

Quiz Dec-18

1. Match the approximate transmission rate with the the wireless technology that achieves that rate. Of course, sender/receiver distance, noise and other factors determine actual transmission speed

- A. 802.11 ax
- B. 5G cellular
- C. 802.11 ac
- D. 4G LTE
- E. 802.11 g
- F. Bluetooth

- a) hundreds of Mbps
- b) 14 Gbps
- c) 54 Mbps
- d) 2 Mbps
- e) 10 Gbps
- f) 3.5 Gbps

2. What is meant when we say that a network of devices is operating in "infrastructure mode"? (choose 1)

- a) Devices communicate with each other and to the larger outside world via a base station (also known as an access point).
- b) All network equipment, except the mobile devices, must be racked in a temperature-controlled and power-smoothed building.
- c) The mobile device is operating in a reduced power mode, forcing the network base station and routers to take on additional functionality that would normally be done by the mobile.
- d) Network devices can communicate directly with each other, with no need for messages to be relayed through a base station. The devices are the "infrastructure".

3. Which of the following statements about the characteristics of wireless links are true?

- a) Path loss refers to the dropping of link-layer frames that are being relayed among wireless access points due to buffer overflow, just as network-layer datagrams are dropped at routers with full buffers.
- b) The "hidden terminal problem" happens when A sends to B over a wireless channel, and an observer, C (that is further away from A than B), does not detect/receive A's transmission because the signal strength of A's transmission has faded significantly by the time it reaches C.
- c) The "hidden terminal problem" refers to the fact that many people can never seem to find their mobile phones.
- d) Path loss refers to link-layer frames that are corrupted due to the higher bit error rates in wireless channels.
- e) The bit error rate (BER) of a wireless channel increases as the signal-to-noise ratio (SNR) increases.
- f) Multipath propagation occurs when a sender sends multiple copies of a frame to a receiver, which is relayed over different by base stations or other wireless devices to the receiver.
- g) Path loss refers to the decrease in the strength of a radio signal as it propagates through space.

- h) The "hidden terminal problem" happens when A sends to B over a wireless channel, and an observer, C (that can be even closer to A than B), does not detect/receive A's transmission because of physical obstacles in the path between A and B.
- i) Multipath propagation occurs when portions of the electromagnetic wave reflect off objects and the ground taking paths of different lengths between the sender and a receiver, and thus arriving at the receiver at slightly different points in time.
- j) The bit error rate (BER) of a wireless channel decreases as the signal-to-noise ratio (SNR) increases.
- k) The "hidden terminal problem" happens when A sends to B over a wireless channel, and an observer, C (that can be even closer to A than B), does not detect/receive A's transmission because of physical obstacles in the path between A and C.

4. What is the purpose of a beacon frame in WiFi (802.11) networks? (choose 1)

- a) A beacon frame allows a mobile device to signal that it is ready to receive a frame.
- b) A beacon frame allows a node with a directional antenna to aim the antenna towards the beacon point to maximize the quality of the send and receive signal.
- c) A beacon frame allows a mobile node to determine the direction in which it should move in order to obtain an increasing signal strength.
- d) A beacon frame allows an access point to advertise its existence, and the frequency channel it is operating on, to devices that want to connect to an access point.

5. Why are link-layer ACKs used in WiFi (802.11) networks? (choose 2)

- a) Because of the hidden terminal problem, a node that is transmitting and hears no collisions still doesn't know if there was a collision at the receiver.
- b) The sender can use the differences in the signal strength in an ACK to infer whether the receiver is moving towards, or away from, the sender.
- c) Hearing a receiver ACK, all other stations will stop transmitting. This reduces collisions.
- d) Wireless links are noisier than wired links, and so bit level errors are more likely to occur, making link-layer error recovery more valuable than in less-noisy wired links.

6. Why does the WiFi (802.11) link-layer frame have three addresses? (choose 1)

- a) Because both the access point that will relay this frame to the intended link-layer receiving host or router interface, as well as that intended destination host or router interface need to be specified.
- b) Because there may be two hosts or routers that are possible destinations for this link-layer frame and we need to identify which of these is the intended receiver.
- c) Because the sender of this frame can be either the access point or a link-layer host or router interface, and we need to identify which of these two is the sender.

7. What is the purpose of RTS (request to send) and CTS (clear to send) frames in WiFi (802.11) networks? Select one or more of the answers below. (choose 2)

- a) RTS/CTS frames help nodes in a wireless network mitigate the effects of the hidden terminal problem.
- b) A CTS that is sent allows a receiver to force other nodes (other than the intended sender who sent the RTS) to refrain from transmitting, thus allowing the sender who sent the RTS to then transmit a frame with less likelihood of a collision.

- c) A CTS allows a receiver to let the sender (who sent that RTS) know that it (the receiver) has enough buffers to hold a frame transmitted by that sender
- d) RTS/CTS frames allow a sender to gather CTS frames from all other network nodes, so that it knows it can then send without collisions.

8. Which of the following statement are true about the 802.11 (WiFi) MAC protocol? (choose 1)

- a) The 802.11 MAC protocol performs collision detection. That is, an 802.11 sender will listen to the channel while it is transmitting, and stop transmitting when it detects a colliding transmission from another node.
- b) The 802.11 MAC protocol performs collision avoidance. That is, an 802.11 sender and receiver can use approaches such as RTS/CTS, inter-frame spacing, and explicit acknowledgments to try avoid, rather than detect, colliding transmissions from another node.
- c) The 802.11 MAC protocol performs carrier sensing. That is, it listens before transmitting and will only transmit if the channel is sensed idle.

9. Which of the following statement are true about the Bluetooth protocol? (choose 1)

- a) Bluetooth uses TDM, FDM, polling, error detection and correction, and has sleep modes to conserve device power. Pretty sophisticated for a consumer technology!
- b) Bluetooth networks have a centralized controller that serves to coordinate the various client devices in a Bluetooth piconet.
- c) Bluetooth transmission rates can be as high as in WiFi networks.
- d) Bluetooth transmits all frames in the same frequency band.

10. Match the function of an element in the 4G LTE architecture with its name, using the pulldown menus.

- A. Located in a mobile device's home network, this element provides authentication, access privileges in home and visited networks.
 - B. This router in a cellular carrier's network, coordinates packet forwarding and routing to outside the carrier's network.
 - C. This element coordinates mobile device services - authentication, mobility management - for a mobile resident in that network.
 - D. This element is on the network side of wireless link into the LTE network.
 - E. This element is the wireless link between mobile device and a base station
- a) Home Subscriber Server (HSS)
 - b) Serving Gateway (S-GW)
 - c) Base Station (eNode-B)
 - d) Radio Access Network (RAN)
 - e) Mobility Management Entity (MME)

11. In 4G LTE cellular systems, what is an International Mobile Subscriber Identity (IMSI)? (choose 1)

- a) A 64-bit identifier that identifies the cellular network to which an mobile subscriber is attaching. Somewhat analogous to the Autonomous System (AS) number used in BGP to identify/name networks.
- b) A fancy name for a globally unique phone number, including country code.
- c) Assigned by a mobile carrier network to a device, when the device attaches to the radio access network, serving a similar link-layer role as MAC addresses in a wired network.
- d) A 64-bit identifier stored on a cellular SIM (Subscriber Identity Module) card that identifies the subscriber in the worldwide cellular carrier network system.

12. Which of the following statements is true about “sleep modes” that allow a wireless device to “sleep” and occasionally “wake up” as a technique for saving battery life? (choose 1)

- a) WiFi provides sleep modes but LTE does not.
- b) LTE provides sleep modes but WiFi does not.
- c) Neither WiFi nor LTE provide sleep modes.
- d) Both WiFi and LTE provide sleep modes.

13. Which of the following statements is true about how 4G cellular networks (operated by different carriers/companies) connect together?

- a) 4G networks are generally all-IP, and so cellular networks interconnect (peer) directly to each other, or peer at the cellular equivalents of the Internet Exchange Points that we saw used for interconnecting wired networks in the public Internet.
- b) 4G networks connect to each other using the existing phone interconnection networks from earlier 3G and 2G networks.
- c) In a 4G network, the radio access network connects to the legacy phone network for voice calls, but to the public Internet for data connections.