CSE 160: HW 1-2

d) The bandwidth is infinite and during the first RTT, we can send one packet (2^{1-1}) during the second RTT we can send two packets (2^{2-1}), during the third we can send four (2^{3-1}), and so on.

after "n" RTT the total number of packets sent will be

$$*2^{i-1} \Rightarrow 2^{1-1}+2^{2-1}+2^{3-1}+\dots+2^{n-1}+2^{n}=1+2+4+\dots+2^{n-1}+2n$$

$$= \frac{1\cdot(2^{n+1}-1)}{(2-1)} = (2^{n+1}-1) \text{ packets}$$

* $2^9 = 512$ and the last batch arrives 0.5 RTT later

$$\text{total time} = 2\cdot RTT + 9.5\cdot RTT$$
$$= 11.5\, RTT$$

RTT = 0.05s

$$= 11.5\cdot(0.05) \boxed{= 0.575s}$$

1.6: Consider a point-to-point link 2km in length. At what bandwidth would propagation delay (at a speed of $2\cdot10^8$ ms) equal transmit delay for 100-byte packets? What about 512 byte packets?

*the length of point to point link is 4 km

$$\text{delay} = \frac{\text{length of link}}{\text{speed of signal}} = \frac{4km}{(2\cdot10^8 ms)} = \frac{4\cdot10^3 m}{2\cdot10^8 m/s} = 2\cdot10^{-5}s = 20\cdot10^{-6}s$$
$$= 20\mu s$$

$$\text{bandwidth} = \frac{\text{size of packet}}{\text{propagation delay}} \Rightarrow 800 \text{ bits}/20\cdot10^{-6}s \Rightarrow 40\cdot10^6 bps$$
$$= 40Mbps$$

*size of packet is 100 bytes. Each byte has 8 bits in it

$$\text{bandwidth} = \frac{\text{size of packet}}{\text{propagation delay}} \Rightarrow \frac{4096 \text{ bits}}{20\cdot10^{-6}s} = 204.8\cdot10^6 bps$$

512 · 8 = 4096 bits

$$\boxed{= 204.8 Mbps}$$