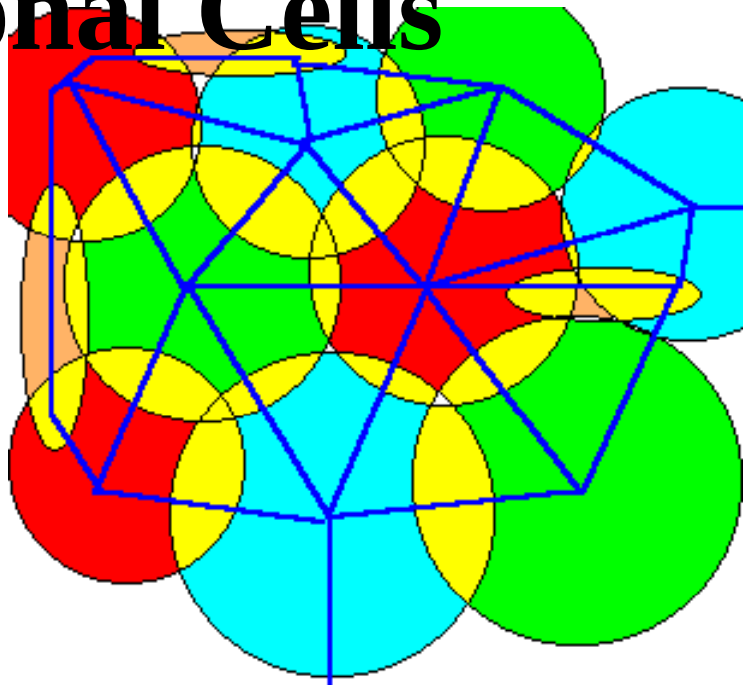
Cell Geometry and Hexagonal Cells



Cell Geometry

Triangular cell

Square cell

Hexagonal cell

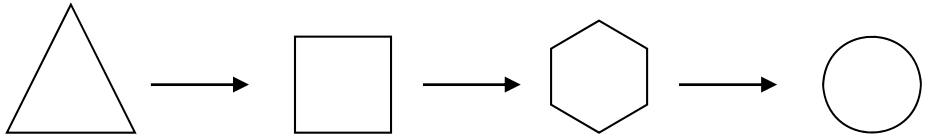
Circle cell

Types of cells depends on the location of BSs

Cell boundary: Equal power line

Why Hexagonal?

Compactness increases



Each cell has same area: A=area/cell

Worst case user is more adjacent to the BS

Why Hexagonal?

Cell design needs to consider the path loss of the **worst case user**

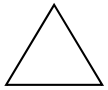
Radius of the worst case user

$R_T = 0.87\sqrt{A}$

$R_S = 0.70\sqrt{A}$

$R_H = 0.62\sqrt{A}$

$R_C = 0.56\sqrt{A}$

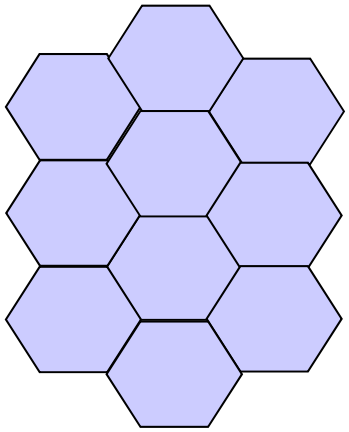
Worst case user from the center of  is 30% more apart compared to 

$P_T/P_H = (0.62/0.87)^4 = -6dB$

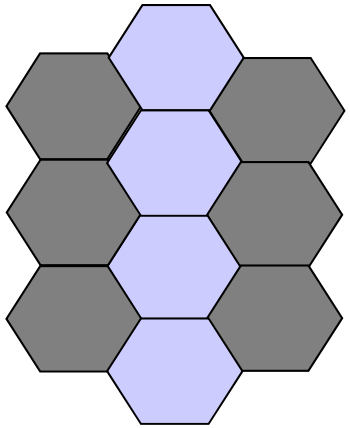
Reuse patterns in Hexagonal cells

N = valid reuse cluster size
= # of cells per valid reuse cluster

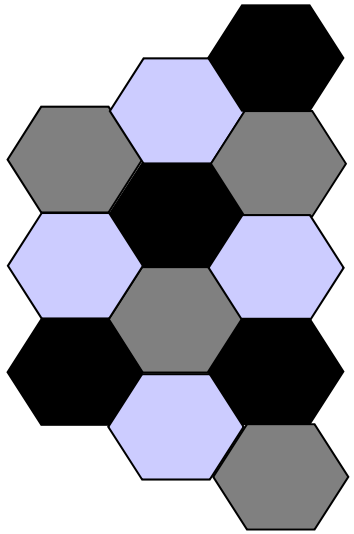
N=1



N=2



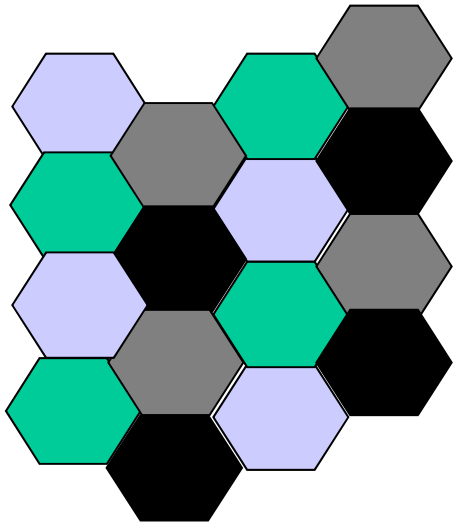
N=3



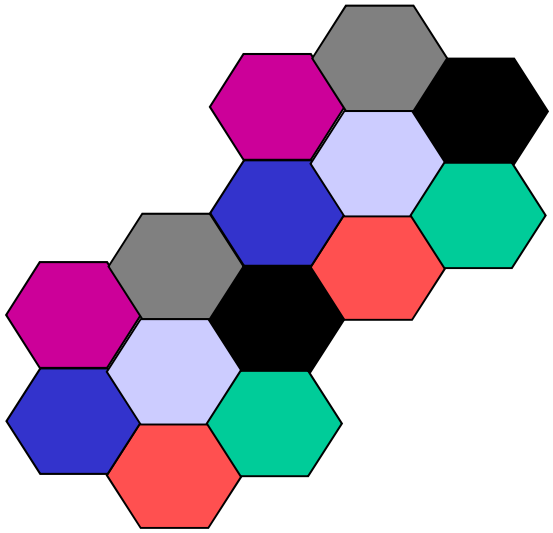
Not valid: the nearest interferer
is same distanced as in N=1

Reuse patterns in Hexagonal cells

N=4



N=7



Reuse Cluster Size

How do you decide a certain number N is valid or not?

$N = i^2 + j^2 + ij$, i, j: nonnegative integers

i	j	N
1	0	1
1	1	3
2	0	4
2	1	7
2	2	12
3	0	9

Reuse Cluster Size

How do you find the nearest co-channel cell?

1. Move *i* cells along any chain of hexagons
2. Turn 60º counter clockwise and move *j* cells

Reuse Cluster Size and C/I

# of ch/cell = Total # of ch/*N*

How do you decide *N* ?

Smallest *N* that meets the required C/I

It increases the # of channels that can be used at each cell

Small cluster (*N*=4)	Big cluster (*N*=7)
More ch/cell	Less ch/cell
Worse C/I	Better C/I

Reuse Cluster Size and C/I

Co-channel Interference

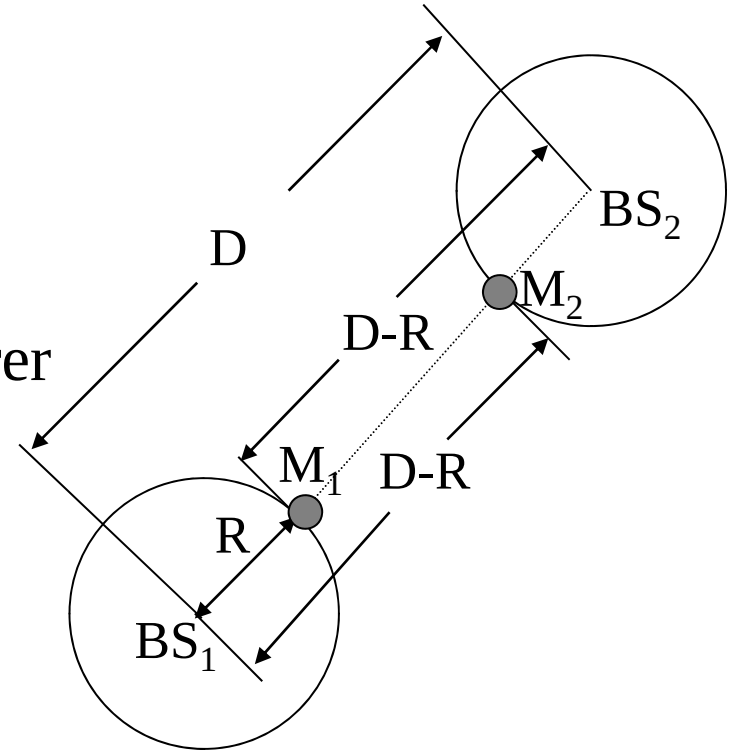
$$D = R\sqrt{3(i^2 + j^2 + ij)} = R\sqrt{3N}$$

$$\frac{D}{R} = \sqrt{3N}$$

C/I by nearest co-channel interferer

$$\left(\frac{C}{I}\right)_1 = \left(\frac{D-R}{R}\right)^4$$

$$\left(\frac{C}{I}\right)_6 = \frac{1}{6}\left(\frac{D-R}{R}\right)^4 = \frac{1}{6}(\sqrt{3N}-1)^4$$



Reuse Cluster Size and C/I

$$\frac{C}{I} = \frac{1}{6}(\sqrt{3N} - 1)^4$$

In AMPS

N	C/I
1	< 1
3	≈ 3
4	≈ 6
7	$27 \cong 15$ dB
9	51
12	$104 \cong 20$ dB