HW1 Network Ruicong Xie

1. See the last Page for data and detail.

(108byte, 1008byte)

a) Pinged usc.edu in Los Angeles, with 2 Packages size for 100 times

Assuming the lowest Ping doesn't have any queuing delay,

use the diffenet between 2 lowest ping from 2 Package Sizes to derive transmition rate $\frac{1008}{x} + Prop - \frac{108}{x} - Prop = 84.6 - 83.92 = 0.69ms$ $X = 1308.14$ byte/ms

Tranmition delay $= 1008/1308.14 = 0.77ms$, $108/1308.14 = 0.08ms$

round trip → Propagation delay $=$ (min Ping $-$ Tranmition delay $\times 2)/2 = 41.53ms$, $41.58ms$

Because Tranmition delay and propagation delay are the same (package travels the same route) for all 100 Packages. The variation is caused by queuing delay.

b) see last Page

c) The network meased delay × speed of light ⇒ network meased distance $41.53ms \times 2\times10^8 m/s / 1000^2 = 8306.29km$. The actual physical distance is 4450 km. However network doesn't travel in straight Line, which may cause the additional difference.

2.

The packet losses are independent at each hop, so if the probability of a packet from one hop to the next without loss is $(1-p)$. Three routers and four Links the probability that a packet sent by the client arrives at server is $(1-P)^4$

3.

For the 1st one the throughput for A should be 5Mb/s and for C should be 4Mb/s. because there is not bottleneck in the network.

For the 2nd one the throughput for A could be 4Mb/s and for C could be 6 Mb/s. Because the Link to B is bottlenecked by A and C's Link. Assuming common Link divides its transmition rate equally among the hosts, then any excess bandwith from the common link will then be divided among hosts with extra throughput needs. In this case the extra 2mb/s will go to A.

C:B $\Rightarrow$ 4Mb/s A:B $\Rightarrow$ 6mb/s = 5mb/s + 1mb/s.

4.

a) $8\,bit/bytes \times (50Mbytes + 50bytes) / 5Mb/s \times (3+1)$

$\approx 320S$

b) $(M+H) \times 8bit/byte / b \times (R+1) + (\frac{F}{M}-1) \times (M+H) \times 8bit/byte / b$

c) simplify the above expression

$T = (F+\frac{FH}{M}) \cdot 8bit/bytes / b + R(M+H) \cdot 8bit/byte / b$

$= (\frac{FH}{M} + RM + F + HR) 8bit/byte / b$

$\frac{A}{x} + Bx =$

$-\frac{A}{x^2} + B = 0$

$x = \sqrt{\frac{A}{B}}$

the minim T occurs when $M = \sqrt{\frac{FH}{R}}$

apply this to (a)

$M = \sqrt{\frac{50Mbytes \times 50bytes}{3}} = \sqrt{\frac{5 \times 10^8\ bytes^2}{3}} = 28.868kbyte$.

The optimal size is 12.909 kbytes per package.

Plug it in the formula we get T = 80.277S

d) without segmentation if a error corrupts the message, users have to retransmit the entire message, however with segmentation and error detection users only have to retransmit one small packet where the error occured.

5.

Assume overnight delivery take 12 hours to deliver.

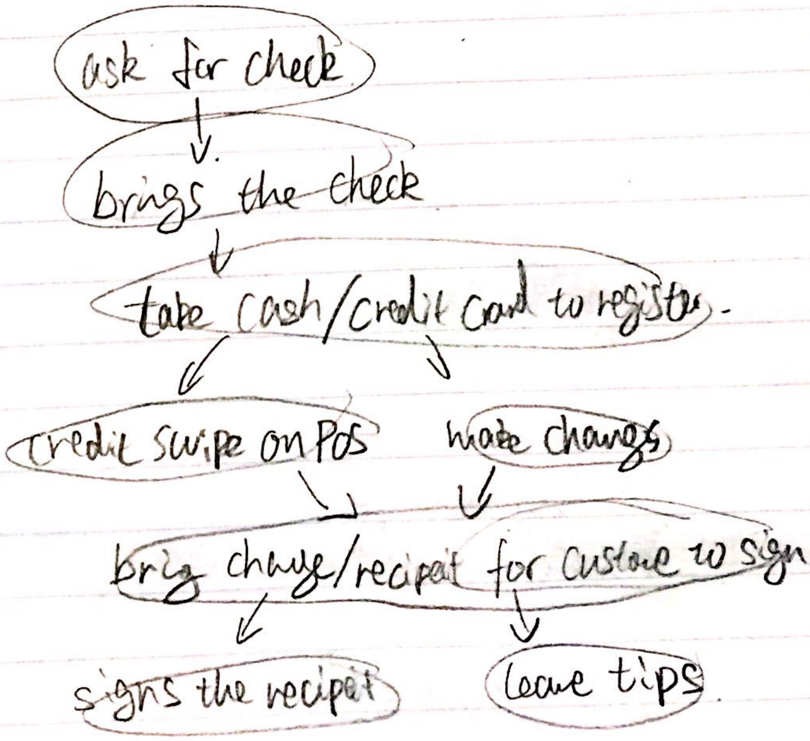
12 hrs × 60 min/hr × 60 s/min × 1 Gb/s

= 4.32×10^{13} b/s

If the file size is great than 5.4 TBytes we should use FedEx to deliver, otherwise Internet2 is faster.

6.

Action	Message	Error
asking for check	"Check Please"	waiter/waitress didn't respond
waiter/waitress brings the check	"Sorry the check is not for the"	wrong check
waiter/waitress takes credit card/cash to register	"Do you need more time"	no cash or credit card
If credit card, swipe on POS Terminal	"Your card is declined"	Credit declined
If cash, make changes	"We have no chance, have smaller bill"	conterfite money/not enough change
bring change/reciept back to customer	"Sorry wrong Recipet"	wrong table
Customer signs the recipet	"Thank you"	wrong receipt
Custome leave tips	"Thank you"	wrong change



Yes, there is equivalent of network layer. When waiter/waitress bring Credit Card/cash and Check back and forth, the process is similar to network layer. where IP is the only protocall and Other layers don't care about which route it traveled, as far as it arrived in reasonable amount of time. For the waiter/waitress, he/she wants to travel the shortest path and routing between tables.

size of packages (byte)	1008		108			
No.	PING ms	queue delay	PING ms	queue delay		
1	85.14	0.54	87.41	3.49		
2	86.66	2.06	91.90	7.98		
3	95.54	10.94	86.32	2.40		
4	115.12	30.51	87.03	3.11		
5	107.99	23.38	87.15	3.24		
6	89.72	5.11	85.33	1.41		
7	89.04	4.44	92.53	8.61		
8	93.17	8.57	85.92	2.00		
9	85.85	1.24	86.99	3.07		
10	94.93	10.32	102.91	19.00		
11	88.54	3.94	84.65	0.73		
12	99.41	14.81	87.14	3.22		
13	93.61	9.01	84.36	0.44		
14	88.10	3.50	85.47	1.56		
15	92.83	8.22	87.25	3.34		
16	85.88	1.27	89.81	5.89		
17	94.37	9.77	89.84	5.92		
18	87.47	2.87	84.92	1.00		
19	90.74	6.13	131.10	47.18		
20	85.91	1.30	85.77	1.86		
21	85.29	0.68	85.41	1.49		
22	85.81	1.21	85.36	1.44		
23	88.50	3.90	85.83	1.91		
24	86.22	1.61	85.35	1.44		
25	95.21	10.61	88.23	4.31		
26	87.04	2.44	85.69	1.78		
27	93.36	8.75	86.97	3.05		
28	88.19	3.58	84.69	0.78		
29	93.45	8.85	83.92	0.00		
30	112.24	27.64	86.14	2.22		

31	112.38	27.77	97.89	13.98		
32	84.92	0.31	89.84	5.93		
33	91.80	7.19	99.04	15.12		
34	88.25	3.65	311.93	228.02		
35	85.18	0.58	86.27	2.35		
36	89.33	4.72	85.25	1.33		
37	88.34	3.74	88.62	4.71		
38	93.81	9.20	87.14	3.22		
39	90.52	5.92	83.99	0.08		
40	99.20	14.60	84.51	0.59		
41	89.78	5.18	85.43	1.51		
42	86.21	1.60	87.42	3.51		
43	85.78	1.18	89.88	5.96		
44	84.78	0.18	89.85	5.93		
45	84.98	0.37	88.72	4.80		
46	87.62	3.02	88.66	4.74		
47	99.51	14.91	87.59	3.67		
48	97.63	13.03	84.98	1.06		
49	99.21	14.60	89.47	5.55		
50	87.46	2.86	84.85	0.93		
51	86.64	2.03	88.42	4.50		
52	87.79	3.18	149.78	65.86		
53	90.76	6.16	88.60	4.69		
54	88.42	3.82	84.51	0.59		
55	86.78	2.17	84.52	0.60		
56	92.37	7.77	85.34	1.42		
57	99.27	14.67	85.24	1.33		
58	105.08	20.47	86.87	2.96		
59	89.49	4.88	88.86	4.94		
60	100.68	16.08	85.77	1.86		
61	86.06	1.46	85.36	1.45		
62	85.06	0.46	85.90	1.98		

63	86.00	1.39	85.37	1.45		
64	88.98	4.38	87.88	3.97		
65	87.12	2.52	86.23	2.31		
66	91.90	7.29	85.48	1.57		
67	89.91	5.31	86.94	3.03		
68	91.47	6.86	94.73	10.81		
69	88.51	3.91	90.31	6.40		
70	87.96	3.35	86.53	2.61		
71	85.86	1.25	86.04	2.12		
72	87.59	2.99	86.62	2.70		
73	101.93	17.32	88.87	4.96		
74	85.50	0.89	88.81	4.89		
75	98.04	13.43	88.12	4.20		
76	87.14	2.53	85.35	1.43		
77	97.99	13.39	85.63	1.72		
78	86.45	1.85	85.04	1.12		
79	96.87	12.26	85.98	2.06		
80	87.39	2.78	89.60	5.68		
81	86.82	2.21	85.49	1.57		
82	96.38	11.78	92.16	8.24		
83	90.57	5.96	89.68	5.77		
84	85.95	1.35	86.67	2.76		
85	108.56	23.96	88.94	5.02		
86	103.45	18.84	87.88	3.96		
87	95.49	10.89	92.60	8.68		
88	88.81	4.21	88.54	4.62		
89	97.19	12.59	89.10	5.18		
90	96.90	12.29	84.76	0.84		
91	97.84	13.24	84.63	0.71		
92	118.47	33.87	84.66	0.75		
93	98.30	13.69	92.98	9.06		
94	85.81	1.20	88.88	4.96		

95	86.65	2.05	89.80	5.89		
96	87.90	3.29	89.14	5.22		
97	84.97	0.36	86.72	2.81		
98	84.60	0.00	116.68	32.76		
99	86.37	1.76	115.63	31.72		
100	86.38	1.78	97.56	13.64		
					difference in delay (ms)	**bandwith (byte/ms)**
min total delay	84.60		83.92		0.69	1308.14
transmition delay	0.77		0.08		caused only	
propagation delay	41.53		41.88		by diflence	
					package size	
queueing delay						
std dev	7.26		~~24.03~~			
average	5.63		8.11			
physical distance (km)	4450.32					
speed light(m/s)	200000000					
calculated distance (km	8306.29					