CS305 HW1

Question1

> Compare packet switch and circuit switch under the following scenario. Suppose you would like to deliver a message of xbit. There are k links from the source to destination. The propagation delay of each link is d second, the transmission rate is b bit/second. The circuit setup time under circuit switch is s second. Under packet switch network, when the packet length is p bit, the queue delay in every node can be neglected. Please calculate the condition, under which the delay of packet switch is smaller than that of the circuit switch.

- Message: x bit
- Link number: k
- Propogation delay: d(s)
- Transmission rate: b(bit/s)
- Circuit setup time: s(s)
- Packet length in packet switch: p(bit)

$$Circuit\ switch = s + \frac{x}{b} + d$$

$$Packet\ switch = \lceil \frac{\lceil \frac{x}{p} \rceil}{k} \rceil (\frac{p}{b}) + d$$

Thus, if k ≥ 1, the delay of packet switch is smaller than that of the circuit switch.

This means if there is only one user, packet switch is always better than circuit switch.

Question2

> Calculate the overall delay of transmitting a 1000KB file under the following circumstance. The overall delay is defined as the time from the starting point of the transmission until the arrival of the last bit to the destination. RTT is assumed to be 100ms, one packet is 1KB (1024B) size. The handshaking process costs 2RTT before transmitting the file.

> 1) Transmission bandwidth is 1.5Mb/s, the packets can be continuously transmitted

Handshaking process:

- 2RTT = 200ms

File transmission delay:

- 1000KB = 1024000B = 8192000bit
- Dtrans = 8192000bit / 1500000 bit/s = 5.461s = 5461ms

The last file transmit to the destination

- 0.5RTT = 50ms

Overall delay = 200ms + 5461ms + 50ms = 5711ms

> 2) Transmission bandwidth is 1.5Mb/s, but when one packet is transmitted, the next packet should wait for 1 RTT (waiting for the acknowledgement of the receiver) before being transmitted

One packet has 1KB size

Total packets number = 1000

Handshaking process:

- 2RTT = 200ms

File transmission delay(total):

- 1000KB = 1024000B = 8192000bit
- Dtrans = 8192000bit / 1500000 bit/s = 5.461s = 5461ms

ACK delay:

- (1000-1)*RTT = 99900ms

The last packet transmit to the destination

- 0.5RTT = 50ms

Overall delay = 200ms + 5461ms + 99900ms + 50ms = 105611 ms

> 3) Transmission bandwidth is infinite, i.e. transmission delay is 0. After every 1 RTT, as many as 20 packets can be transmitted

Handshaking process:

- 2RTT = 200ms

Transmit Groups number

- 1000 / 20 = 50 groups

File transmission delay(total):

- Dtrans = 50 * RTT = 5000ms

The last group transmit to the destination

- 0.5RTT = 50ms

Overall delay = 200ms + 5000ms + 50ms = 5250ms

Question3

> List six access technologies. Classify each of them as home access, enterprise access, or wide-area mobile access.

Home access

- digital subscribe line (DSL)
- cable network
- fiber to the home (FTTH)

Enterprise access

- Ethernet
- Wifi

Wide-area mobile access

- 3G
- 4G
- LTE

Question4

> List five nonproprietary Internet applications and the application-layer protocols that they use

Bilibili：HTTP

Net Ease Music：HTTP

qq mail：STMP，HTTP

weChat：HTTP，FTH

Taobao：HTTP

> What information is used by a process running on one host to identify a process running on another host?

Source IP, Source port, Destination IP, Destination port

Question5

> List the four 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

SERVICE	TCP	UDP
timing	X	X
data integrity	✓	X
security	X	X
throughput	X	X

Question6

> Suppose within your Web browser you click on a link to obtain a Web page. The IP address for the associated URL **is not cached** in your local host, so a DNS lookup is necessary to obtain the IP address. Suppose that **n** DNS servers are visited before your host receives the IP address from DNS; the successive visits incur an **RTT of RTT1, . . ., RTTn**. Further suppose that the Web page associated with **one HTML file**, and the HTML file references **eight very small objects** on the same server. Let **RTT0** denote the RTT between the local host and the server containing these objects. Assuming **zero transmission time of the objects**. Please calculate the time which elapses from when the client clicks on the link until the client receives the object under the following circumstance.

> a) **Non-persistent HTTP** with no **parallel TCP connections**?

DNS query cost

- $\Sigma\{i = 1 \rightarrow n\}$ RTTi

Each object transmit cost

- RTT0 * 2 * 9

Total time cost = $\Sigma\{i = 1 \rightarrow n\}$ RTTi + 18RTT0

> b) **Non-persistent HTTP** with the browser configured for **5 parallel connections**?

DNS query cost

- Σ{i = 1 →n} RTTi

Five object transmit cost

- RTT0 * 2

Four object transmit cost

- RTT0 * 2

Total time cost = Σ{i = 1 →n} RTTi + 4RTT0

> c) Persistent HTTP?

5 parallel connections

DNS query cost

- Σ{i = 1 →n} RTTi

Five object transmit cost

- RTT0 * 2

Four object transmit cost

- RTT0 * 1

Total time cost = Σ{i = 1 →n} RTTi + 3RTT0

No parallel connections

DNS query cost

- Σ{i = 1 →n} RTTi

First object transmit cost

- RTT0 * 2

Eight object transmit cost

- RTT0 * 8

Total time cost = Σ{i = 1 →n} RTTi + 10RTT0

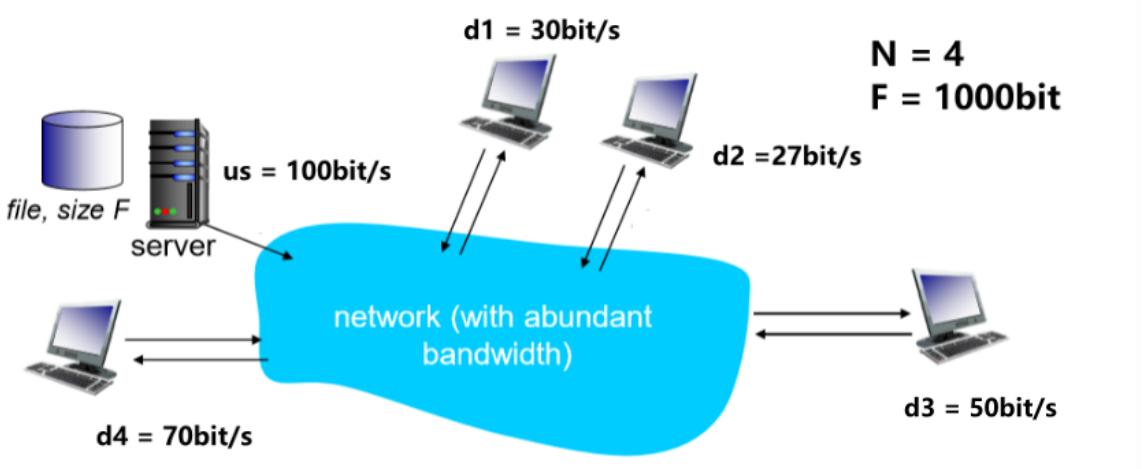
Question7

> Consider distributing **a file of F bits to N peers** using a client-server architecture. Assume a fluid model where the server can simultaneously transmit to multiple peers, transmitting to each peer at different rates, as long as the combined rate does not exceed us.

> a) Suppose that us/N ≤ dmin. Specify a distribution scheme that has a distribution time of NF/us.

If us/N ≤ dmin, which means the throughput is bounded by server

Thus

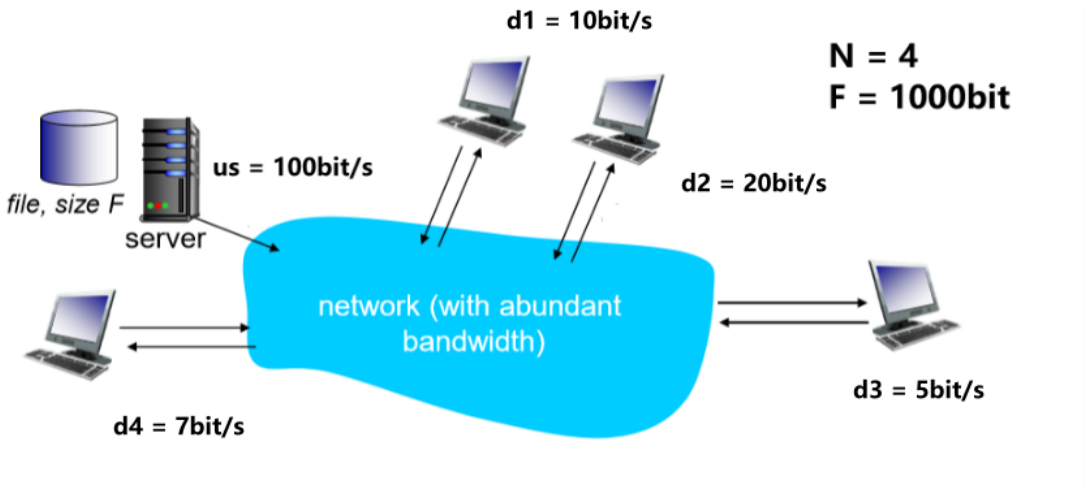


Distribution time = 4 * 1000 / 100 = 40s

> b) Suppose that us/N ≥ dmin. Specify a distribution scheme that has a distribution time of F/dmin.

If us/N ≥ dmin, which means the throughput is bounded by client

Thus



Distribution time = 1000 / 5 = 200s

> c) Conclude that the minimum distribution time is in general given by max {NF/us, F/ dmin}.

Thus, in two situation of a) and b)

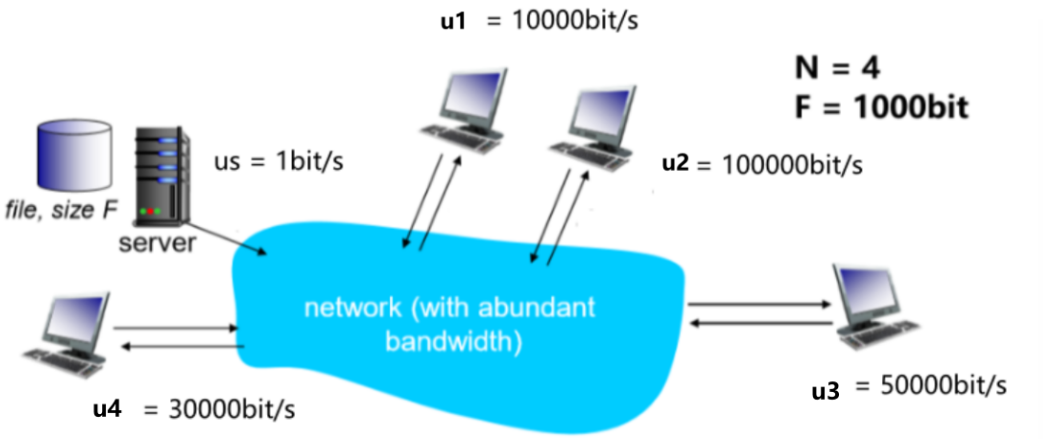
We see that the minmum distribution time is in given by max {NF/us, F/ dmin}

Question8

> Consider distributing a file of F bits to N peers using a P2P architecture. Assume a fluid model. For simplicity assume that dmin is very large, so that peer download bandwidth is never a bottleneck.

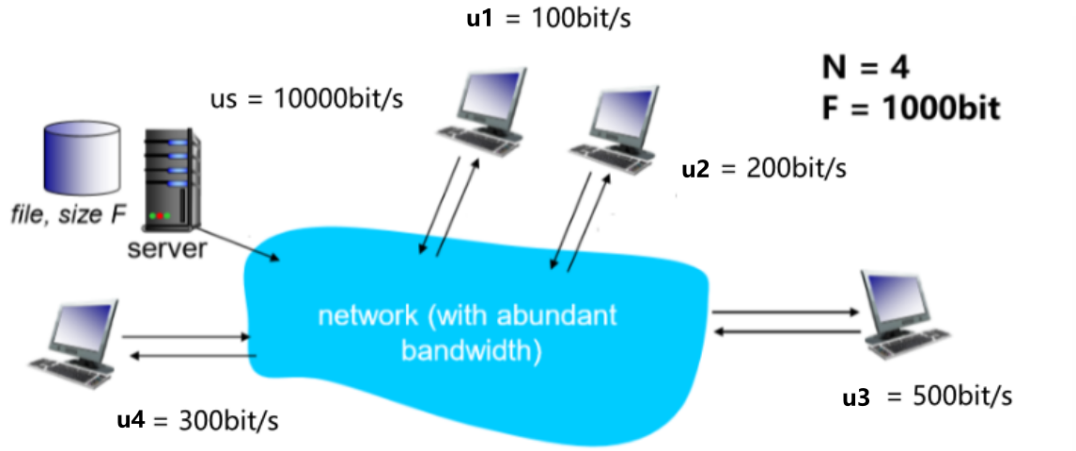
Because dmin is very large, thus we consider F/dmin is very small, which is smaller than F/us and NF/(us + u1 + ... + uN)u

> a) Suppose that us ≤ (us + u1 + ... + uN)/N. Specify a distribution scheme that has a distribution time of F/us.



Distribution time = 1000 / 1= 1000s

> b) Suppose that us ≥ (us + u1 + ... + uN)/N. Specify a distribution scheme that has a distribution time of NF/(us + u1 + ... + uN).



Distribution time = 1000 * 4 / (10000 + 100 + 200 + 300 + 500)= 0.36s

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> c) Conclude that the minimum distribution time is in general given by max {F/us, NF/(us + u1 + ... + uN)}.

Thus, in two situation of a) and b)

We see that the minmum distribution time is in given by max {F/us, NF/(us + u1 + ... + uN)}

Question9

> Consider a DASH system for which there are **N video versions** (at N different rates and qualities) and **N audio versions** (at N different rates and qualities). Suppose we want to allow the player to choose at **any time any of the N video versions and any of the N audio versions**

> a) If we create files so that the audio is mixed in with the video, so server sends only one media stream at given time, how many files will the server need to store (each a different URL)?

The server need to store N*N files

> b) If the server instead sends the audio and video streams separately and has the client synchronize the streams, how many files will the server need to store?

The server need to store 2N files