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Q1.

1).

$total\ size\ of\ clip = 0.5\ (s) \times 30\ (fps) \times (1280 \times 720)\ (pixels) \times 3\ ({}^{bytes}/_{pixel}) \times 8 =$

$331776000\ bit$

$$T_{delay} = \frac{total\ size\ of\ clip}{rate\ of\ transmission} = \frac{331776000\ (bit)}{1 \times 10^6\ (bps)} = 331.776\ sec$$

$$P_{delay} = \frac{length\ of\ channel}{speed\ of\ signals} = \frac{10000(km)}{200000({}^{km}/_{s})} = 0.05\ sec$$

$$Latency = L = T_{delay} + P_{delay} = 331.776(sec) + 0.05(sec) = 331.826\ sec$$

2).

$$T_{delay} = \frac{total\ size\ of\ clip}{rate\ of\ transmission} = \frac{331776000\ (bit)}{100 \times 10^6\ (bps)} = 3.31776\ sec$$

$$P_{delay} = \frac{length\ of\ channel * 2}{speed\ of\ signals} = \frac{2 * 36000(km)}{300000({}^{km}/_{s})} = 0.24\ sec$$

$$Latency = L = T_{delay} + P_{delay} = 3.31776(sec) + 0.24(sec) = 3.55776\ sec$$

Q2.

1).

Given it's a noisy channel, we can use Shannon's theorem:

$$Max.data\ rate = B \times \log_2\left(1 + \frac{S}{N}\right) = 8 \times 10^3 \times \log_2\left(1 + \frac{S}{N}\right) \geq 64 \times 10^3 (bps)$$

$$then\ we\ can\ get: \frac{S}{N} \geq 255$$

$$SNR(dB) = 10 \times \log_{10}\left(\frac{S}{N}\right) \geq 10 \times \log_{10}(255)$$

$$10 \times \log_{10}(255) = 24.0654\ dB$$

In conclusion, to support a data rate of 64 kbps, the minimum signal-to-noise ratio (in dB) should be 24.0654 (dB).

2).

Given it's a noiseless channel, we can use Nyquist's theorem:

$$Max.data\ rate = 2B \times \log_2 V \geq 64 \times 10^3 (bps)$$

$$then\ we\ can\ get: V \geq 16$$

In conclusion, we should use the signal whose level is larger than 16 so that we support a data rate of 64kbps.

Q3.

1). 8 fragments

Each 32-bit data block needs to be split into 8 fragments and transmitted using 8 Hamming (7,4) codes blocks.

2).

7*8=56 bits

3).

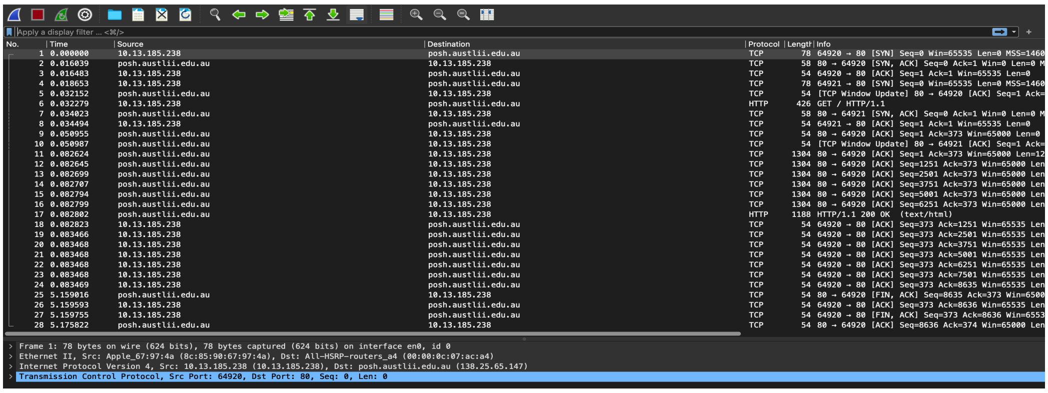
We can interleave codewords in continuous stripe to prevent the effects of consecutive bit (burst) errors. Specifically, we compose the first bit of each encoded block into a new interleaved block, the second bit into another interleaved block, and so on until all the bits are organized into a new, interleaved data block, then we can transmit this interleaved data block to make our system robust to sequences of errors.

Q4.

1. Modularization eases maintenance: Each layer in the model performs a specific function, and the layers are designed to be modular, which makes it easier to upgrade or replace specific components of the network without affecting the entire system.
2. Reduced Complexity: Each layer is independent, and each layer provides services up and down through the interlayer interface without exposing the internal implementation. Since each layer only implements a relatively independent function, an intractable complex problem can be decomposed into several smaller problems that are easier to handle, so that the complexity of the whole problem is reduced.
3. Better scalability: Layered models are scalable, which means that additional layers can be added to accommodate new technologies or protocols. This allows the model to adapt to changing requirements without requiring a complete redesign.

Q5.

1).

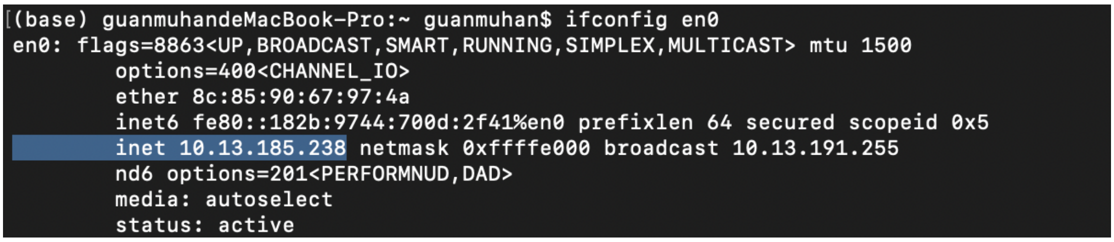


IP address of source:10.13.183.179

IP address of destination: 138.25.65.147

website: http://www.austlii.edu.au/

Way of validation: For the IP address of source, we can validate it by the terminal command line (ifconfig en0) to check if it is the same with the 'Source' column.



For the IP address of destination, we can validate it by typing it directly into browser to check if it is the same website we are capturing.

2).

CONNECT(red square): The client calls the CONNECT primitive to send a SYN packet to the server, indicating a request to establish a TCP connection.

DISONNECT(black square): The server calls the DISCONNECT primitive to send FIN and ACK packets to client ,indicating a request to terminate a connection.