Network Performance Evaluation: Queueing Theory Equations

- M/M/1

$$\textit{Average Number in System} = E[K] = \frac{\rho}{1-\rho}$$

$$\text{Variance of } \textit{Number in System} = \mathrm{Var}[K] = \frac{\rho}{(1-\rho)^2}$$

$$\textit{Delay through System} =$$

$$E[D] = \frac{1}{\mu(1-\rho)} = \frac{\frac{E[L]}{C}}{(1-\rho)} = \frac{E[TH]}{(1-\rho)} = \frac{1}{\mu-\lambda}$$

Probability of k in system = $P[K=k] = \rho^k(1-\rho)$

Probability of system busy = utilization = ρ

Probability of system empty = $1-\rho$

- M/M/1/S

$$P[K=k] = \frac{(1-\rho)\rho^k}{1-\rho^{S+1}} \text{ for } k \le S$$

$$P[K=k] = 0 \text{ for } k > S$$

$$P_{Blocking} = P[K=S] = \frac{(1-\rho)\rho^S}{1-\rho^{S+1}}$$

- M/M/S/S

$$P[K=k] = \frac{\frac{\rho^k}{k!}}{\sum_{n=0}^{S} \frac{\rho^n}{n!}}$$

$$P[K=k] = 0 \text{ for } k > S$$

$$P_{Blocking} = P[K=S] = \frac{\frac{\rho^S}{S!}}{\sum_{n=0}^{S} \frac{\rho^n}{n!}}$$