CHAPTER 14

PRACTICE SET

Questions

Q14-1. The telephone network is made of three major components: *local loops*, *trunks*, and *switching offices*.

Q14-3. *Signaling System Seven* (SS7) is the protocol used to provide signaling services in the telephone network. It is somehow similar to the five-layer Internet model.

Q14-5. *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.

Q14-7. 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.

Q14-9. 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.

Q14-11. SONET defines a hierarchy of electrical signaling levels called *synchronous transport signals* (STSs). SDH specifies a similar system called a *synchronous transport modules* (STMs).

Q14-13. *STSs* are the hierarchy of electrical signals defined by the SONET standards. *OCs* are the corresponding optical signals.

Q14-15. A single clock handles the timing of transmission and equipment across the entire network.

Q14-17. SONET defines four layers: *path*, *line*, *section*, and *photonic*.

Q14-19. *A virtual tributary* is a partial payload that can be inserted into an STS-1 and combined with other partial payloads to fill out the frame. Instead of using all 86 payload columns of an STS-1 frame for data from one source, we can subdivide the SPE and call each component a VT.

Q14-21. The larger data items can block the access of small data items to the multiplexers. This results in unusual delays for small items. This may cause the small data items to be assumed lost and resent.

Q14-23. A transmission path (TP) is the physical connection between a user and a switch or between two switches. It is divided into several (VPs), which provide a connection or a set of connections between two switches. VPs in turn consist of several virtual circuits (VCs) that logically connect two points together.

Q14-25.

a. The *Application Adaptation Layer* (AAL) allows existing networks to connect to ATM facilities by mapping packet data into fixed-sized ATM cells.

b. The *ATM layer* provides routing, traffic management, switching, and multiplexing services.

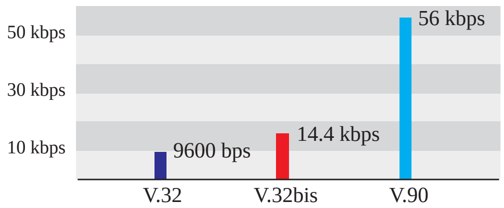
c. The *Physical layer* defines any transmission media that can be the carrier of the cells.

Problems

P14-1. 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.

P14-3. 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.

P14-5. Although we did not discuss these rate in the book, the following information can be obtained from the Internet.



P14-7. We can calculate the time based on the assumption of 56 Kbps data rate:

$$\text{Time} = (1{,}000{,}000 \times 8) / 56{,}000 \approx 143 \text{ seconds}$$

P14-9. We can calculate the time based on the assumption of 10 Mbps data rate:

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

P14-11. 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.

P14-13. Each STS-*n* frame carries (9 × ***n*** × 86) bytes of bytes. SONET sends 8000 frames in each second. We can then calculate the user data rate as follows:

$$\text{STS-3} \rightarrow 8000 \times (9 \times \mathbf{3} \times 86) \times 8 = 148.608 \text{ Mbps}$$
$$\text{STS-9} \rightarrow 8000 \times (9 \times \mathbf{9} \times 86) \times 8 = 445.824 \text{ Mbps}$$
$$\text{STS-12} \rightarrow 8000 \times (9 \times \mathbf{12} \times 86) \times 8 = 594.432 \text{ Mbps}$$

P14-15. The user data rate of STS-1 is (8000 × 9 × 86 × 8) = 49.536 Mbps. To carry a load with a data rate 49.540, we need another 4 kbps. This means that we need to insert 4000 / 8 = 500 bytes into every 8000 frames. In other words, 500 out of every 8000 frames need to allow the H3 byte to carry data. For example, we can have sequences of 16 frames in which the first frame is an overloaded frame and then 15 frames are normal.

P14-17.

a. The minimum number of cells is 1. This happens when the data size £ 36 bytes. Padding is added to make it exactly 36 bytes. Then 8 bytes of header creates a data unit of 44 bytes at the SAR layer.

b. The maximum number of cells can be determined from the maximum number of data units at the CS sublayer. If we assume no padding, the maximum size of the packet is 65535 + 8 = 65543. This needs 65543 / 44 ≈ 1489.61. The maximum number of cells is 1490. This happens when the data size is between 65,509 and 65,535 (inclusive) bytes. We need to add between 17 to 43 (inclusive) bytes of padding to make the size 65552 bytes. The 8 byte overhead at the CS layer makes the total size 65560 which means 1490 data units of size 44.