



A12.2 Topologies and wireless networks

Networks and the web · A level · OCR H446 1.3.3, AQA 7517 4.9.2.1,
Eduqas A500QS 2.1 · about 25 min

Name _____

Class _____

Date _____

What this lesson is about

Physical and logical bus and star; Wi-Fi, SSIDs, WPA2 and CSMA/CA with RTS/CTS.

- Bus and star, physically
- Physical star, logical bus
- Wireless networking
- CSMA/CA

Questions

6 marks in all

1. Devices are cabled to a central hub, which repeats every frame out of every port. What is the network's topology? [1 mark]

- ☐ A Physical star, logical bus
- ☐ B Physical bus, logical star
- ☐ C Physical star, logical star
- ☐ D Physical bus, logical bus

2. Which of these are advantages of a physical star over a physical bus? Choose all that apply. [1 mark]

Tick every answer that is true.

- ☐ A A single cable failure only affects one device
- ☐ B It uses less cable
- ☐ C Performance holds up better when the network is busy
- ☐ D There is no central device that could fail

3. Why does Wi-Fi use collision avoidance rather than detecting collisions? [1 mark]

- ☐ A A transmitting wireless device cannot hear other signals over its own, so it cannot detect a collision
- ☐ B Wireless signals never collide
- ☐ C Collision detection needs a hub
- ☐ D RTS/CTS is only possible on cables

4. Put the steps of CSMA/CA with RTS/CTS in order. [1 mark]

Number the lines 1 to 6 to put them in the right order.

- ___ Send a request to send (RTS)
- ___ Receive clear to send (CTS) from the access point
- ___ Transmit the data frame
- ___ If it is busy, wait a random back-off time and listen again
- ___ Wait for an acknowledgement (ACK)
- ___ Listen to check whether the channel is idle

5. What problem does RTS/CTS solve?

[1 mark]

- ☐ A Two devices that cannot hear each other both transmit to the access point at once (the hidden node problem)
- ☐ B A device forgetting the SSID
- ☐ C Devices with spoofed MAC addresses
- ☐ D Weak encryption keys

6. Why is a MAC address allow list, on its own, weak protection for a wireless network?

[1 mark]

- ☐ A MAC addresses can be read from captured frames and copied (spoofed)
- ☐ B MAC addresses change every time a device joins
- ☐ C Access points cannot read MAC addresses
- ☐ D It stops the SSID being broadcast

The task: wait for a quiet channel

The Neighbour is sending frames for the first couple of seconds. The AccessPoint replies CTS bot when it hears RTS, and ACK bot when it hears a message starting DATA. Both replies come about 0.2 s later. Carry out CSMA/CA with RTS/CTS: 1. Call `messages()` once to clear anything old. Then listen for a window of 0.4 s: `wait(0.4)`, then `messages()`. 2. If anything arrived in the window, print `busy`, `backing off`, wait a random time from 0.1 to 0.5 seconds (`random.uniform(0.1, 0.5)`), and listen for another window. Repeat until a window is silent. 3. Print `channel clear` and send RTS. 4. Wait for a message starting CTS, checking `messages()` every 0.1 s for up to 2 seconds. When it comes, print `got CTS` and send DATA `hello`. 5. Wait the same way for a message starting ACK, then print `got ACK`. The robot does not drive.

```
# the two lines every program starts with: the commands, then the robot
from bugbot import *
connect()
import random

send("RTS")
wait(1)
print(messages())
```

Plan your program here, then type it in and press Run.



Do it on the robot

www.bugbotlab.com/learn/a12-2-topologies-and-wireless/

The simulator checks it and tells you when it passes. Nothing to install, no account.

Challenges

1. Count how many times you backed off and print the total. Run it with different values in `random.uniform`: what changes?
2. Real Wi-Fi doubles the maximum back-off each time a frame goes unacknowledged. Add that to your retry loop.
3. Draw a physical star with a switch at the centre. Explain why its logical topology is a star, not a bus.