Transmission speed

The propagation delay is the total distance in meters divided by the speed in meters per millisecond

In[0]:= $\mathbf{distance := 775\ meters}$

In[1]:= $\mathbf{speed := 2.4 * 10^{11}\ meters / milliseconds}$

In[2]:= $\mathbf{d_{prop} = \frac{distance}{speed}}$

Out[2]= $3.22917 \times 10^{-9}\ \text{milliseconds}$

The return trip time (RTT) is thus

In[3]:= $\mathbf{RTT = d_{prop} * 2}$

Out[3]= $6.45833 \times 10^{-9}\ \text{milliseconds}$

To calculate the time it takes to send the file we convert the size to bits

In[4]:= $\mathbf{filesize := 640 * 10^{3}\ bytes * 8\ bits / bytes}$

The final delay is the sum of all the individual transmission delays and the RTT

In[5]:= $\mathbf{d_{AP} := \frac{filesize}{54 * 10^{6}\ bits / milliseconds}}$

In[6]:= $\mathbf{d_{modem} := \frac{filesize}{100 * 10^{6}\ bits / milliseconds}}$

In[7]:= $\mathbf{d_{DSLAM} := \frac{filesize}{2 * 10^{6}\ bits / milliseconds}}$

In[8]:= $\mathbf{d_{Internet} := \frac{filesize}{1 * 10^{6}\ bits / milliseconds}}$

In[9]:= $\mathbf{delay = d_{AP} + d_{modem} + d_{DSLAM} + d_{Internet} + RTT}$

Out[9]= $7.82601\ \text{milliseconds}$