$$\text{SIR} \approx \frac{1}{K}\left(\sqrt{3N}\right)^{\gamma} \qquad C = \frac{A_{\text{total}}}{A_{\text{cell}}} \times \frac{S}{N}$$

# Sectoring

- Advantages
  - Reduce interference by reducing K
    - Increase SIR (better call quality).
    - The increase in SIR can be **traded** with reducing the cluster size (N) which increase the capacity.
- Disadvantages
  - Increase number of antennas at each base station.
  - Next section: Decrease **trunking efficiency** due to channel sectoring at the base station.
    - The available channels in the cell must be subdivided and dedicated to a specific antenna.

Make sure that you understand where numbers in this table come from!

# Example 3 (3)

| | Omnidirectional | 120° Sectoring | 60° Sectoring |
|---|---|---|---|
| K | 6 | 2 | 1 |
| N | 7 | 3 | 3 |
| SIR [dB] | 18.7 | 16.1 | 19.1 |
| #channels/cell | $\lfloor 400/7 \rfloor = 57$ | $\lfloor 400/3 \rfloor = 133$ | $\lfloor 400/3 \rfloor = 133$ |
| #sectors | 1 | 3 | 6 |
| #channels/sector | 57 | $\left\lfloor \frac{400}{3}/3 \right\rfloor = 44$ | $\left\lfloor \frac{400}{3}/6 \right\rfloor = 22$ |
| A [Erlangs]/sector | 51.55 | 38.56 | 17.13 |
| A [Erlangs]/cell | 51.55 | $38.56 \times 3 = 115.68$ | $17.13 \times 6 = 102.78$ |
| #users/cell | 18558 | 41645 | 37001 |

Assume that each user makes 2 calls/day and 2 min/call on average → 1/360 Erlangs.

Conclusion: With $\gamma = 4$, SIR $\geq 15$ dB, and Pb $\leq 5\%$,
120° sectoring with cluster size $N = 3$ should be used.

# Example 3 (4): Remarks

| | Omnidirectional | 120° Sectoring | 60° Sectoring |
|---|---|---|---|
| K | 6 | 2 | 1 |
| N | 7 | 7 | 7 |
| SIR [dB] | 18.7 | 23.43 | 26.44 |
| #channels/cell | $\lfloor 400/7 \rfloor = 57$ | $\lfloor 400/7 \rfloor = 57$ | $\lfloor 400/7 \rfloor = 57$ |
| #sectors | 1 | 3 | 6 |
| #channels/sector | 57 | $\left\lfloor \frac{400}{7}/3 \right\rfloor = 19$ | $\left\lfloor \frac{400}{7}/6 \right\rfloor = 9$ |
| A [Erlangs]/sector | 51.55 | 14.31 | 5.37 |
| A [Erlangs]/cell | 51.55 | $14.31 \times 3 = 42.94$ | $5.37 \times 6 = 32.22$ |

For the same $N$, we see that 120° sectoring and 60° sectoring give much better SIR. However, sectoring reduces the trunking efficiency and therefore suffer reduced value of A.

| | Omnidirectional | 120° Sectoring | 60° Sectoring |
|---|---|---|---|
| K | 6 | 2 | 1 |
| N | 7 | 7 | 7 |
| SIR [dB] | 18.7 | 23.43 | 26.44 |
| #channels/cell | $\lfloor 400/7 \rfloor = 57$ | $\lfloor 400/7 \rfloor = 57$ | $\lfloor 400/7 \rfloor = 57$ |
| #sectors | 1 | 3 | 6 |
| #channels/sector | 57 | $\left\lfloor \frac{400}{7}/3 \right\rfloor = 19$ | $\left\lfloor \frac{400}{7}/6 \right\rfloor = 9$ |
| A [Erlangs]/sector | 51.55 | 14.31 | 5.37 |
| A [Erlangs]/cell | 51.55 | $14.31 \times 3 = 42.94$ | $5.37 \times 6 = 32.22$ |

Idea: The values of SIR are too high for the cases of 120° sectoring and 60° sectoring. We can further reduce the cluster size. This increases the number of channels per cell and hence per sector.

| | Omnidirectional | 120° Sectoring | 60° Sectoring |
|---|---|---|---|
| K | 6 | 2 | 1 |
| N | 7 | 3 | 3 |
| SIR [dB] | 18.7 | 16.1 | 19.1 |
| #channels/cell | $\lfloor 400/7 \rfloor = 57$ | $\lfloor 400/3 \rfloor = 133$ | $\lfloor 400/3 \rfloor = 133$ |
| #sectors | 1 | 3 | 6 |
| #channels/sector | 57 | $\left\lfloor \frac{400}{3}/3 \right\rfloor = 44$ | $\left\lfloor \frac{400}{3}/6 \right\rfloor = 22$ |
| A [Erlangs]/sector | 51.55 | 38.56 | 17.13 |
| A [Erlangs]/cell | 51.55 | $38.56 \times 3 = 115.68$ | $17.13 \times 6 = 102.78$ |