Extra Notes for Section 2.4

Wednesday, December 12, 2012 10:53 AM

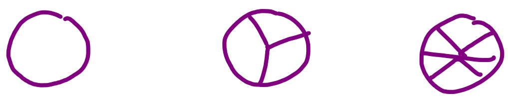
Sec. 2.4

Old formula: capacity $= \dfrac{A_{total}}{A_{cell}} \times \dfrac{S}{N}$

- $\dfrac{A_{total}}{A_{cell}}$: # cells in the system
- $\dfrac{S}{N}$: # channels per cell. usually $\gg S$

New formula: $\dfrac{A_{total}}{A_{cell}} \times n \times \Delta$

- n: get this from the Erlang B formula; # users that a sector can support
- $n \times \Delta$: # users that a cell can support



Sectoring	No Sectoring	120°	60°
K	6	2	1
Δ	1	3	6
$\left\lfloor \dfrac{S}{N\Delta} \right\rfloor = m$	$\left\lfloor \dfrac{S}{N} \right\rfloor$	$\left\lfloor \dfrac{S}{N3} \right\rfloor$	$\left\lfloor \dfrac{S}{N6} \right\rfloor$

$$n = \frac{A}{A_u} = \frac{A}{\lambda_u \times \frac{1}{\mu}}$$

A: Erlang B formula

call blocking probability: $P_b = \dfrac{\dfrac{A^m}{m!}}{\displaystyle\sum_{k=0}^{m} \dfrac{A^k}{k!}}$

$$A = \lambda \times \frac{1}{\mu} \quad \xleftarrow{\times n} \quad A_u = \lambda_u \times \frac{1}{\mu}$$

- λ: call request rate (Poisson process)
- $\frac{1}{\mu}$: average call duration

X = call duration

$X \sim \mathcal{E}(\mu)$

$$f_X(x) = \begin{cases} \mu e^{-\mu x}, & x > 0 \\ 0, & \text{otherwise} \end{cases}$$

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$$\mathbb{E}X = \int_{-\infty}^{\infty} x \, f_X(x) \, dx = \frac{1}{\mu} \equiv H$$

μ = service "rate"