**Assignment #002**

In the following 5 questions, we are sending a 30\*106 bits MP3 file from a source host to a destination host. All links in the path between source and destination have a transmission rate of 10 Mbps. Assume that the propagation speed is 2\*108 meters/second, and the distance between source and destination is 10,000 km.

1. Initially suppose there is only one link between source and destination. Also suppose that message switching is used, with the message consisting of the entire MP3 file. Please calculate the transmission time (i.e. *TRANSP*) and the end-to-end delay (i.e. latency).

**dtrans = L/R = (3\*107)/107 = 3 S**

**dend-end = dtrans + dprop**

**= L/R + D/S**

**\  =3 + 107/(2\*108)**

**=3 + 0.05 = 3.05 S**

1. Referring to the above question, how many bits will the source have transmitted when the first bit arrives at the destination?

**第一位的传播时间 T 为：**

**T= D/S = 107/(2\*108) = 0.05 S**

**时间 T 内，已经传输的位数 n 为：n = 107\*0.05 = 5\*105 b**

1. Now suppose there are two links between source and destination, with one router connecting the two links. Each link is 5,000 km long. Again suppose the MP3 file is sent as one message. Suppose there is no congestion, so that the message is transmitted onto the second link as soon as the router receives the entire message. Please calculate the end-to-end delay (i.e. latency) .

**当链路中有一个路由器时，端到端时延为没有路由器时的端到端 时延再加上一个传输时延，即：**

**T = 107/(2\*108) + (3\*107)/107 + (3\*107)/107 = 6.05 S**

1. Now suppose that the MP3 file is broken into 3 packets, each of 10\*106 bits. Ignore headers that may be added to these packets. Also ignore router processing delays. Assuming store and forward packet switching at the router, Please calculate the total delay (i.e. latency).

**若分为三个包传输，所需时间为端到端时延加上一个包的传输时 延，即：**

**T = dend-end + 107/107 = 3.05 + 1 = 4.05**

1. Now suppose there is only one link between source and destination, and there are 10 FDMA (frequency division multiple access) channels in the link. The MP3 file is sent over one of the channels. Please calculate the end-to-end delay (i.e. latency).

**若分为十分频传输，则信息量变为原来的十分之一，所以传输时 间变为原来的十倍，同时传播时间不变，即：**

**T = 10\*dtrans + dprop**

**= 10\*3 + 0.05**

**= 30.05 S**