

COMP90007 Internet Technologies

Semester 2, 2020

Mid-Semester Exam Solution

Question 1

The transmission media used in the physical layer can be wired or wireless. Compare wireless medium microwave with wired medium fibre optics:

- (1) List both the advantages and disadvantages of these two media.
- (2) Describe one typical scenario when it is better to use fibre optics than wireless transmission.

(1) The advantages and disadvantages of these two transmission media include:

Microwave:

- + Naturally supports mobility
- + Naturally supports broadcast
- Transmissions interfere and must be managed
- Signal strengths hence data rates vary greatly

Fibre optics:

- + Easy to maintain a fixed data rate over point-to-point links
- + Provide high data rates over long distances.
- Can be expensive to deploy, esp. over distances or places hard to reach
- Doesn't readily support mobility or broadcast

(2) When it is better to use fibre optics: backbone links between ISP facilities

Question 2

Calculate the Internet checksum (with 4-bit word) using one's complement arithmetic for sending data 1001 0011 1110 0110.

- (1) Show your calculation.
- (2) Briefly explain how the receiver can use this checksum to detect any errors.
- (3) Can the receiver correct errors using the checksum? Why or why not?

(1) $1001 + 0011 = 1100$

$1100 + 1110 = 1010 + 1$ (move overflow to last bit) = 1011

$1011 + 0110 = 0001 + 1$ (move overflow to last bit) = 0010

One's complement: 1101

Checksum: 1101

(2) The receiver compute checksum for 1001 0011 1110 0110 1101 to see if the result is 1111. If it is not, there are errors.

- (3) The checksum cannot help receiver to correct error, as it cannot locate the errors.
Another valid reason is that based on Hamming distance, the Hamming distance of checksum is 2, so it cannot even correct a single error.

Question 3

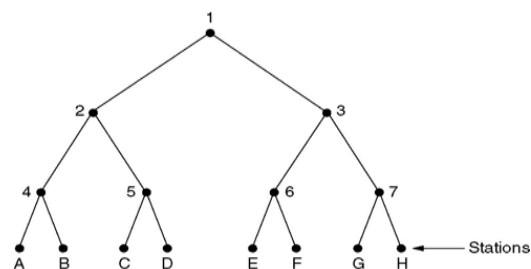
The link utilisation can be measured by the proportion of transmission time among total communication time. For a stop and wait protocol, given a link with bandwidth 10 Mbps, one-way propagation delay 10 ms.

- (1) What is the link utilisation to transmit a frame of 1500 bytes? Show your calculation.
- (2) How can sliding window protocols improve the link utilisation? (using 2-3 sentences)

- (1) Link utilisation = $L / (L + 2Tp)$ = $1500 \times 8 / (1500 \times 8 + 2 \times 0.01 \times 10^7) = 5.66\%$
 (2) Sliding window protocols allow senders to keep transmitting the frames in the sliding window before receiving acknowledgements. The sender can increase the proportion of transmission time, which increases the link utilisation.

Question 4

We have an 8-station network with stations labelled as A, B, C..., H. All stations are competing to transmit using Adaptive Tree Walk protocol. Using the tree given below, show step by step what happens **in each timeslot** if A, C, D and G have data to send now.



- (1) Slot 1: A, C, D, G - collision
- (2) Slot 2: A, C, D - collision
- (3) Slot 3: A can send
- (4) Slot 4: C, D - collision
- (5) Slot 5: C can send
- (6) Slot 6: D can send
- (7) Slot 7: G can send

Question 5

Given a network A with prefix 128.18.3.0/25.

- (1) What is the maximum number of hosts that this network can represent?
- (2) Given an IP address 128.18.3.140, does this address belong to network A? Explain your reasoning.

- (1) The length of host portion is $32 - 25 = 7$, so the number of hosts are $2^7 = 128$
 (2) Network A starts from: 128.18.3.0 and the block ends at 128.18.3.127, this IP address 128.18.3.140 doesn't belong to network A.