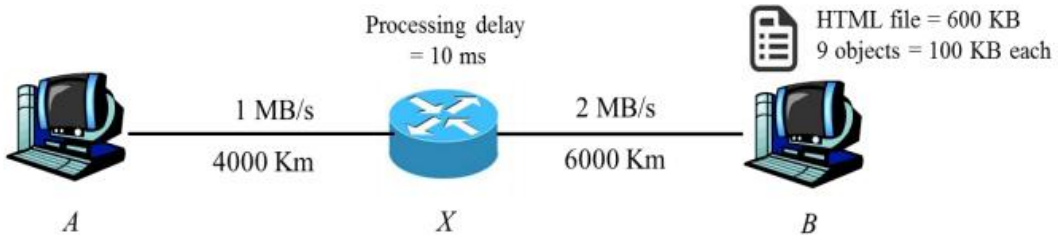
1. Two devices, A and B, are connected via a router, X, as shown in the figure below. Link AX is 4000 Km long and has data rate R1 = 1 MB/s; while link XB is 6000 Km long and has data rate R2 = 2 MB/s. The propagation speed on both links is 2.0 × 10^8 m/s and the processing time at the router is 10 ms (ignore queuing delay). The web browser on A is trying to retrieve a web page from B that consists of an HTML file and 9 objects. The size of the HTML file is 600 KB and each object is 100 KB. In addition, all TCP messages and HTTP requests have a size of 50 KB. You may assume that HTTP response messages have the same size as the object being transferred within that response. You may also ignore TCP acknowledgments.



a) Calculate the RTT (time for one bit to go from A to B and back from B to A)

RTT = 2 * (Dprop + Dproc)

RTT = 2 * (((4000*10^3)/(2*10^8)) + ((6000*10^3)/(2*10^8)) + 10*10^{-3})

b) What is the total delay in transferring all contents of the webpage if persistent connections are used.

Total Delay = (n+1) * RTT + Dtrans

= (10+1) * RTT + ((600 + 9*100)KB/(1MB/s)) + ((600 + 9*100)KB/(2*MB/s)) + ((12*50)KB/(1MB/s)) + ((12*50)KB/(2MB/s))