

Problem 1

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

From top-to-bottom: application, transport, network, link, and physical.

Responsibilities:

- Application Layer: Where network applications and their application-layer protocols reside.
- Transport Layer: Transports application-layer messages between application endpoints.
- Network Layer: Responsible for moving network-layer packets known as datagrams from one host to another.
- Link Layer: Responsible for moving a packet from one node (host or router) to the next node in the route.
- Physical Layer: Responsible for moving the individual bits within the frame from one node to the next.

Problem 2

List six access technologies. Classify each one as residential access, company access, or mobile access.

- 1) Dial-up modem over telephone line: residential
- 2) DSL over telephone line: residential
- 3) Cable to HFC: residential
- 4) 100 Mbps switched Ethernet: company
- 5) Wireless LAN: mobile
- 6) Cellular mobile access: mobile

Problem 3

Compare the delay in sending an x -bit message over a k -hop path in a circuit-switched network and a (lightly loaded) packet-switched network. The circuit setup time is s seconds, the propagation delay is d seconds per hop, the packet size is p bits, and the data rate is b bps. Under what conditions does the circuit-switched network have a shorter delay? [NOTE: you need to explain the reasoning process on how you come out the final answer.]

Circuit-switched: Total Delay = $s + kd + x/b$

Packet-switched: Total Delay = $kd + x/b + (k-1)p/b$

Here we see that both total delays have the $(kd + x/b)$ terms, so the determining factor in which is faster is the difference between s and $(k-1)p/b$, or more explicitly: The circuit setup time vs. The time to send a packet of p bits at b bps over $k-1$ hops.

*When $s > (k-1)p/b$, the packet-switched network has a lower total delay.

Problem 4

List the four broad classes of services that a transport protocol can provide. For each of the service classes, indicate if either UDP or TCP (or both) provides such a service.

- a) Reliable Data Transfer
 - a. TCP provides a reliable byte-stream between client and server but UDP does not
- b) Guarantee that a certain value for throughput is maintained

- a. Neither can provide this
- c) Guarantee that data will be delivered in specific amount of time
 - a. Neither can provide this
- d) Security
 - a. Neither can provide this