**Chapter 1 Assignments**

1120211099 周豪捷

**1.**

(a) Packet size = 1 KB = 1 \* 1024 \* 8 bits = 8192 bits

1.5 Mbps = 1.5 \* 106 = 1.5 \* 106 bits/s

RTT = 100 ms = 0.1 s

Transmit time per packet

= Size of packet / Bandwith

= 8192 bits/(1.5 \* 106 bits/s)

= 0.00546 s =

= 5.46 ms

Number of packets

= Size of file / Size of packet

= 1000 KB / 1 KB

= 1000

Total Transmit time

= 5.46 ms \* 1000

= 5.46 s

Total time = Initial 2 RTT + Total Transmit time + Propagation

= 2 \* RTT + Total Transmit time + RTT/2

= 2 \* 0.1 s + 5.46 s + 0.1 s/2=

= 0.2 s + 5.46 s + 0.05 s =

= 5.71 s

(b) There are 1000 packets, so we must wait for 999 RTTs.

Total Time = 5.71 s + 999\*RTT =

= 5.71 s + 999 \* 0.1 s =

= 5.71 s + 99.9 s =

= 105.61 s

(c) We need to send 1000 packets, then we will need 1000 / 20 = 50 RTTs. But the last 20 packet only need (RTT/2), so the total RTTs are 49.5.

Total time = Initial 2 RTT + Required RTTs

= 2\*RTT + 49.5 \* RTT

= 51.5 \* RTT

= 51.5 \* 0.1 s

= 5.15 s

(d) At n > RTTs after the initial handshaking we have sent:

1 + 2 + 4 + ... + 2n - n = 2(n+1) - n – 1

packets.

Therefore, at n = 9 we have sent all of 1000 packets. And there is also a propagation delay.

Total time = Initial 2 RTT + 9 \* RTT + Propagation

= 2 \* RTT + 9.5 \* RTT

= 11.5 \* RTT =

= 11.5 \* 0.1 s =

= 1.15 s

**2.**

(a) dprop = seconds.

(b） dtrans = seconds.

(c) dend −to−end = dprop + dtrans = seconds.

(d) The last bit is just leaving Host A and arrives at the start of link.

(e) The first bit is in the link and has not reached Host B.

(f) The first bit has reached Host B.

(g) m = L / R \* s

= 120 bits / (56 \* 103 bps) \* 2.5 \* 108 m/s

= 535714 km

**3.**

For packet switching, at time **(x / b)** the message is sent over the first hop. And the delay over the routers is **(k - 1) \* (p / b)**. Besides, the propagation delay is **kd**.

For circuit switching, setup time is **s**, the transmission delay is **(x / b)**, and the propagation delay is also **kd**.

The total delay of packet switching is:

The total delay of circuit switching is:

Therefore, when , the packet network has a lower delay.

**4.**

The total number of header bytes with n-layers and h bytes per header is **nh**. At layer-n, the total bytes of message is **M + nh**.

Therefore, the fraction of the network bandwidth filled with headers is

**5.**

**The two reasons:**

(1) Modularity: Layered protocols allow for the separation of concerns, making it easier to manage and maintain each layer independently.

(2) Abstract functionality: In layered protocols, lower layers can be changed or updated without affecting the upper layers.

**One possible disadvantage:**

Information hiding: There exists inefficient implementations. Data may need to be processed at each layer, which can introduce overhead and lead to bad performance.