COMP90007 Internet Technologies

Week 3 Workshop

Semester 2, 2018

Question 1 (Layers)

- Identify 2 ways in which the OSI reference model and the TCP/IP reference model are the same.
- Identify 2 ways in which these models differ.

  (*NB: You can use the textbook to solve this question*)

Question 2 (Delay and bandwidth)

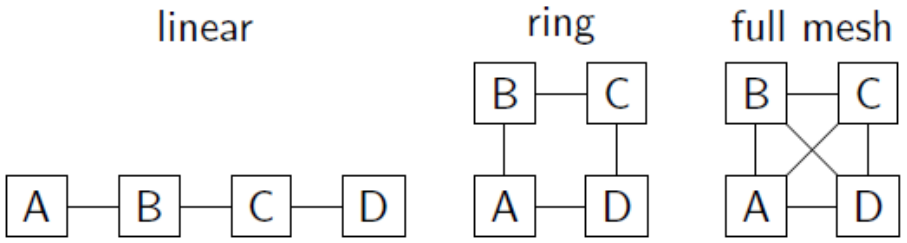
- Calculate the end-to-end transit time for a packet for
  - GEO (*Geostationary orbit*) (altitude: 35,800 km),
  - MEO (*Medium Earth orbit*) (altitude: 18,000 km) and
  - LEO (*Low Earth orbit*) (altitude: 750 km) satellites.

Question 3 (Delay and bandwidth)

- An image is 1600 × 1200 pixels with 3 bytes/pixel. Assume the image is uncompressed.
  - How long does it take to transmit it over a 56-kbps modem channel, assuming zero propagation delay over the channel?
  - Over a 1-Mbps cable modem? Over a 10-Mbps Ethernet?
  - Over 100-Mbps Ethernet? Over gigabit Ethernet?

Question 4 (Topology)

- Consider the following 3 network topologies for connecting N nodes. In the general case of an N node network:



  - (a) How many links are there in each network?
  - (b) What is the maximum delay between any pair of nodes, assuming each link has a delay of 10ms, and the shortest path is used between nodes?
  - (c) What is the minimum number of links that need to be cut in order to isolate one or more nodes?
  - (d) Which topology would you use to connect military command centres?

Question 5 (Topology)

- Is an oil pipe a simplex system, a half-duplex system, a full duplex system or none of the above? Under which conditions?

Question 6 (Sampling)

- Consider a telephone signal that is bandwidth limited to 4 kHz.
  - (a) At what rate should you sample the signal so that you can completely reconstruct the signal?
  - (b) If each sample of the signal is to be encoded at 256 levels, how many bits/symbol are required for each sample?
  - (c) What is the minimum bit rate required to transmit this signal?

Question 7 (Sampling)

- Is the Nyquist theorem true for optical fibre or only for copper wire?

Question 8 (Sampling)

- A noiseless 4 kHz channel is sampled every 1 ms. What is the maximum data rate of the communications channel?

Question 9 (Sampling)

- The bandwidth of a television video stream is 6 MHz. How many bits/sec are sent if four-level digital signals are used? Assume a noiseless channel.

Question 10 (Sampling)

- Radio antennas often work best when the diameter of the antenna is equal to the wavelength of the radio wave. Reasonable antennas range from 1 cm to 5 meters in diameter. What frequency range does this cover?

Question 11 (Modulation)

- Ten signals of bandwidth 4 kHz, are multiplexed onto a single channel using FDM (*frequency division multiplexing*). What is the minimum bandwidth required for the multiplexed channel? Assume that guard bands of 400 Hz are used.

Question 12 (Modulation)

- In a constellation diagram, all points lie on a circle centred on the origin. What kind of modulation is being used?