Class: 4th

MOBILE COMMUNICATIONS

Tetorial 3

Chapter Two

Cellular Network Coverage

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Q1: What is the Dynamic Channel Assignment Strategy?

Answer:

Dynamic Channel Assignment

• Voice channels are allocated to different cells Dynamically

• Each time a call request is made, the BS request a channel from the MSC.

• MSC Dynamic allocates a channel to the requesting cell using an algorithm that takes into account

1. likelihood of future blocking

2. The reuse distance of the channel (should not cause interference)

3. Other parameters like cost

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Q2: What are the advantage and disadvantage of dynamic channel assignment?

Answer:

Advantage:

1- reduces call blocking (it increases the trunking capacity), and increases voice quality.

2- Increases the channel utilization and decreases probability of a blocked call

Disadvantage: increases storage & computational load on the MSC.

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Q3: Define the Following:

1- Borrowing strategy: a cell is allowed to borrow channels from a neighboring cell if all of its own channels are already occupied. The mobile switching center (MSC) supervises such borrowing procedures.

2- Umbrella cell approach: using different antenna heights (often on the same building or tower) and different power levels, it is possible to provide "large" and "small" cells which are co-located at a single location.

Q4: what are the types of Handoff?

1. INTRA-CELL, within a cell, narrow-band interferences could make transmission at a

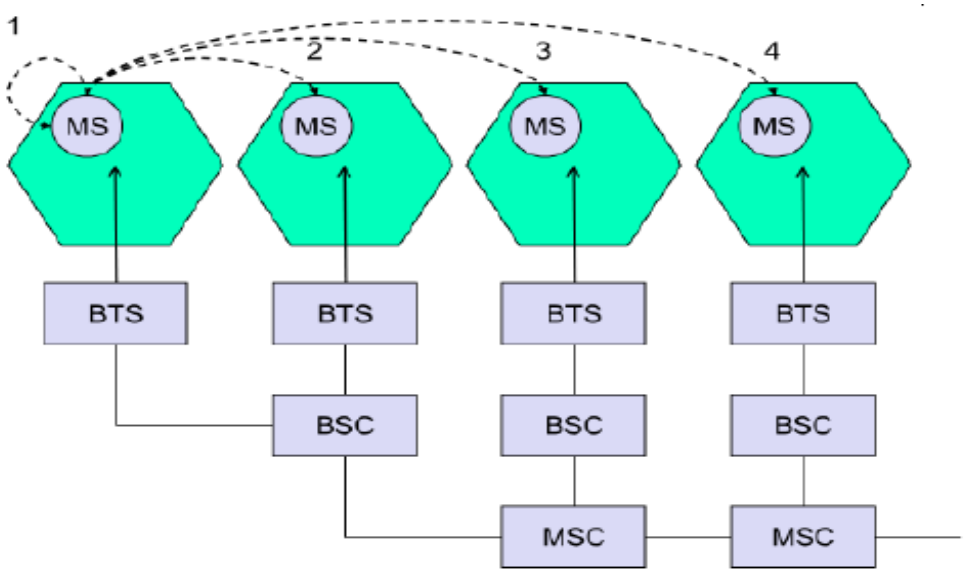
certain frequency impossible. The BSC decides to change the carrier frequency.

2. INTRA BSS, between cells controlled by the same BSC. The BSC performs the handover, assigns a new radio channel in the new cell and releases the old one

3. INTER BSS, between cells controlled by different BSCs, and the MSc is involved.

4. INTER MSC-from region to region where more than one MSC is involved. Between two cells

belonging to different MSCs. Both MSCs perform the handover together



Q5: Consider the advanced mobile phone system (AMPS) in which an S/I ratio of 17 dB is required for the accepted voice quality. Assume $\gamma = 4$.

(a) What should be the reuse factor for the system?

(b) What will be the reuse factor of the Global System of Mobile (GSM) system in which an S/I of 11 dB is required?

Solution

a) $N = \frac{1}{3}[6(\frac{S}{I})]^{\frac{2}{\gamma}}$

Convert S/I from dB to ratio

S/I= $10^{1.7}$ =50.11

$$N_{AMPS} = \frac{1}{3}[6(50.11)]^{\frac{2}{4}} = 5.78 \cong 6$$

Convert S/I from dB to ratio

S/I=$10^{1.1}$=12.589

$$N_{GSM} = \frac{1}{3}[6(12.589)]^{\frac{2}{4}} = 2.897 \cong 3$$

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Q6: Consider a cellular system with 395 total allocated voice channel frequencies. Calculate the mean S/I ratio for cell reuse factor equal to 4, 7, and 12. Assume omnidirectional antennas with six interferers in the first tier and a slope for path loss of 40 dB/decade ($\gamma = 4$). Discuss the results.

For a reuse factor $N = 4$, the number of voice channels per cell site = $K/N = 395/4 = 99$.

$$N = \frac{1}{3}\left[6\left(\frac{S}{I}\right)\right]^{\frac{2}{\gamma}}$$

$$4 = \frac{1}{3}\left[6\left(\frac{S}{I}\right)\right]^{\frac{2}{4}}$$

$$\frac{S}{I} = 24\ (13.8\,dB)$$

The results for $N = 7$ and $N = 12$ are given in Table below.

N	Voice channels per cell	Mean S/I (dB)
4	99	13.8
7	56	18.7
12	33	23.3

It is evident from the results that, by increasing the reuse factor from $N = 4$ to $N = 12$, the mean S/I ratio is improved from 13.8 to 23.3 dB.

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Q7/ Design a cellular system for a city, the path loss measurements indicated that the loss exponent γ = 2.93 and a cellular system needs an S/I ratio of 15 dB. Find the minimum reuse factor (N) required for omnidirectional antennas.

Solution:

$$N = \frac{1}{3}\left[6\left(\frac{S}{I}\right)\right]^{\frac{2}{\gamma}}$$

$$N = \frac{1}{3}\left[6\left(10^{\frac{15}{10}}\right)\right]^{\frac{2}{2.93}} = 11.96 \approx 12$$

Q8/ What are the parameters that the Handoff depending on ?

Solution

a. Power

b. Traffic

c. Channel quality

d. Distance

e. Administration

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Q(9) how the Adjacent Channel Interference (ACI) can be reduced?

Answer:

The ACI can be reduced by:

(1) Using modulation schemes which have low out-of-band radiation.

(2) Carefully designing the band-pass filter (BPF) at the receiver front end.

(3) Assigning adjacent channels to different cells in order to keep the frequency separation between each channel in a given cell as large as possible.

(4) The effects of ACI can also be reduced using advanced signal processing techniques that employ equalizers.