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CECS 327 Homework #1

1. What advantages does a packet-switched network have over a circuit-switched network?

- Packets in packet-switched networks can take different routes allowing for an efficient use of the network
- Allows for high data transmission

2. What are the five layers in the Internet protocol stack? What are the principal responsibilities of each of these layers?

- Application
  - How one application uses the Internet
  - Unit of data exchanges in this layer is called a “message”
- Transport
  - Specifies how to provide reliable transfer from one application one computer to another
  - Unit of data exchange in this layer is called a “segment”
- Internet
  - Handles IP addressing and the mechanisms for forwarding packets
- Network Interface
  - Handles the frame and mac addressing
- Physical
  - Handles the transmission of raw bits over a communication link

3. How long does it take a packet of length 1500 bytes to propagate over a link of distance 2500 km, propagation speed of 2.5· 10^8 m/s, and transmission rate 2Mbps? Does this delay depend on packet length? Does this delay depend on transmission rate?

Propagation time = distance of link / propagation speed = (2500 * 10^3) / (2.5 * 10^8) = .01 sec = 10 msec delay

Delay does not depend on packet length or transmission rate

4. Suppose a 1-Gbps point-to-point link is being set up between the Earth and a new lunar colony. The distance from the moon to the Earth is approximately 385,000 km, and data travels over the link at the speed of light—3 × 108 m/s.

a) Calculate the minimum RTT for the link.

RTT = (distance / speed of light) * 2 = (385,000 * 10^3) / (3 * 10^8) = 1.283 sec

1.283 * 2 = 2.56 sec

b) Using the RTT as the delay, calculate the delay × bandwidth product for the link.

Delay-Bandwidth = delay * bandwidth = 2.56 * (1 x 10^9) = 2.56 x 10 ^9 bits

c) What is the significance of the delay × bandwidth product computed in (b)?

It is the measure of network capacity.

d) A camera on the lunar base takes pictures of the Earth and saves them in digital format to disk. Suppose Mission Control on Earth wishes to download the most current image, which is 25 MB. What is the minimum amount of time that will elapse between when the request for the data goes out and the transfer is finished?
Latency = Tp + Tx + Tq
25 MB = 200000000 bits
Tp = (distance) / (speed of light delay) = (385,000 * 10^3) / (3.0 * 10^8 ms) = 1.283 sec
Tx = (size of data) / (throughput) = (2 x 10^8 bits) / (1 x 10^9 bits/s) = 2 x 10^-1 = 0.2 sec
Tq = Assume 0? = 0
Latency = 1.283 sec + 0.2 sec + 0 sec = 1.483 sec

Hands-On Activities

5. Measuring round trip times with Ping.
a) Try a simple ping www.google.com. Record the minimum, maximum, and average round trip times.
Minimum = 12 ms, Maximum = 14ms, Average = 12ms

b) Try option ping -n 2 www.google.com and then try ping -n 7 www.google.com. What difference do you notice?
For ping -n 2, ping sends outs 2 packets and calculates the minimum, maximum, and average round trip times of those 2 packets.
For ping -n 7, ping sends out 7 packets and calculates the minimum, maximum, and average round trip times of those 7 packets.

c) Try ping 10.0.0.50 and write down what output you get and explain why you get the result.
Result:
Pinging 10.0.0.50 with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Ping statistics for 10.0.0.50:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

The reason for this result is because the IP is not live or unreachable from my device therefore ping could not receive back the packets resulting in a 100% loss of packets.

d) Try ping www.imperialequestriancenter.com. Did you receive any responses for the packets you sent? What are some reasons as to why you might not have gotten a response?
Ping www.imperialequestriancenter.com received no response. Although the site is live, the ping request was unreachable from my device. This ping request could have been rejected for security measures by the web server.

6. Understanding Internet routes using Traceroute:
a) Try a simple tracert www.google.com. How many hops were there between your computer and www.google.com?
There were about 11 hops between my computer and www.google.com

b) Compare tracert www.google.com and tracert www.ieee.org. What hops are the same for each destination?
No hops were the same for each destination.

c) Try tracert www.ubc.ca and then try the option tracert -d www.ubc.ca. What difference do you notice?
The difference between traceroute and traceroute -d is that traceroute shows both hostnames and ip addresses while traceroute -d shows only the ip address.

d) Compare round trip times to the number of hops from local host to three hosts, www.tsinghua.edu.cn, www.usyd.edu.au, and www.harvard.edu at different times of day. What correlation do you find? Are these your expectations? Explain.
Pinging these hosts at different times of day show different average round trip times. Where the round trips times are larger during a specific time, this is most likely because internet usage is much higher during that time.
The round trip time is also much larger when pinging to www.tsingua.edu.cn and www.usyd.edu.au compared to www.harvard.edu because of how far the host location is.