Tutorial 8 Solutions

Instructions

1. Form ad-hoc groups of 2 to 3 students to solve this week's exercise.
2. Each group must answer the following review Q's
3. Each group will use shared google docs to work with all group members and tutor. The document must include the group members' names and the tutorial sheet number.

Review Questions

1. Q6-1. Compare the medium of a wired LAN with that of a wireless LAN in today's communication environment.

   Answer: The medium of a wired LAN is guided (cable or wire); the medium of a wireless LAN is unguided (air).

2. Q6-2. Explain why the MAC protocol is more important in wireless LANs than wired LANs?

   Answer: In the case of wired LANs, we have moved from a shared medium to a dedicated medium (point-to-point communication). In this situation a MAC protocol, such as CSMA/CD, is not needed anymore. In the case of a wireless LAN, the medium (air) is still shared between the users. We need MAC protocols such as CSMA/CA or channelization protocols to control sharing the medium.

3. Q6-3. Explain why there is more attenuation in a wireless LAN than in a wired LAN, ignoring the noise and the interference.

   Answer: Propagation in a wireless LAN is not confined as in a wired LAN. In a wired LAN, propagation is confined to the wires. Most of the original power may reach the destination. In a wireless LAN, the power is distributed in a sphere with the sender at the center and the receiver at one point on the surface. Only a part of the power arrives at the receiver; the rest is lost in the air.

4. Why is SNR in a wireless LAN normally lower than SNR in a wired LAN?

   ***Solution**: SNR is the ratio of the signal power to the noise power. If the signal power is decreased or the noise power is increased, SNR will decrease. In a wireless LAN, the signal power is less (using batteries). The noise power is higher in a wireless LAN because the noise is not controlled. The noise from any source can affect the signal exchanged between the sender and the receiver.*

5. Q6-5. What is multipath propagation? What is its effect on wireless networks?

   ***Solution**: In a wireless environment, a receiving station may receive more than one signal from the same sender related to the same message. One of these signals can be the one received directly; the others are signals reflected back from some barrier.*

Since the signals have travelled different distances, they can be out of phase. The combination of these signals creates a signal which is the distorted version of the original signal sent by the sender. It is sometimes difficult to detect the original message.

6. Q6-9. There is no acknowledgment mechanism in CSMA/CD, but we need this mechanism in CSMA/CA. Explain the reason .

   Answer: The lack of collision in CSMA/CD serves as an indication that data arrived safely.

   In CSMA/CA, the sending station does not check the possibility of collision; an acknowledgment is needed to insure that a collision did not occur and the frame arrived at its destination.

7. Q6-14. An AP may connect a wireless network to a wired network. Does the AP need to have two MAC addresses in this case?

   ***Solution**: No! The answer is negative. The MAC addresses are coming from the same address space. Only one MAC address can serve in this case.*

8. Q6-15. An AP in a wireless network plays the same role as a link-layer switch in a wired network. However, a link-layer switch **may or may not** have a MAC address, but an AP normally **needs** a MAC address. Explain the reason.

   Solution:

   *In a **wired network**, a link-layer switch is connected to the hosts via point-to-point dedicated connections; there is no need for addresses for communication between hosts and the switch.*

   *In a **wireless network**, an AP is connected to the hosts via a **multicast network (air);** the MAC addresses of the host and the AP make the communication more efficient; when a host sends a frame to the AP, all other hosts drop the received copy of the frame at the MAC sublayer when they find that the frame does not belong to them.*

9. Q6-12. Explain why we have only one frame type in a wired LAN, but four frame types in a wireless LAN?

   ***Solution:** In a wired LAN, the medium access process is achieved using the collision detection mechanism. In a wireless LAN, the same task is done using the RTS, CTS, and ACK frames. We need all of these as well as data frames.*

10. Q6-13. Do the MAC addresses used in an 802.3 (Wired Ethernet) and the MAC addresses used in 802.11 (Wireless Ethernet) belong to two different address spaces?

    ***Solution**: The answer is negative. The addresses are selected from the same address space. For example, if locally there are one wireless and one wired device, they cannot have the same MAC address; addresses should be unique.*

11. Compare and contrast satellite-based and terrestrial wireless communications link

design?

***Solution**: There are a number of differences between satellite-based and terrestrial wireless communications that affect design:*

The area of coverage of a satellite system far exceeds that of a terrestrial system. In the case of a geostationary satellite, a single antenna is visible to about one-fourth of the earth's surface.

Spacecraft power and allocated bandwidth are limited resources that call for careful trade-offs in earth station/satellite design parameters.

Conditions between communicating satellites are more time invariant than those between satellite and earth station or between two terrestrial wireless antennas. Thus, satellite-to-satellite communication links can be designed with great precision.

Transmission cost is independent of distance, within the satellite's area of coverage.

Broadcast, multicast, and point-to-point applications are readily accommodated. Very high bandwidths or data rates are available to the user.

Although satellite links are subject to short-term outages or degradations, the quality of transmission is normally extremely high.

For a geostationary satellite, there is an earth-satellite-earth propagation delay of about one-fourth of a second. A transmitting earth station can in many cases receive its own transmission.