COMP90007 Internet Technologies
Semester 1, 2018
Due date: March 23rd March, 5:00 pm, 2018
Assignment 1 – Suggested Solutions

Question 1

In a system with 5-layer protocol hierarchy, applications generate messages of length *M* bytes. Assuming each layer has a different header size: 20-byte, 20-byte, 20-byte, 100-bytes and 150-bytes for Layers 1, 2, 3, 4 and 5 respectively. What fraction of the network bandwidth is filled with headers?

Ans:
The total number of header bytes per message = (20+20+20+100+150).
Hence the space wasted on headers = 310.
The total message size is then M + 310.
The fraction of bandwidth wasted on headers = 310/(M + 310).

Question 2

An image is 1920 × 1080 pixels with 3 bytes/pixel. Assume the image is uncompressed. How long does it take to transmit it over 56-kbps model channel? Over a 1-Mbps cable modem? Over a 100 Mbps Ethernet? Over gigabit Ethernet?

Ans:
# of bytes needed for representing the image: 1920 × 1080 × 3 bytes = 6,220,800 bytes. This is 49,766,400 bits.

At 56 kbits/sec, it takes about 888.69 sec.
At 1 Mbits/sec, it takes 49.77 sec.
At 100 Mbits/sec, it takes about 0.5 sec.
At 1 Gbits/sec it takes about 0.05 sec.

Question 3

When a large file is transferred across the network between two computers, two different possible acknowledgement schemes can be used. In the first, the file is divided into smaller packets, which are then individually acknowledged by the receiver as they are received, but the file transfer as a whole is not acknowledged. In the second scheme, the packets are not acknowledged individually, but the entire file is when it arrives at its destination. Discuss the practical implications of these two approaches in terms of bandwidth utilization.

Ans:
Acknowledging each packet separately ensures that in a network where packet loss is high, lost packets can be re-transmitted without re-transmitting the whole file. However, if packet loss is

low or negligible, then bandwidth can be saved by not transmitting acknowledgement packets. The price to pay is that if one packet is lost, then the entire file must be retransmitted. Approach 1 is more reliable in a real world situation.

An Example (Not Necessary): In Lab 2, when the file was being transferred, acknowledgement packets from our computer to the remote host can be seen after every one or two frames that were received.

Question 4

Consider any TCP stream in your Wireshark trace and provide its Flow graph diagram. Provide a print screen of your trace and explain what information can you gather from the graph comparing it with each of the Service primitives given below (source: 1.3.4 Service Primitives – Tanenbaum Fifth Edition)?

Primitive	Meaning
LISTEN	Block waiting for an incoming connection
CONNECT	Establish a connection with a waiting peer
ACCEPT	Accept an incoming connection from a peer
RECEIVE	Block waiting for an incoming message
SEND	Send a message to the peer
DISCONNECT	Terminate a connection

Ans: Look for responses that compare the trace with each of these Service Primitives.

Listen can be explained using the TCP 3 way handshake.
Connect can be explained using the TCP 3 way handshake
Accept can be explained using the TCP 3 way handshake
Send and Receive can be explained using the HTTP request data exchange or any other part of the data exchange process. If something else is there and the rationale is valid then that is also accepted.
The DISCONNECT part may not necessarily need a trace as most people would not have been able to capture it but it is essential that the student discusses it.

The student is not expected to show the entire trace but make sure the relevant sections are present (screenshots) and are legible. IP address resolution may or may not be present.

Question 5

The performance of a network application is influenced by two major network characteristics: the bandwidth of the network (number of bits per second that the network can transport) and the latency (the delay experienced by each bit transported).

Identify the requirements of the following applications in terms of bandwidth and latency, and then give an example of a network that is suitable for each of these applications:

i) File transfers between Melbourne and USA
ii) Bandwidth intensive interactive gaming
iii) Connecting a large number of real-time environment monitoring sensors (frequent low data transmissions from sensors but application requires critical event notification)
iv) Broadband connections in regional Australia
v) Video streaming during commutes

Ans:

i) High bandwidth but latency insensitive → transcontinental fiber link
ii) High bandwidth, low latency → Optical fiber access networks
iii) Low bandwith, low latency → Low-end local and personal area wireless technologies such as Zigbee, NB-IOT, Bluetooth
iv) Diverse range of applications with different requirements on bandwidth and latency but the deployment is really due to lack of infrastructure so → Satellite links
v) High bandwidth, low latency + mobility → Mobile wireless network, ex: 4G, 5G, etc.