ECE570 Computer Networks HW1-2

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1 Service Rate (μ)

Given:

- Data rate $R_b = 1,000,000$ bits per second
- Package length $L = 1024$ bits

Formula:

$$\mu = \frac{R_b}{L}$$

Calculation:

$$\mu = \frac{1000000}{1024} \approx 976.56 \text{ Packets per second}$$

Therefore, the Service Rate is:

$$\mu \approx \textbf{976.56 Packets per second}$$

2 Traffic Intensity (I)

Given:

- Packet arrival rate $\lambda = 400$ packets per second
- Packet service rate $\mu = 976.56$ packets per second

Formula:

$$I = \frac{\text{Packet arrival rate}(\lambda)}{\text{Packets service rate}(\mu)}$$

Calculation:

$$I = \frac{400}{976.56} \approx 0.4098$$

Therefore, the traffic intensity is:

$$I \approx \textbf{0.4098}$$

3 Queuing length (Lq)

Given:

- Traffic intensity $I = 0.4098$

Formula:

$$Lq = \frac{I^2}{(1 - I)}$$

Calculation:

$$\frac{0.409^2}{(1 - 0.409)} \approx 0.283 \text{ Packets in queue}$$

Therefore, the queuing length is:

$$Lq \approx \textbf{0.283 Packets}$$

4 Queuing delay (Wq)

Given:

- Traffic intensity $I = 0.4098$
- Service rate $\mu = 976.56$

Formula:

$$Wq = \frac{I}{mu \times (1 - I)}$$

Calculation:

$$\frac{0.4098}{976.56 \times (1 - 0.4098)} \approx 0.00071 seconds$$

Therefore, the queuing delay is:

$$Wq \approx \mathbf{0.00071\ seconds}$$