Vidun Jayakody - Assignment 3

1. Suppose a device in Halifax, Nova Scotia is sending back-to-back packets to another in Coleraine, United Kingdom. Each packet travels through the EXA North and South submarine cable, at a propagation speed that is two-thirds the speed of light. Each packet is 1,200 bytes. Assume the cable's transmission rate is 10 Gbps (10×10^9 bits per second).

   (a) (10 points) How big would the window size have to be for the sender utilization to be at least 20%?

   $$\text{Window Size} = \text{Utilization} \times \text{RTT} \times \text{Bandwidth}$$

   The *RTT* is going to be twice the distance over the propagation distance. The length of the EXA North and South submarine cable is 12,200 km and the speed of light is about 300,000 km/hr. $\frac{2}{3}$ of this is 200,000.

   $$RTT = 2 \cdot \frac{\text{Distance}}{\text{Propagation Speed}} = \frac{2 \cdot 12200}{200,000} = \frac{61}{50} \approx 0.122 \text{ hours}$$

   We want to calculate U_{sender} such that it is equal to 20%. Thus, we substitute into our equation as follows:

   $$\begin{aligned}\text{Windows Size} &= 0.2 \times 0.122 \times 10 \times 10^9 \\ &= 0.244 \times 10^9 \text{ bits} = \frac{0.244 \times 10^9 \text{ bits}}{9600 \text{ bits}} \approx 25416.\overline{6} \text{ packets}\end{aligned}$$

2. Consider a device, D, sending five TCP segments to another device. D measures the RTT of each packet, `SampleRTT`, as part of its regular TCP procedure to calculate the TCP timeout interval, `TimeoutInterval`. Suppose that the five measured `SampleRTT` values are 98ms, 95ms, 120ms, 110ms, and 75ms. *(Note: For the three questions below, you will fill-in the table at the bottom. Copy/redraw the table into the solution file that you will upload onto Brightspace.)*

   (a) (5 points) Compute the `EstimatedRTT` after each of these `SampleRTT` values is obtained, using a value of $\alpha = 0.125$ and assuming that the value of `EstimatedRTT` was 100ms just before the first of these five samples was obtained.

SampleRTT	**EstimatedRTT**	**DevRTT**	**TimeoutInterval**
98	99.75	4.1875	116.5
95	99.15625	4.1796875	115.875
120	101.76171875	7.6943359375	132.5390625
110	102.79150390625	7.5728759765625	133.0830078125
75	99.31756591796875	11.7590484619141	146.353759765625

(b) (5 points) Compute the `DevRTT` after each sample is obtained, assuming a value of $\beta = 0.25$ and assuming the value of `DevRTT` was 5ms just before the first of these five samples was obtained.

SampleRTT	EstimatedRTT	DevRTT	TimeoutInterval
98	99.75	4.1875	116.5
95	99.15625	4.1796875	115.875
120	101.7617188	7.694335938	132.5390625
110	102.7915039	7.572875977	133.0830078
75	99.31756592	11.75904846	146.3537598

(c) (5 points) Compute the TCP TimeoutInterval after each of these SampleRTTs is obtained.

SampleRTT	EstimatedRTT (ms)	DevRTT (ms)	TimeoutInterval (ms)
98	99.75	4.1875	116.5
95	99.1562	4.17969	115.875
120	101.762	7.69434	132.539
110	102.792	7.57288	133.083
75	99.3176	11.759	146.354