ITS 323 –PERFORMANCE EXAMPLES

1 Delay

Assume the following for a link:

- Transmission velocity, V = $2.8x10^8$m/s
- No queuing or processing delay

Calculate the propogation delay (d_p) and transmission delay (d_t), as well as the total delay (d).

1.1 Case 1

Length, L = 10km

Rate, R = 1Mb/s

Packet size, P = 100 Bytes

d_p = L/V = 10000 / 2.8 x 10^8 = 35.7usec

d_t = P / R = 100 x 8 / 10^6 = 800usec

d = 835 usec = 0.835msec

1.2 Case 2

L = 1000km

R = 1Mb/s

P = 100B

d_p = 3571usec

d_t = 800usec

d = 4.37msec

1.3 Case 3

GEO satellite

L = 36000km

R = 1Mb/s

P = 1000B

V = 3 x 10^8m/s

Bent pipe transmission (that is, we must count delay from ground up to satellite, and satellite back to ground).

d_p = 36000/3x10^8 = 0.12sec

d_t = 8x1000 / 10^6 = 80msec

D (total) = 2 x (0.12 + 0.08) = 0.4 sec

2 Packet Overhead and Throughput

Consider example on Slide 3 of “Protocol Architectures Examples” powerpoint.

Lets assume the image file is 100kB = 800,000 bits

Assume the following headers are added by respective layers:

- Application (to message): 30bytes
- Transport: 30 bytes to each segment, each segment is 1000Bytes
- Network: 20 bytes to each packet
- Data link: 10 byte header, 5 byte trailer
- Physical: 96 bits (12 bytes)

If the transmission line has a capacity of 1Mb/s, what is the throughput achieved (assuming no other overheads except packet headers).

Overheads:

- 30 bytes for App
- 101 segments at transport layer: 101 x 30
- 101 x 20 for network layer
- 101 x 15 for DL
- 101 x 12 for PHY

Total overhead = 30 + 101 x (30 + 20 + 15 + 12) = 7807 bytes

So have to send 107,807 bytes to get 100,000 bytes of real data through. Hence, throughput is:

(100,000 / 107,807) x 1Mb/s = 0.928Mb/s = 928kb/s