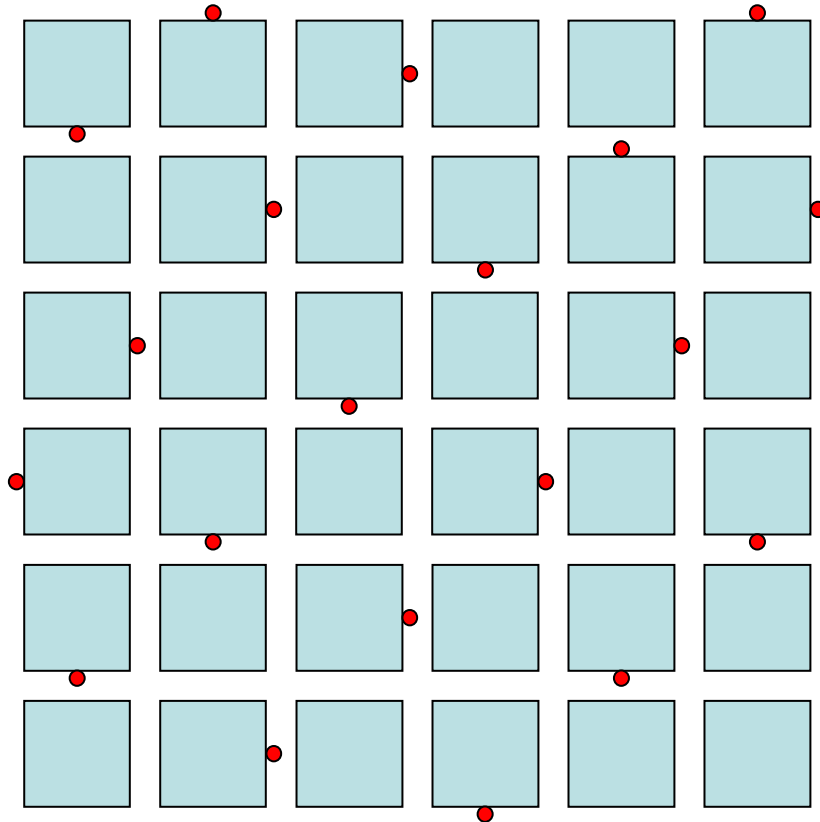


# Cellular network planning and optimization: Exercise

13.2.2008

# SystemLayout



## Simplified pathloss model

Blocksize=75m

Streetwidth=15m

Pathloss along the street

$$L = 20 \cdot \log_{10} \frac{4\pi d}{\lambda} + n \cdot 20 \quad [\text{dB}]$$

$d$  = distance along the street

$\lambda$  = signal wavelength

$n$  = number of corners

• Microbase station

This is called a Manhattan deployment and it is used to evaluate the efficiency of micro-cell systems in urban environments.

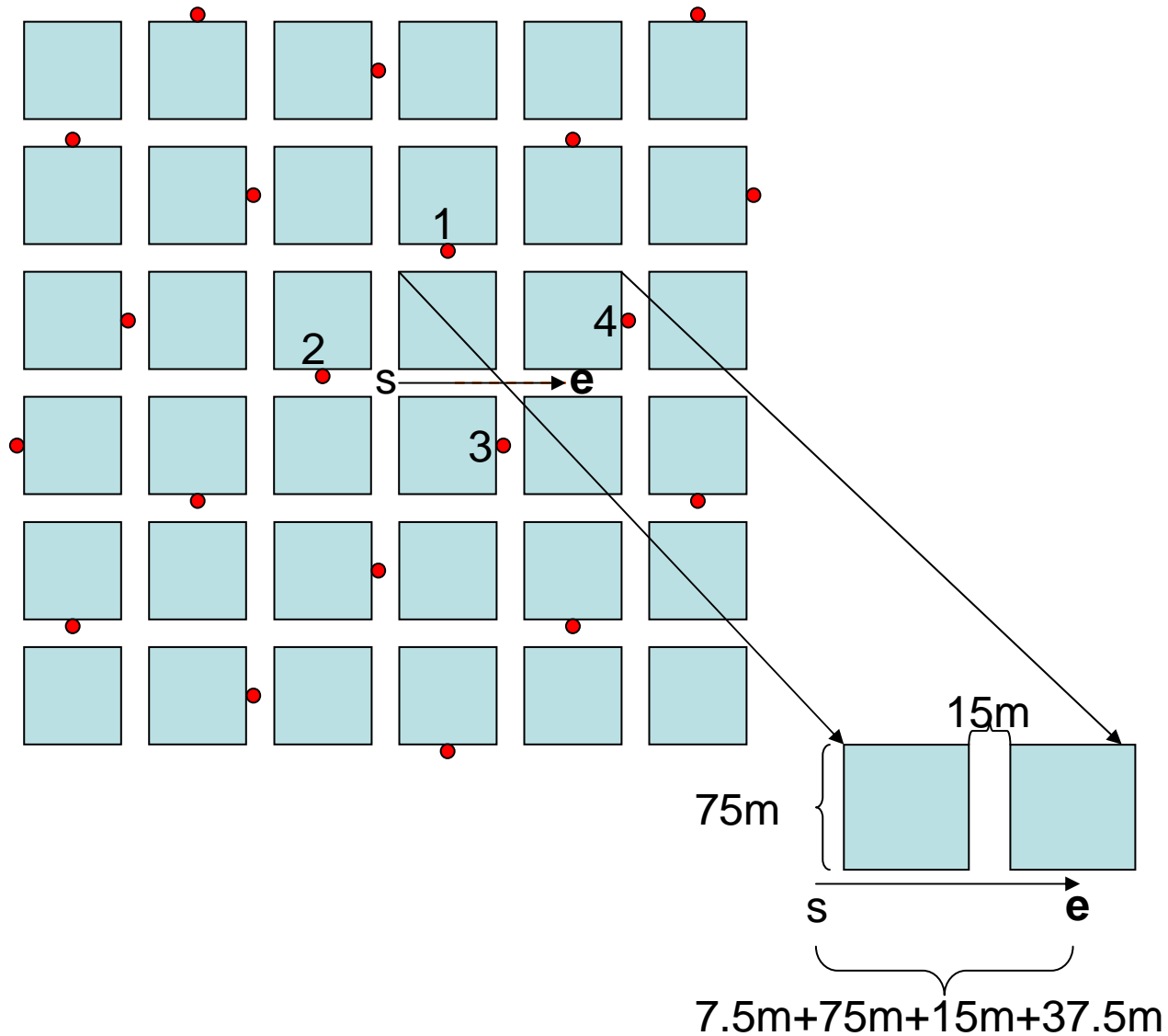
# Assumptions

- Consider cluster sizes  $K=1,3,4$
- MS is always connected to the strongest BS (strongest = smallest path loss between BS and MS).
- All base stations have the same transmission power (in fact transmission power is not needed for the solution)
- When computing the path loss between two points, keep in mind that there are alternative routes between points but
  - Compute path loss/interference only along the route with smallest number of corners.
  - If there are multiple routes for which the number of corners is the same, then compute path loss only for the shortest route (in practice this model is not very good but our rule simplifies the exercise).

# Tasks1

- Make a frequency plan for cluster sizes  $K=3$  and  $K=4$ . Assign frequency numbers with base stations in the figure.

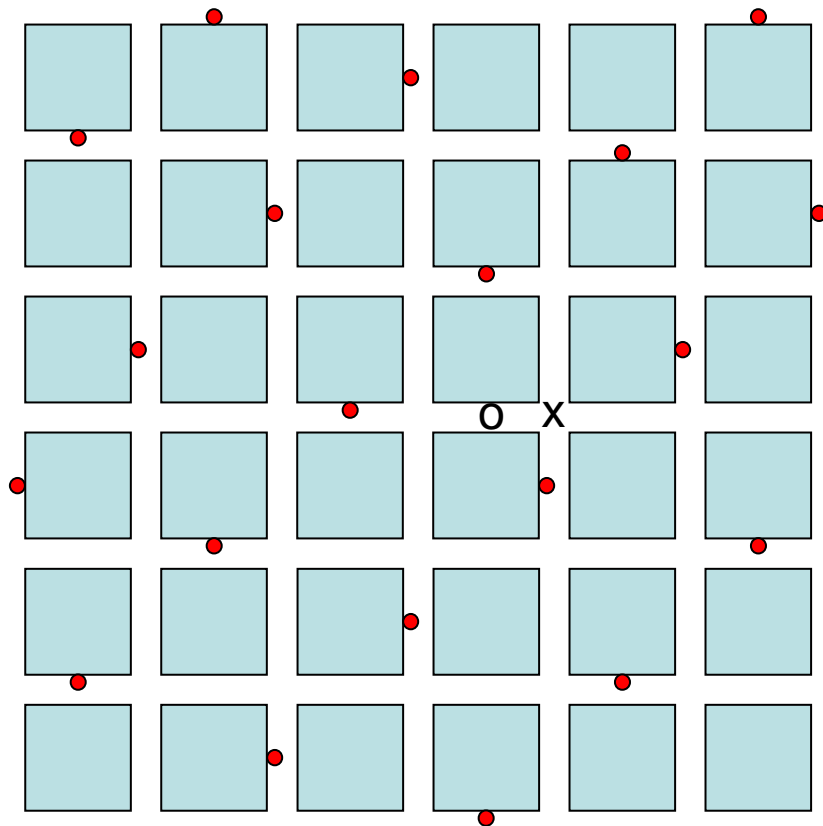
# Figurefortask2.



# Task2

- Assume  $K=1$  and make a program (excel or matlab) that calculates the path losses and SIR in the MS receiver along the route that is depicted in the figure by black arrow.
- Take into account only 4 nearest base stations (3 interferers).
- You can simplify the task by doing computations on only 10 different points on the route. Your tasks:
  - Plot a figure where path losses between MS and different base stations are shown.
  - Denote in figure the (hard) handovers between base stations
  - Plot SIR (in decibels) as a function of distance from the starting point.
  - Is the nominal GSM SINR requirement fulfilled everywhere in the route?
  - Report your conclusions.

# Figure for Task3



# Task3

- Make a program (excel or matlab) that calculates the SIR given points (x, in the crossroad, o in the middle of the building block).
  - If  $K=1$ , take into account the nearest 4 base stations (3 interferers)
  - If  $K=3$  or  $4$ , take into account first tier interferers only
  - Report your conclusions.