COMPUTER NETWORKS [CSA0735]

ASSIGNMENT-4

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SCENARIO: A smart grid uses priority queues to manage control and billing data.

PARAMETERS: Arrival rate (λ_1) = 5/s
Billing data (λ_2) = 10/s
Service rate (μ) = 20/s

1. What is total traffic intensity?

* Traffic intensity (ρ) is a ratio of the total arrival rate (λ) to the service rate (μ).

Given $\lambda_1 = 5/s$, $\lambda_2 = 10/s$

$\lambda_1 + \lambda_2 = \lambda = 15/s$

Service rate (μ) = 20/s

$$\rho = \frac{15}{20} = 0.75 \quad (=75\%)$$

Ans: total traffic intensity = 0.75 (75%)

2. If control has strict priority, what is average waiting time for billing queue?

Answer If control data has strict priority, the billing queue must wait until all control data is processed.

• For billing queue ($\lambda_2 = 10/s$):

→ Residual service time (R):

$$R = \frac{\ell}{\mu} = \frac{0.75}{20} = 0.0375 \text{ sec}$$

→ waiting time due to higher priority traffic control?

$$W = \frac{R}{1-\ell_1} \quad (\text{where } \ell_1 = \lambda_1 / \mu = 5/20 = 0.25)$$

$$= \frac{0.0375}{1-0.25} = \frac{0.0375}{0.75} = 0.05 \text{ seconds.}$$

Average waiting time for billing queue = 0.05 secs or 50 ms.

3. What happens to billing if control queue becomes full?

Ans: * The control queue has finite buffer.

* If the control queue fills up, new control packets are dropped, since strict priority prevents billing data from being processed until the control queue clears.

* It continues to process but may experience delay (longer).

* If the total system capacity load exceeds ($\rho \geq 1$), both ques will grow indefinitely.

Possible outcomes

→ Billing queue keeps growing

→ Packets loss for control data if queue is full.

→ Increased latency for billing data if system is overloaded.