

Chapter 1

Ping

Cloud Instance



1024 MB Server - 45.76.191.63

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EvandeMacBook-Pro:~ evanchoo$ ping 45.76.191.63
PING 45.76.191.63 (45.76.191.63): 56 data bytes
64 bytes from 45.76.191.63: icmp_seq=0 ttl=45 time=475.987 ms
64 bytes from 45.76.191.63: icmp_seq=1 ttl=45 time=496.452 ms
64 bytes from 45.76.191.63: icmp_seq=2 ttl=45 time=517.123 ms
64 bytes from 45.76.191.63: icmp_seq=3 ttl=45 time=538.082 ms
64 bytes from 45.76.191.63: icmp_seq=4 ttl=45 time=452.869 ms
64 bytes from 45.76.191.63: icmp_seq=5 ttl=45 time=473.183 ms
64 bytes from 45.76.191.63: icmp_seq=6 ttl=45 time=493.090 ms
64 bytes from 45.76.191.63: icmp_seq=7 ttl=45 time=512.678 ms
64 bytes from 45.76.191.63: icmp_seq=8 ttl=45 time=434.951 ms
64 bytes from 45.76.191.63: icmp_seq=9 ttl=45 time=554.750 ms
64 bytes from 45.76.191.63: icmp_seq=10 ttl=45 time=471.801 ms
64 bytes from 45.76.191.63: icmp_seq=11 ttl=45 time=493.852 ms
64 bytes from 45.76.191.63: icmp_seq=12 ttl=45 time=422.077 ms
64 bytes from 45.76.191.63: icmp_seq=13 ttl=45 time=452.220 ms
^C
--- 45.76.191.63 ping statistics ---
14 packets transmitted, 14 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 422.077/484.937/554.750/36.569 ms
EvandeMacBook-Pro:~ evanchoo$
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Traceroute

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evanchoo — traceroute www.google.com — 80x24
EvandeMacBook-Pro:~ evanchoo$ traceroute www.google.com
traceroute to www.google.com (216.58.200.228), 64 hops max, 52 byte packets
 1 * 10.135.127.254 (10.135.127.254) 9.656 ms 2.844 ms
 2 172.16.254.14 (172.16.254.14) 4.401 ms 3.218 ms 4.261 ms
 3 172.17.11.214 (172.17.11.214) 3.369 ms 2.859 ms 6.790 ms
 4 172.17.11.254 (172.17.11.254) 4.260 ms 3.650 ms 4.233 ms
 5 218.197.158.254 (218.197.158.254) 5.589 ms 3.200 ms 4.410 ms
 6 wh0.cernnet.net (202.112.53.81) 5.280 ms 3.626 ms 4.975 ms
 7 * * *
 8 101.4.117.38 (101.4.117.38) 21.659 ms 13.875 ms 15.255 ms
 9 101.4.112.1 (101.4.112.1) 21.716 ms 22.888 ms 23.168 ms
10 101.4.113.109 (101.4.113.109) 22.639 ms 22.050 ms 22.789 ms
11 101.4.114.222 (101.4.114.222) 25.494 ms
    101.4.114.170 (101.4.114.170) 22.504 ms 24.352 ms
12 101.4.114.57 (101.4.114.57) 24.490 ms 23.772 ms 51.768 ms
13 * * *
14 * * *
15 * * *
16 * * *
17 * * *
18 * * *
19 * * *
20 * * *
21 * * *
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P5 Review the car-caravan analogy in Section 1.4. Assume a propagation speed of 100 km/hour.

1. Suppose the caravan travels 150km, beginning in front of one tollbooth, passing through a second tollbooth, and finishing just after a third toll- booth. What is the end-to-end delay?
2. Repeat(a), now assuming that there are eight cars in the caravan instead of ten.

Solution:

1. $10 * 12s * 3 + 75km / 100km/h * 2 = 96$ mins
2. $8 * 12s * 3 + 75km / 100km/h * 2 = 94.8$ mins

P8 Suppose users share a 3 Mbps link. Also suppose each user requires 150 kbps when transmitting, but each user transmits only 10 percent of the time. (See the discussion of packet switching versus circuit switching in Section 1.3.)

1. When circuit switching is used, how many users can be supported?
2. For the remainder of this problem, suppose packet switching is used. Find the probability that a given user is transmitting.
3. Suppose there are 120 users. Find the probability that at any given time, exactly n users are transmitting simultaneously. (Hint: Use the binomial distribution.)
4. Find the probability that there are 21 or more users transmitting simultaneously.

Solution:

1. $3 \text{ Mbps} / 150 \text{ kbps} = 20$
So 20 users can be supported.
2. According to the text, a given user is transmitting has probability 10%.

3. The probability can be expressed as the following:

$$P(x = n) = C_{120}^n * 0.1^n * (1 - 0.1)^{120-n} = C_{120}^n * 0.1^n * 0.9^{120-n}$$

4. The probability is calculated as follows:

$$P(x \geq 21) = 1 - P(x \leq 20) = 1 - P\left(\frac{\sum_{k=0}^{20} X_k - np}{\sqrt{np(1-p)}} \leq \frac{20 - np}{\sqrt{np(1-p)}}\right) = 0.007$$

P10 Consider a packet of length L which begins at end system A and travels over three links to a destination end system. These three links are connected by two packet switches. Let d_i , s_i , and R_i denote the length, propagation speed, and the transmission rate of link i , for $i = 1, 2, 3$. The packet switch delays each packet by d_{proc} . Assuming no queuing delays, in terms of d_i , s_i , R_i , ($i = 1, 2, 3$), and L , what is the total end-to-end delay for the packet? Suppose now the packet is 1,500 bytes, the propagation speed on all three links is $2.5 \cdot 10^8$ m/s, the transmission rates of all three links are 2 Mbps, the packet switch processing delay is 3 msec, the length of the first link is 5,000 km, the length of the second link is 4,000 km, and the length of the last link is 1,000 km. For these values, what is the end-to-end delay?

Solution:

$$d_{overall} = d_{proc} * 2 + \left(\frac{L}{R_1} + \frac{L}{R_2} + \frac{L}{R_3}\right) + \left(\frac{d_1}{s_1} + \frac{d_2}{s_2} + \frac{d_3}{s_3}\right)$$

$$L = 1500bytes = 12,000bits$$

$$d_{overall} = 3ms * 2 + \frac{12000}{2000}ms * 3 + \left(\frac{5000 * 10^3}{2.5 * 10^8} + \frac{4000 * 10^3}{2.5 * 10^8} + \frac{1000 * 10^3}{2.5 * 10^8}\right) * 10^3ms = 64ms$$

Thus the end-to-end delay is 64ms