1. 1. m/s in seconds
   2. L/R in seconds
   3. (L/R)+(m/s)
   4. When T = tans delay, the last bit would have been transmitted
   5. When dprop > dtrans, the first biit would have left A but not yet reached B
   6. When dprop < dtrans, the first bit will have left A and reached B
   7. (1.2kb/56kb)=(m/2.5\*10^8) => 535714.28571429 = m
2. (56\*8)/(64\*10^3) => ((448)/(2\*10^6)) + 10\*10^-3 => 17.224 milliseconds
3. 1. 3000/150 = 20 people
   2. 10%
   3. P(n) = (.1)^n(.9)^(120-n)
   4. (.1)^n(.9)^(120-n) => 0.0079411 = 0.794% for n >= 21
4. ++++++2()

L = 1500 byte = 1200 bit

= 5000000m, 4000000m, 1000000m

= 2.5\*10^8

= 2000000 bps

= 3\*10^-3

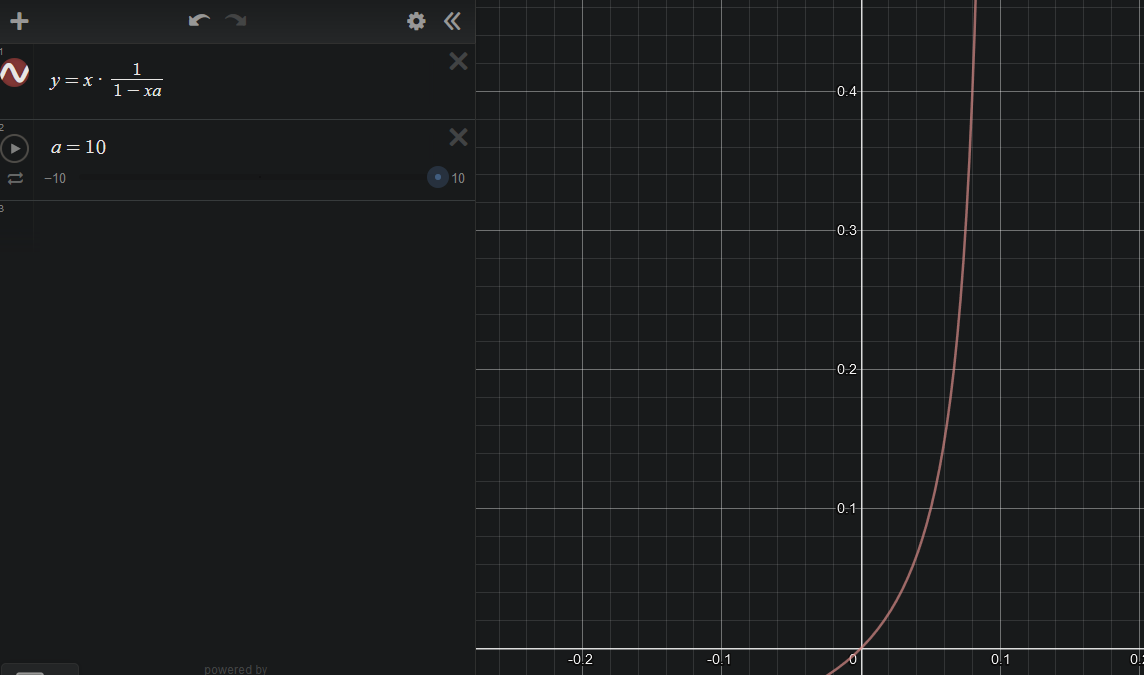
3()+()+()+()+2(3\*10^-3) =>

0.64sec = 64 milliseconds

1. 3()+()i => 3()+()+()+() =>

0.058 = 58 milliseconds

1. Queueing delay = => = 0.027sec = 27 milliseconds
2. 1. Delay = + I =
   2. A = 10, x = , y = x\*



1. = + => + => + => \* => \* =>
2. 1. Transmission delay =
   2. The second packet would be queued at the second link only if there is no queueing delay, T>= +
3. 1. Bandwidth delay = bandwidth \* round trip time =>

2\*10^6 \* => 0.08 \* 2\*10^6 => 160000 bits

* 1. The max bits is the bandwidth delay product = 160000 bits = R\*
  2. Bandwidth delay = total bits in process before receiving an acknowledgement from transmission link.
  3. => => 125m per bit

yes its longer than a 100m football field

* 1. meters per bit
  2. = => 0.15 seconds
  3. 1\*10^7 \* 0.15s => 1500000 bits
  4. 60 \* 10^7 = 600000000 => 1 per minute

1. 1. Time to send from host to first packet switch = = 4 seconds

4\*3hops = 12 seconds

* 1. => 10000/2\*10^6 => 0.005 =>

5 milliseconds for first packet to first switch

5\*2 = 10 milliseconds for second packet from host to source

* 1. Time to send the first packet to the first switch multiplied by the number of switches there are multiplied by how many packets.

5\*3 = 15 milliseconds + remaining packets \* one link time =>

4010 = 4.01 seconds which is a little over a third of the time compared to (a)

* 1. Better tracking because of multiple acknowledgments from each switch.
  2. More to keep track of, multiple acknowledgements and more possibilities of packet loss.

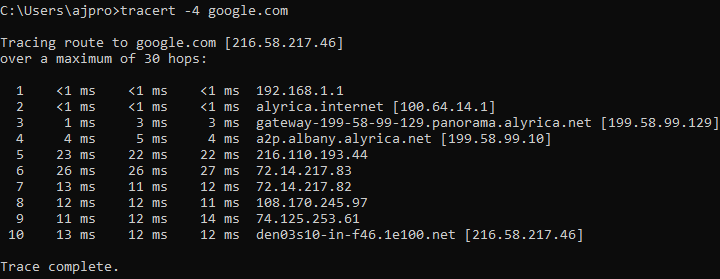
1. \*3 +() => () + () => ()(0+)+()() => ()()+()() => ()-()() => => 2s^2-80F => 2s^2 = 80F => s =



| Site | IP | 10 Ave RTT | 5 Ave RTT |
| --- | --- | --- | --- |
| google.com | 216.58.217.46 | 11ms | 12ms |
| twitter.com | 104.244.42.129 | 28ms | 28ms |
| Baidu.com  (chinese) | 220.181.38.148 | 186ms | 186ms |
| Webgerman.com  (german) | 173.236.155.48 | 104ms | 104ms |

Changing the 10 to 5, reduces the number of pings to the server from 10 to 5, making the average slightly different in some cases.

| Hop No. | Source IP Address | Destination IP Address | Round Trip Time (RTT) |
| --- | --- | --- | --- |
| 1 | 192.168.1.213  (home) | 192.168.1.1 | <1ms |
| 2 | 192.168.1.1 | 100.64.14.1 | <1ms |
| 3 | 100.64.14.1 | 199.58.99.129 | 3ms |
| 4 | 199.58.99.129 | 199.58.99.10 | 4ms |
| 5 | 199.58.99.10 | 216.110.193.44 | 22ms |
| 6 | 216.110.193.44 | 72.14.217.83 | 27ms |
| 7 | 72.14.217.83 | 72.14.217.82 | 12ms |
| 8 | 72.14.217.82 | 108.170.245.97 | 11ms |
| 9 | 108.170.245.97 | 74.125.253.61 | 14ms |
| 10 | 74.125.253.61 | 216.58.217.46 | 12ms |



* 1. The IP is from the first hop destination, it is the router. The second IP is from the second hop destination, this is the modem.

