control of a single telephone-service provider. The services offered by the common carriers inside a LATA are called intra-LATA services. The services between LATAs are handled by interexchange carriers (IXCs). These carriers, sometimes called long-distance companies, provide communication services between two customers in different LATAs.
4. ***Signaling System Seven (SS7)*** is the protocol used to provide signaling services in the telephone network. It is very similar to the five-layer Internet model.
5. Telephone companies provide two types of services: ***analog*** and ***digital***.
6. ***Dial-up modems*** use part of the bandwidth of the local loop to transfer data. The latest dial-up modems use the V-series standards such as V.32 and V.32bis (9600 bps), V.34bis (28,800 or 33,600 bps), V.90 (56 kbps for downloading and 33.6 kbps for uploading), and V.92. (56 kbps for downloading and 48 kbps for uploading.
7. Telephone companies developed ***digital subscriber line (DSL)*** technology to provide higher-speed access to the Internet. DSL technology is a set of technologies, each differing in the first letter (ADSL, VDSL, HDSL, and SDSL). The set is often referred to as xDSL, where x can be replaced by A, V, H, or S. DSL uses a device called ***ADSL modem*** at the customer site. It uses a device called a ***digital subscriber line access multiplexer (DSLAM)*** at the telephone company site.
8. The ***traditional cable networks*** use only coaxial cables to distribute video information to the customers. The ***hybrid fiber-coaxial (HFC) networks*** use a combination of fiber-optic and coaxial cable to do so.

9. To provide Internet access, the cable company has divided the available bandwidth of the coaxial cable into three bands: video, downstream data, and upstream data. The ***downstream-only video band*** occupies frequencies from 54 to 550 MHz. ***The downstream data*** occupies the upper band, from 550 to 750 MHz. The ***upstream data*** occupies the lower band, from 5 to 42 MHz.
10. The ***cable modem (CM)*** is installed on the subscriber premises. The ***cable modem transmission system (CMTS)*** is installed inside the distribution hub by the cable company. It receives data from the Internet and passes them to the combiner, which sends them to the subscriber. The CMTS also receives data from the subscriber and passes them to the Internet.

Exercises

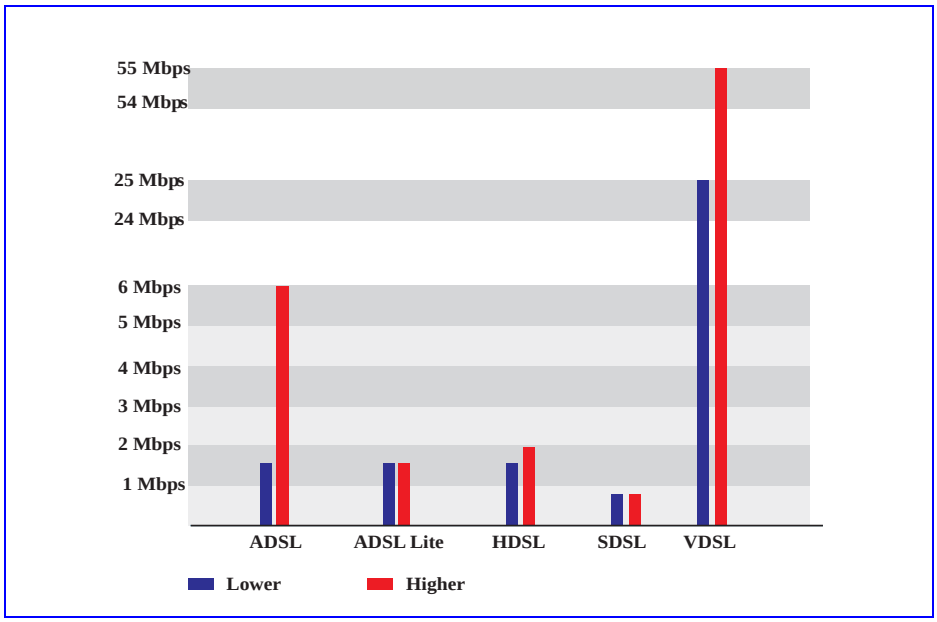
11. ***Packet-switched*** networks are well suited for carrying data in packets. The end-to-end addressing or local addressing (VCI) occupies a field in each packet. Telephone networks were designed to carry voice, which was not packetized. A ***circuit-switched*** network, which dedicates resources for the whole duration of the conversation, is more suitable for this type of communication.
12. ***The setup phase*** can be matched to the dialing process. After the callee responds, the ***data transfer phase*** (here voice transfer phase) starts. When any of the parties hangs up, the data transfer is terminated and the ***teardown phase*** starts. It takes a while before all resources are released.
13. In a telephone network, the ***telephone numbers*** of the caller and callee are serving as source and destination addresses. These are used only during the setup (dialing) and teardown (hanging up) phases.
14. The ***delay*** can be attributed to the fact that some telephone companies use ***satellite*** networks for overseas communication. In these case, the signals need to travel several thousands miles (earth station to satellite and satellite to earth station).
15. See Figure 9.1.

Figure 9.1 *Solution to Exercise 15*



16. See Figure 9.2.

Figure 9.2 *Solution to Exercise 16*



17.

a. V.32 → **Time = (1,000,000 × 8) /9600** ≈ **834 s**
b. V.32bis → **Time = (1,000,000 × 8) / 14400** ≈ **556 s**
c. V.90 → **Time = (1,000,000 × 8) / 56000** ≈ **143 s**

18.

a. ADSL → **Time = (1,000,000 × 8) / 1,500,000** ≈ **5.3 s**
b. ADSL Lite → **Time = (1,000,000 × 8) / 1,500,000** ≈ **5.3 s**
c. HDSL → **Time = (1,000,000 × 8) / 1,500,000** ≈ **5.3 s**
d. SDSL → **Time = (1,000,000 × 8) / 768,000** ≈ **10.42 s**
e. VDSL → **Time = (1,000,000 × 8) / 25,000,000** ≈ **0.32 s**

19. We can calculate time based on the assumption of 10 Mbps data rate:

$$\text{Time} = (1{,}000{,}000 \times 8) / 10{,}000{,}000 \approx 0.8 \text{ seconds}$$

20. The ***DSL*** technology is based on ***star*** topology with the hub at the telephone office. The local loop connects each customer to the end office. This means that there is no sharing; the allocated bandwidth for each customer is not shared with neighbors. The data rate does not depend on how many people in the area are transferring data at the same time.

21. The ***cable modem*** technology is based on the ***bus*** (or rather tree) topology. The cable is distributed in the area and customers have to share the available bandwidth. This means if all neighbors try to transfer data, the effective data rate will be decreased.