Mobile Communications

TCS 455

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Lecture 8

Office Hours:
BKD 3601-7
Tuesday 14:00-16:00
Thursday 9:30-11:30

Announcements

- Read
  - Chapter 3: 3.1 – 3.2, 3.5.1, 3.6, 3.7.2
    - Posted on the web
  - Appendix A.1 (Erlang B)
- Due date for HW2: Nov 27
- All ***graduate* students** should send an email to me (prapun@siit.tu.ac.th). I need to somehow add ***your id*** into the SIIT online lecture note system. In the case that there is some delay to this, I might need to send the files to you via ***email***.

Big Picture

S = total # available duplex radio channels for the system

Frequency reuse with **cluster size N**

"Capacity" $C = \frac{A_{total}}{A_{cell}} \times \frac{S}{N}$

Tradeoff $\frac{S}{I} \approx \frac{kR^{-\gamma}}{K \times (kD^{-\gamma})} = \frac{1}{K}\left(\frac{D}{R}\right)^{\gamma} = \frac{1}{K}\left(\sqrt{3N}\right)^{\gamma}$

M = # channels allocated to each cell.

Omni-directional: K = 6
120° Sectoring: K = 2
60° Sectoring: K = 1

Trunking

Call blocking probability $P_b = \frac{\frac{A^M}{M!}}{\sum_{m=0}^{M} \frac{A^m}{m!}}$. Erlang-B formula

λ = Average # call attempts/requests per unit time

A = traffic intensity or load [Erlangs] = $\frac{\lambda}{\mu}$

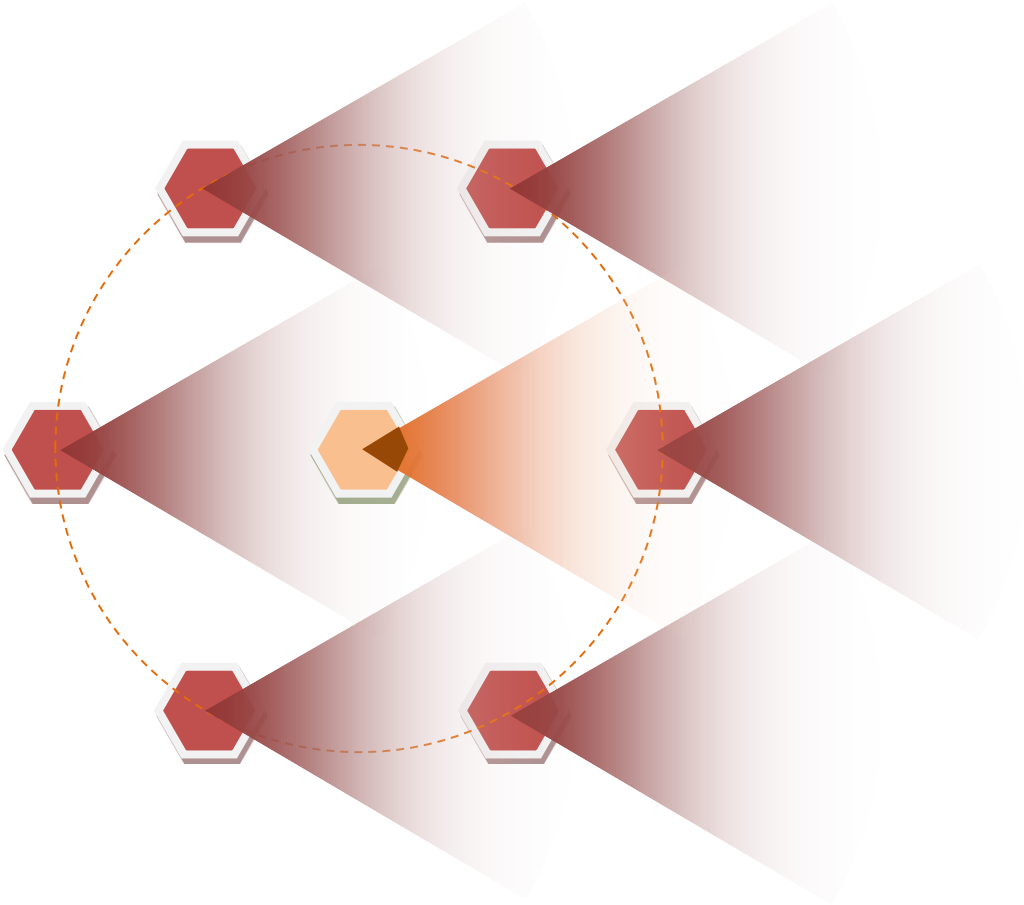
$\frac{1}{\mu} = H$ = Average call length

Erlang B Trunking Efficiency

Table 3.4 Capacity of an Erlang B System

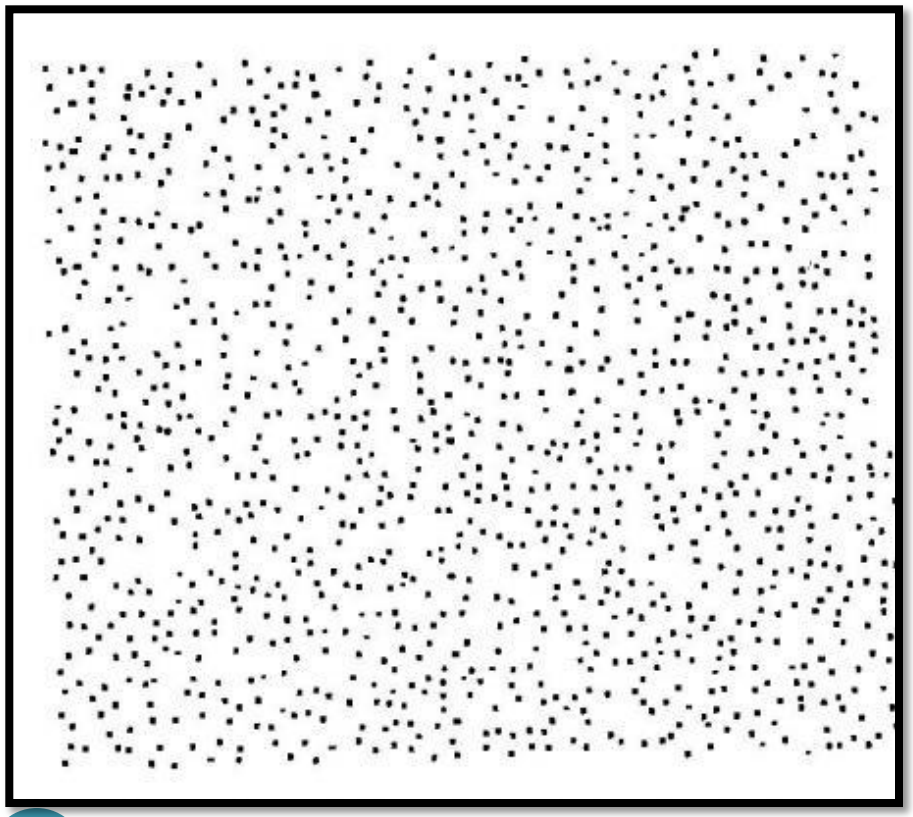
Number of Channels *C*	Capacity (Erlangs) for GOS = 0.01	= 0.005	= 0.002	= 0.001
2	0.153	0.105	0.065	0.046
4	0.869	0.701	0.535	0.439
5	1.36	1.13	0.900	0.762
10	4.46	3.96	3.43	3.09
20	12.0	11.1	10.1	9.41
24	15.3	14.2	13.0	12.2
40	29.0	27.3	25.7	24.5
70	56.1	53.7	51.0	49.2
100	84.1	80.9	77.4	75.2

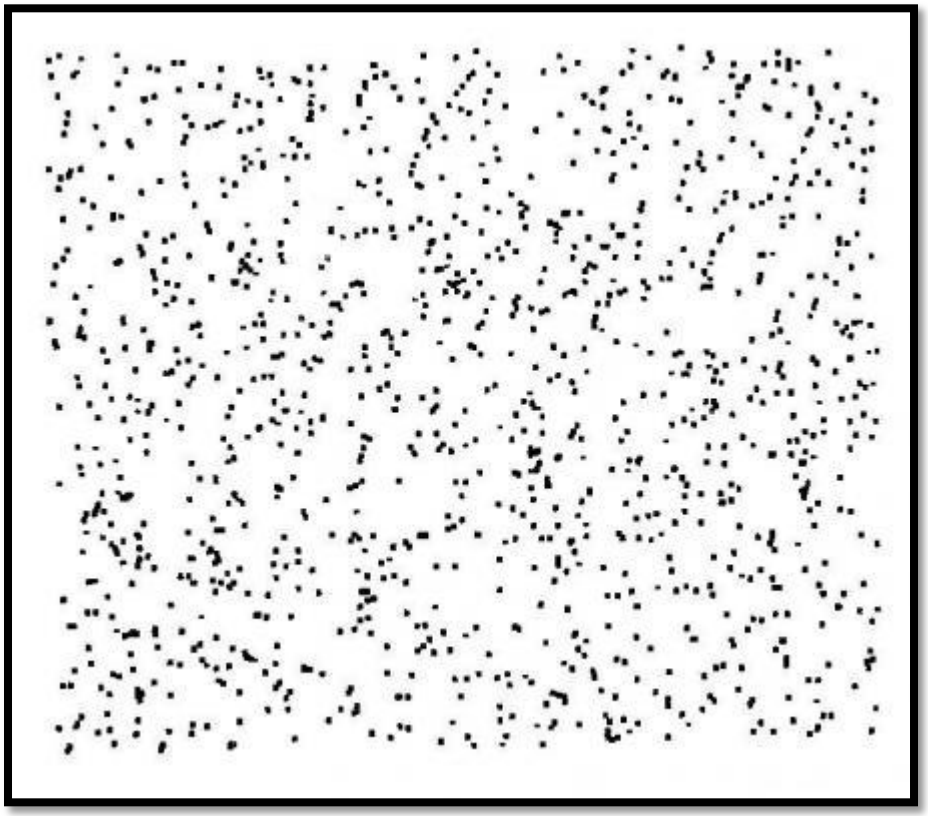
60 Degree Sectoring



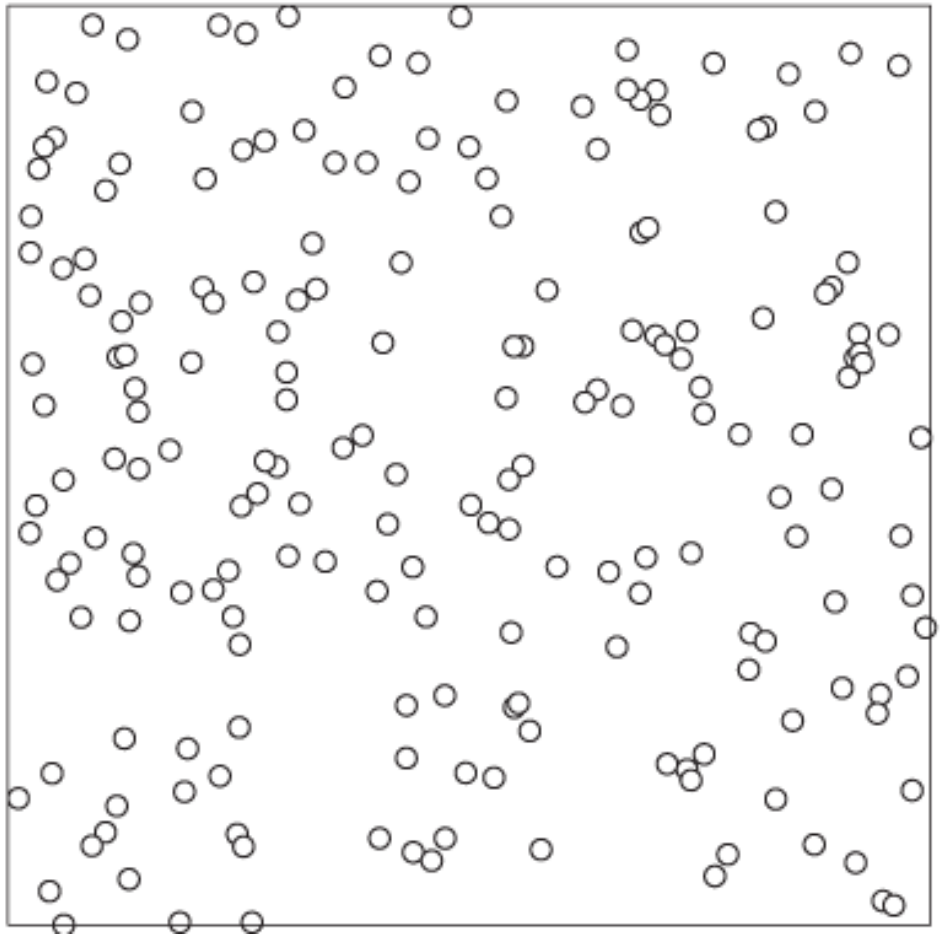
Poisson Process?

One of these is a realization of a two-dimensional Poisson point process and the other contains correlations between the points. One therefore has a real pattern to it, and one is a realization of a completely unstructured random process.





Poisson Process



All the structure that is visually apparent is imposed by our own sensory apparatus, which has evolved to be so good at discerning patterns that it finds them when they're not even there!

Example

- Examples that are well-modeled as Poisson processes include
  - radioactive decay of atoms,
  - telephone calls arriving at a switchboard,
  - page view requests to a website,
  - rainfall.