CS 168 Introduction to the Internet: Architecture and Protocols
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Discussion 13: Wireless

1 True or False

1. Wireless is a fundamentally shared medium.

   (a) True (b) False

2. RTS/CTS with carrier sense solves the exposed terminal problem and the hidden terminal problem.

   (a) True (b) False

3. The path loss of a wireless transmission is always the same in all directions

   (a) True (b) False

4. CSMA is a method which listens for other transmissions and does not transmit if others already are transmitting.

   (a) True (b) False

5. The physical layer can define data using a change in voltages, amplitudes, frequencies, and or phases.

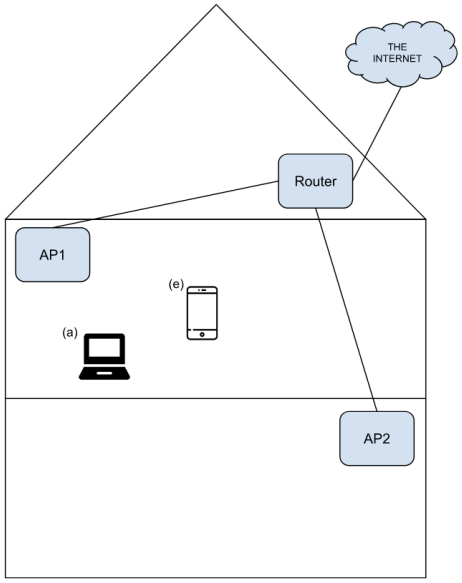
   (a) True (b) False

6. Cellular networks are built on top of the same priorities as the internet.

   (a) True (b) False

2 WiFi

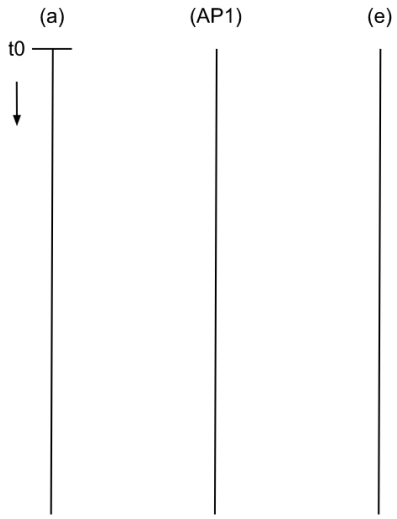
Consider the following home network, with multiple users and devices. There are two access points (AP1 and AP2). The router is connected to the internet (ignore the details of this) and the access points are connected to the router over ethernet. Devices connect to access points over WiFi.



Each access point periodically (100ms) broadcasts beacon messages with SSID and MAC addresses, allowing for discovery. You've been tasked with designing a medium access control algorithm for in-home devices!

1. Devices (a) and (e) both are in range of AP1, but not AP2, they are also in range of each other, so you attempt to use CSMA.

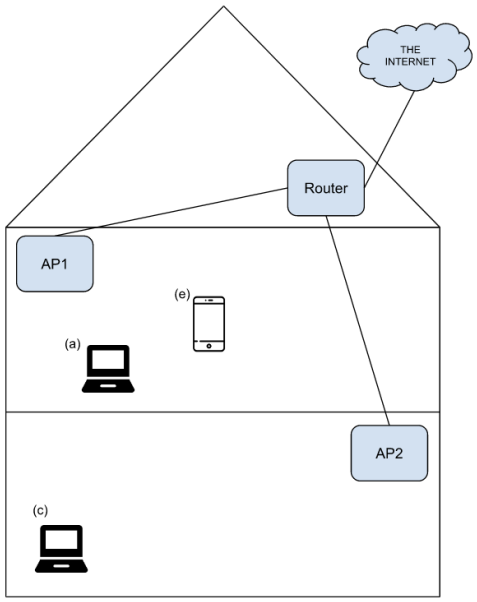
   (a) If (a) starts transmitting first at t0, draw the transmission path and notate the propagation delay to (e) on the following figure.



(b) If (e) runs CSMA during this propagation delay, will (e) transmit data and if so what will happen?

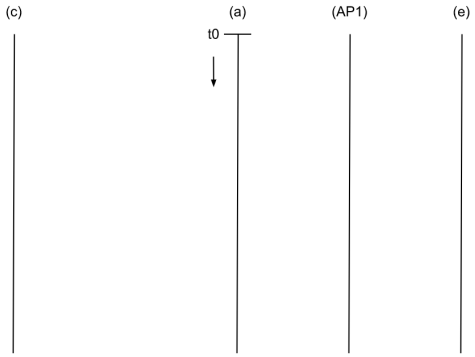
(c) If (e) runs CSMA after this propagation delay, will (e) transmit data and if so what will happen?

2. In part one, you used CSMA and listened to the medium long enough to allow (a) and (e) to take turns. But now, device (c) is present in the home. Device (c) connects to AP1 as well, but device (e) and device (c) are not in range of each other.

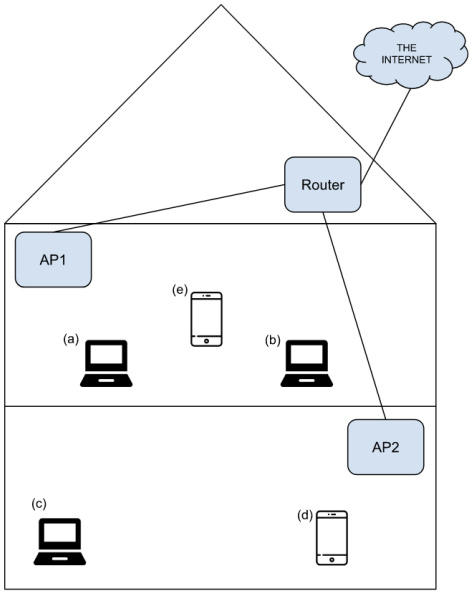


(a) What is the problem with your current CSMA approach in this case?

(b) You decide to use RTS/CTS to fix your problem. Notate the transmissions between the participating devices. Assume that (a) transmits first, then (c) and then (e) and that there are no RTS collisions.



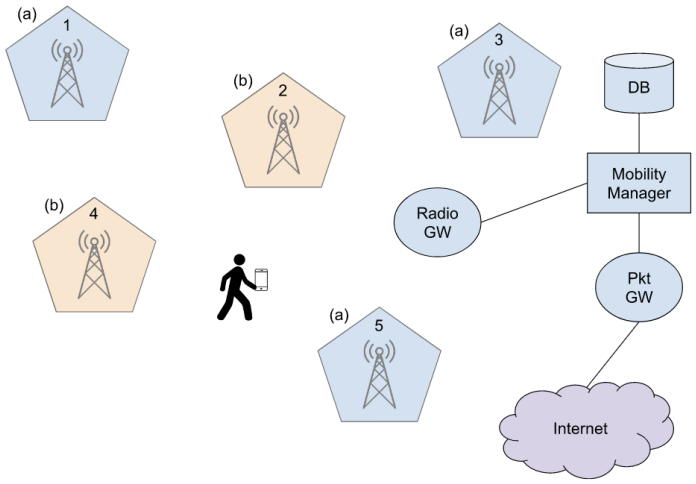
3. In part two, with three devices there was not an issue with RTS collisions, but now even more devices are added to the network, talking to multiple APs.



(a) What should a transmitter do if an RTS does not result in a corresponding CTS?

3 Cellular

In the following cellular architecture, the user is registered with the cellular operator (a) shown in blue and labeled with (a). As the user moves around the area, they discover and transfer data using different cellular towers.



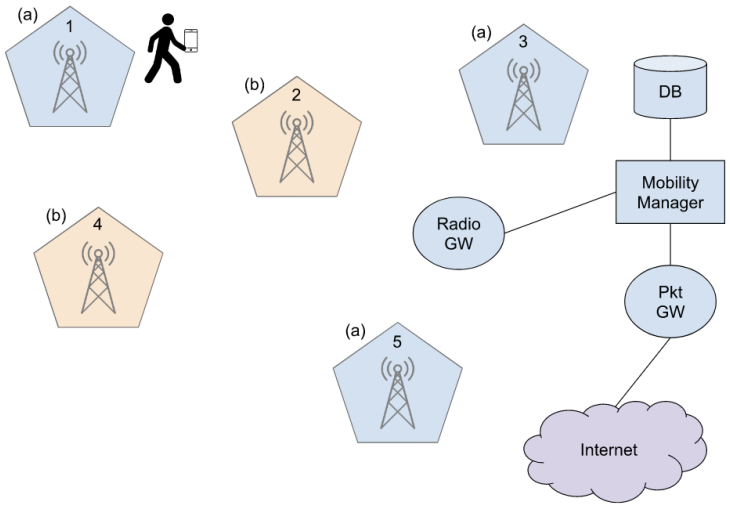
1. The user device is registered with operator (a), and gets the following beacons from the different towers with different received signal strength indicators (RSSI).

Tower	RSSI	Operator
1	-75dBm	(a)
2	-23dBm	(b)
3	-84dBm	(a)
4	-32dBm	(b)
5	-42dBm	(a)

   (a) Which tower should the user device connect to?

   (b) What entity in the cellular core processes the attach request from the user device?

2. Now the user moves as shown below and a handoff to tower 1 must occur.



(a) Who participates in the handoff? Circle all that apply.

i. User Device
ii. Packet Gateway
iii. Tower 1
iv. Old Tower (from part 1)
v. Tower 4
vi. Mobility Manager

(b) Who initiates the handoff?

i. User Device
ii. Packet GW
iii. Tower 1
iv. Old Tower (from part 1)
v. Tower 4
vi. Mobility Manager