*presents*



# Channel planning for wireless systems

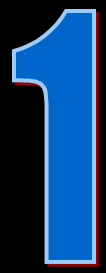
# Successful deployment

- **A successful wireless network deployment is completely dependent on the Wireless planning process.**

# Many network deployments can fail to deliver

1. **reliability,**
2. **capacity and**
3. **Performance**

due to poor planning and network design, a bad site survey or network implementation.



- Judiciously assigning the appropriate radio channels to each base station

  ====➔ is an important process
- That is much more difficult in practice than in theory
- For determining the appropriate frequency reuse ratio (or) cluster size & the appropriate separation between adjacent co- channel cells

# 2

- **Cellular systems in practice**

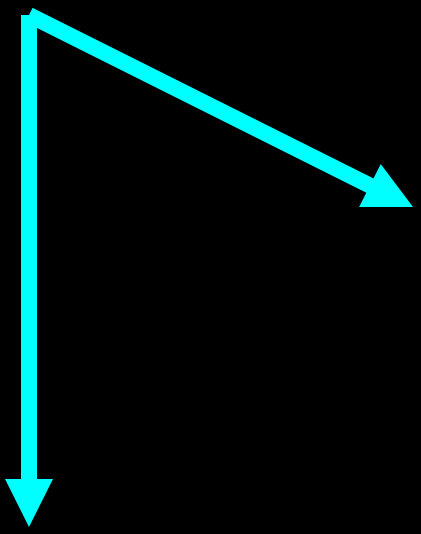
  **seldom obey**

  the homogenous propagation path loss

# Channels

- Generally the available mobile radio spectrum is divided into channels.
- Channels are part of an air interface standard that is used throughout a country or continent

# Channels



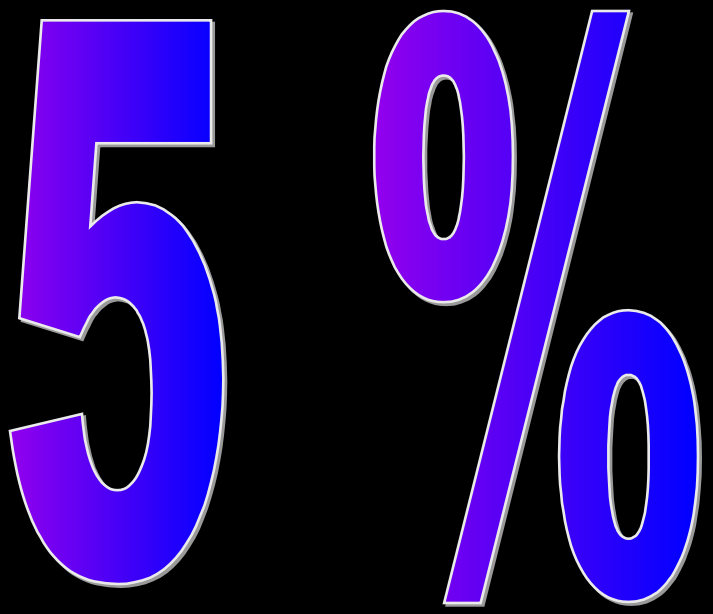
1) voice channel

2) control channel

# control channel

Control channels are vital for

1. INITIATING
2. REQUESTING
3. PAGING



# “ one control channel is needed within a cell ” validate ?

- **Since control channels are vital in successful launch of any call , the frequency re use strategy applied to control channels is different and generally more conservative**

- **Typically,**

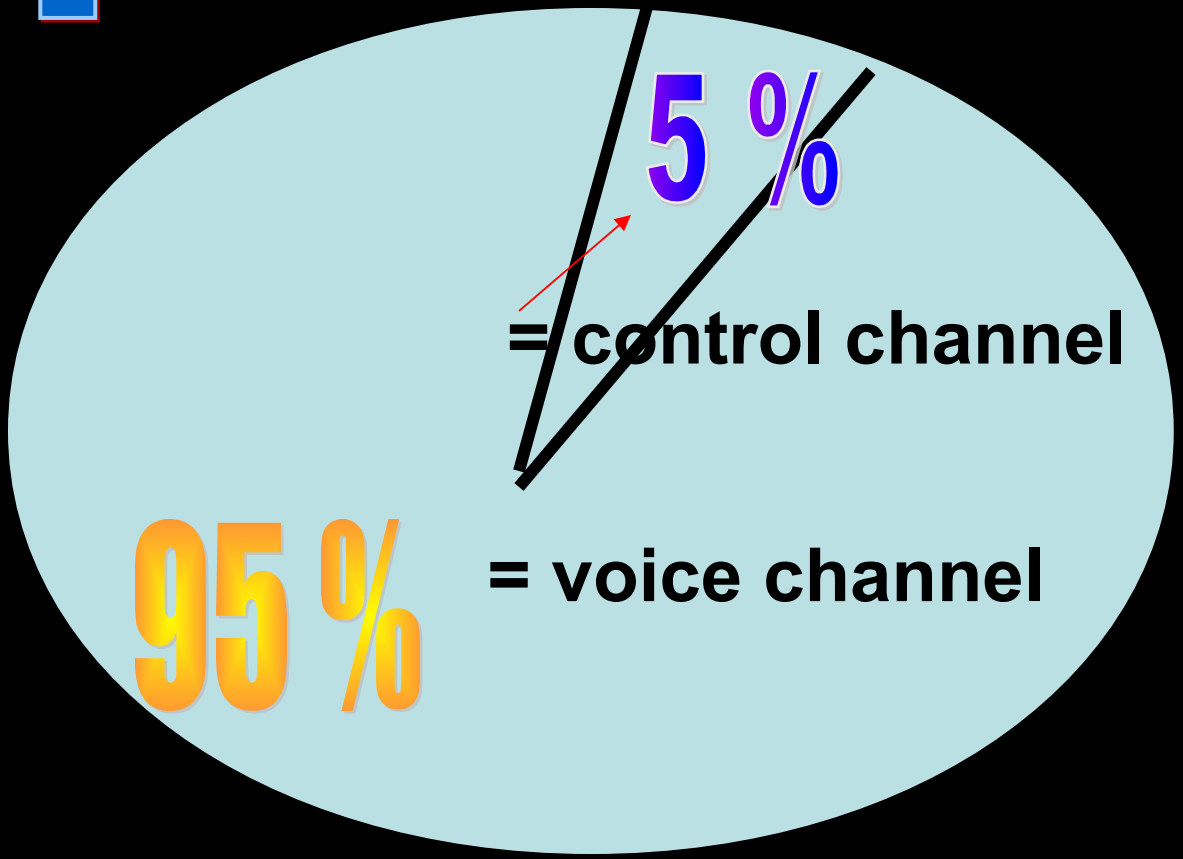
  **Control channels are able to handle a great deal of data such that only one control channel is needed within a cell**

# voice channel

# 95%

- Dedicated for carrying revenue generating traffic

# 4 Pie chart



- In practical systems the air interface standard ensures a distinction between

**Voice channels**

**&**

**Control channels**

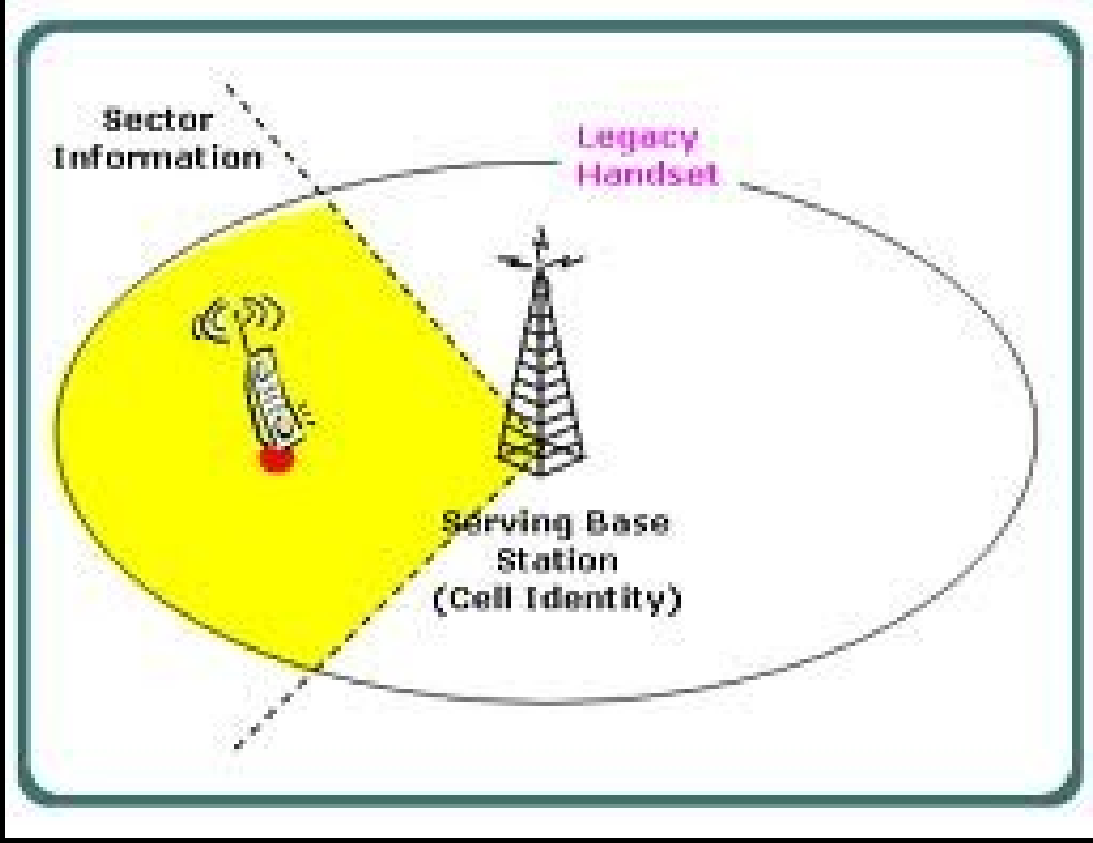
# 5 Regarding usage

- Control channels are generally not allowed to be used as voice channel

&

- voice channels are generally not allowed to be used as Control channel

# 6




- Sectoring is often used to improve the **S/I** ratio ,which may lead to a smaller cluster size
- Also in such case; only a single control channel is assigned to an individual sector of a cell

# 7 f1/ f2 planning

- One of the key features of CDMA systems is that cluster size (N) = 1
- Also frequency planning is not nearly as difficult as TDMA

# However ;

- Propagation considerations require most practical CDMA systems to use some sort of limited frequency reuse where propagation conditions are particularly ill- behaved in a particular **RoC**

# BACKGROUND

- Newer cellular systems are designed to use wider bandwidth channels in order to provide much higher data rates.

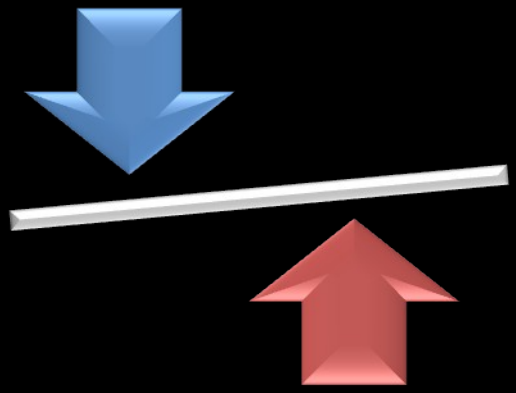
- In order to provide services to similar numbers of users using the existing Frequency Division Multiplexed (FDM) systems such as GSM they would need to purchase *much more spectrum* which is

1. scarce,
2. very expensive and
3. difficult to use efficiently.


# Analogy : size of a house

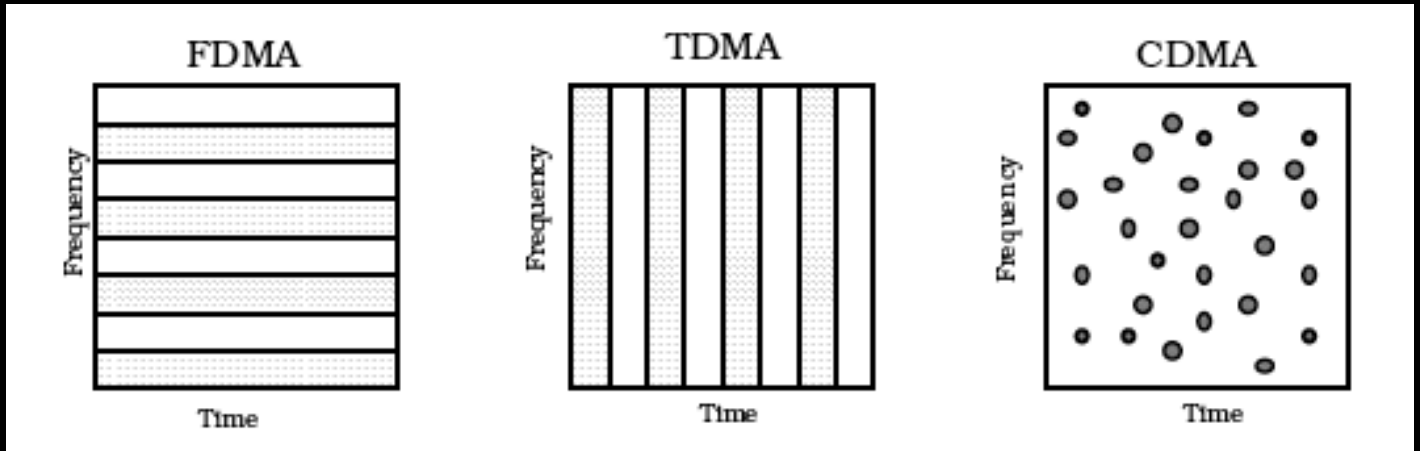
# Problem

- The problem is, it is hard to predict how much load will be required in the future as well as for today.



# CDM

- CDM allows a dynamic set of users to share a channel by renegotiating the codes used (and therefore the delivered data rate to a user) as users join and leave the channel.



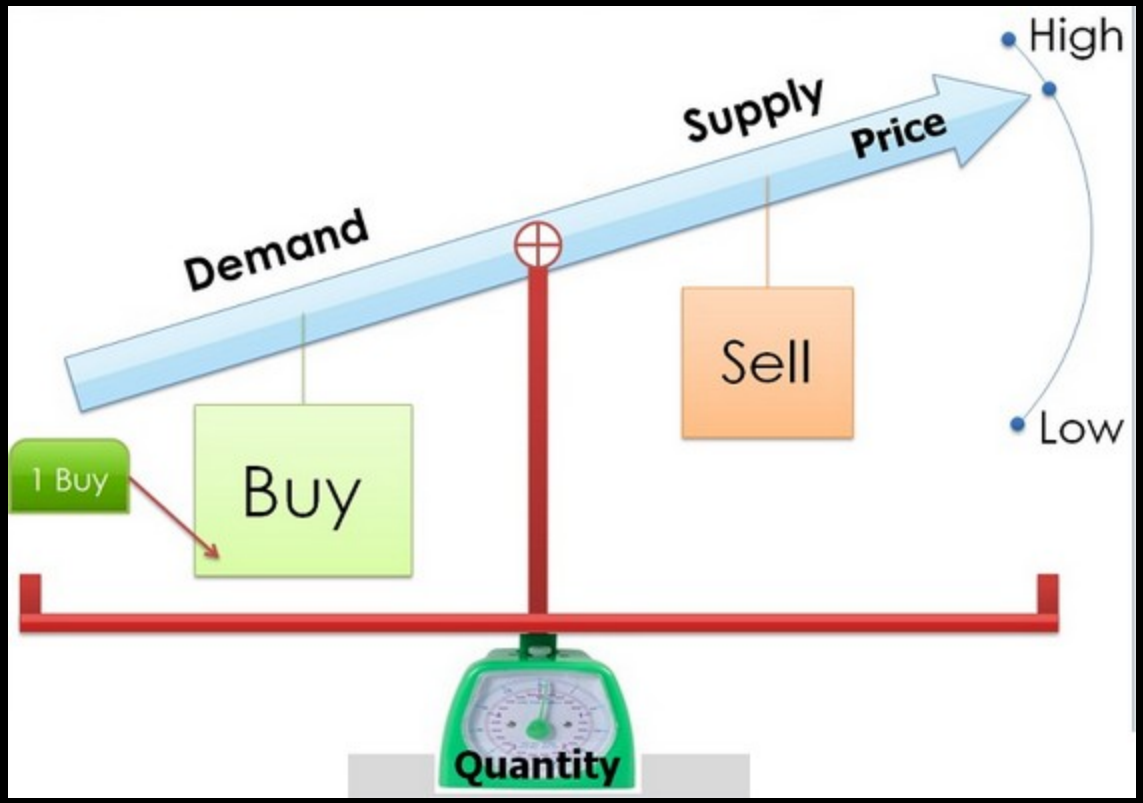
# More users means more codes, more radio frequency emission...

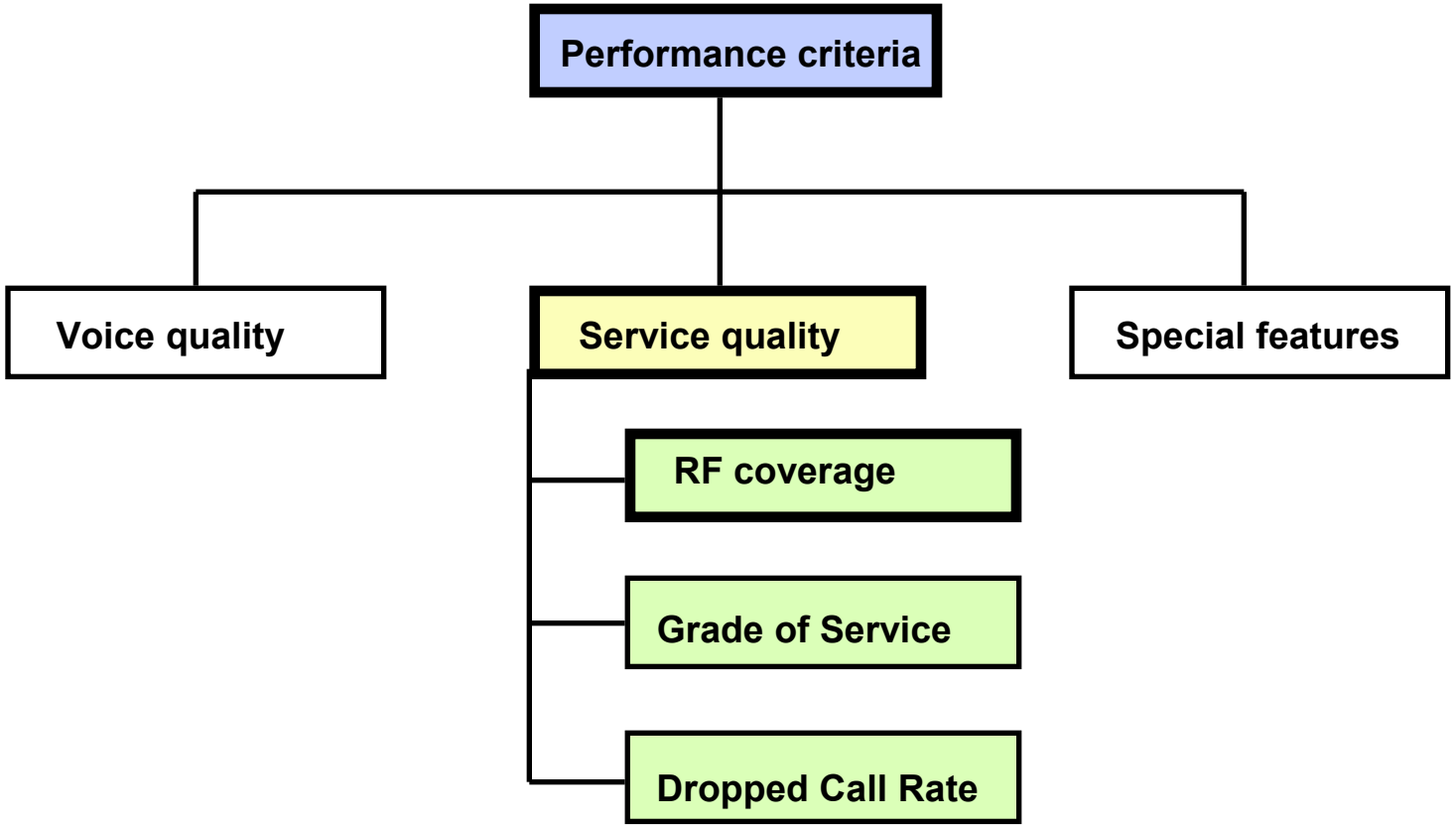
Analogy :

population

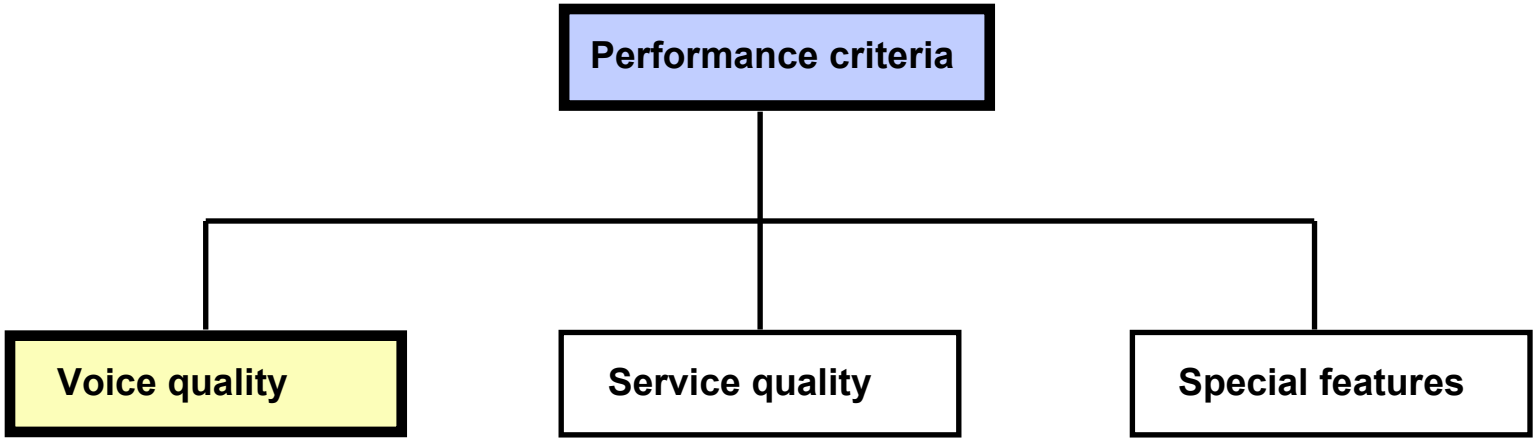
WASTE GENERATED

**The service providers will need to balance supply and demand very carefully to ensure that all users are provided with satisfactory service.**

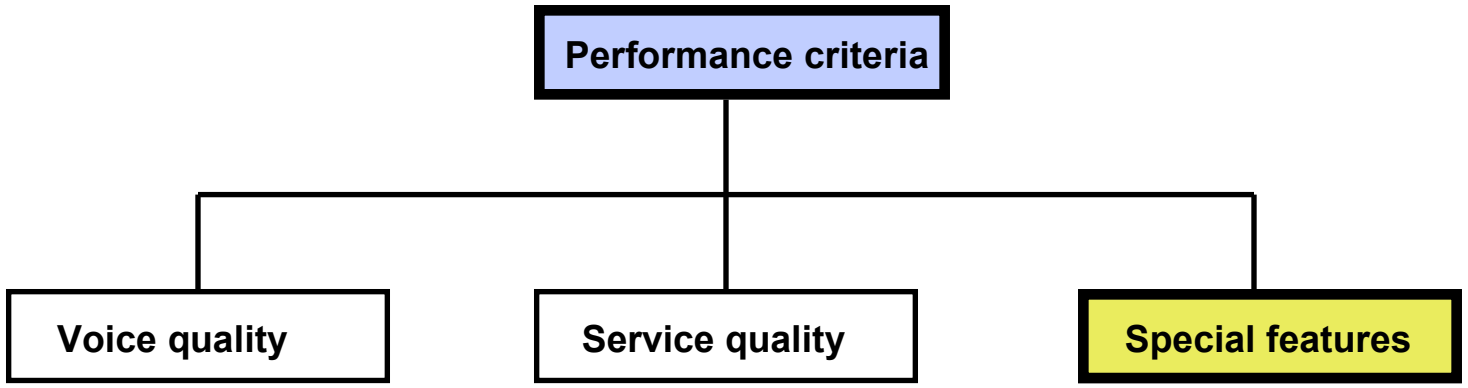



Performance criteria
Voice quality
Service quality
Special features
RF coverage
Grade of Service
Dropped Call Rate

# CDMA Optimization Principles

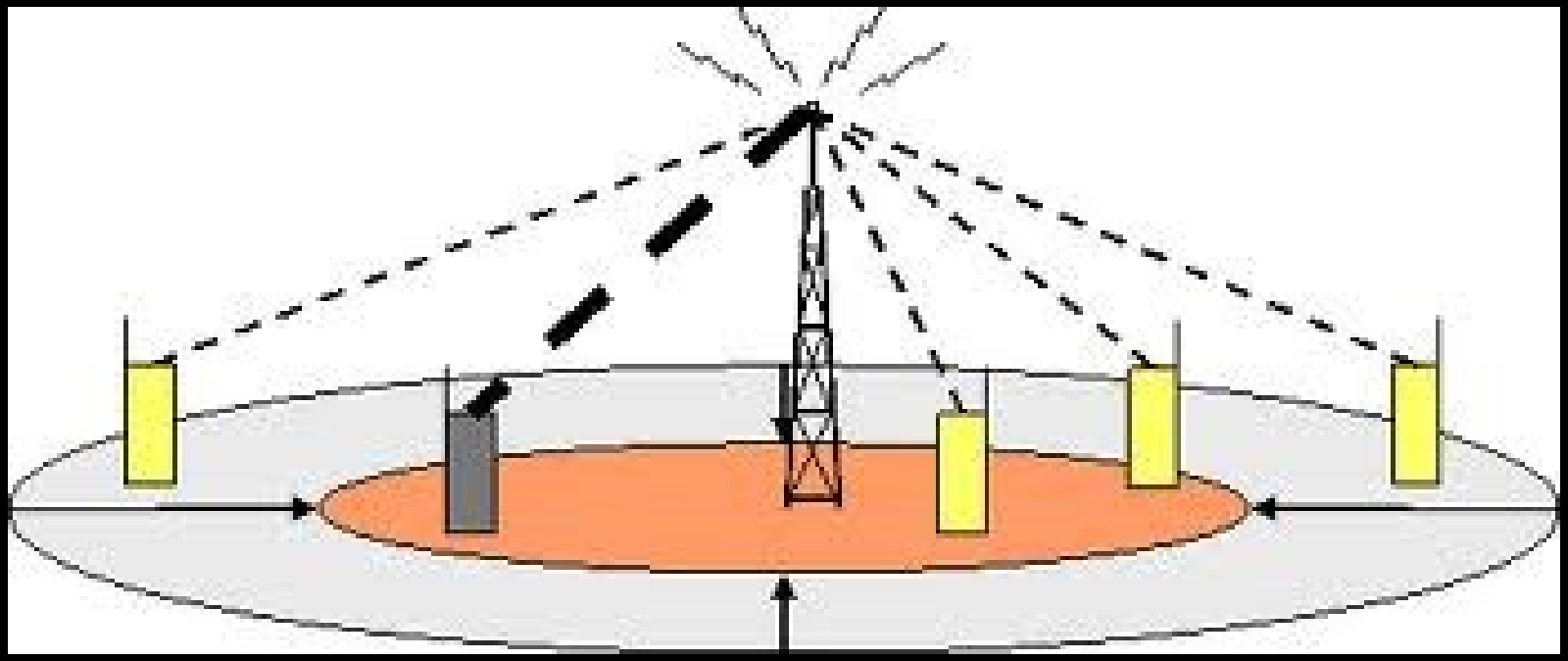


# Cellular System Performance Criteria - Special Features



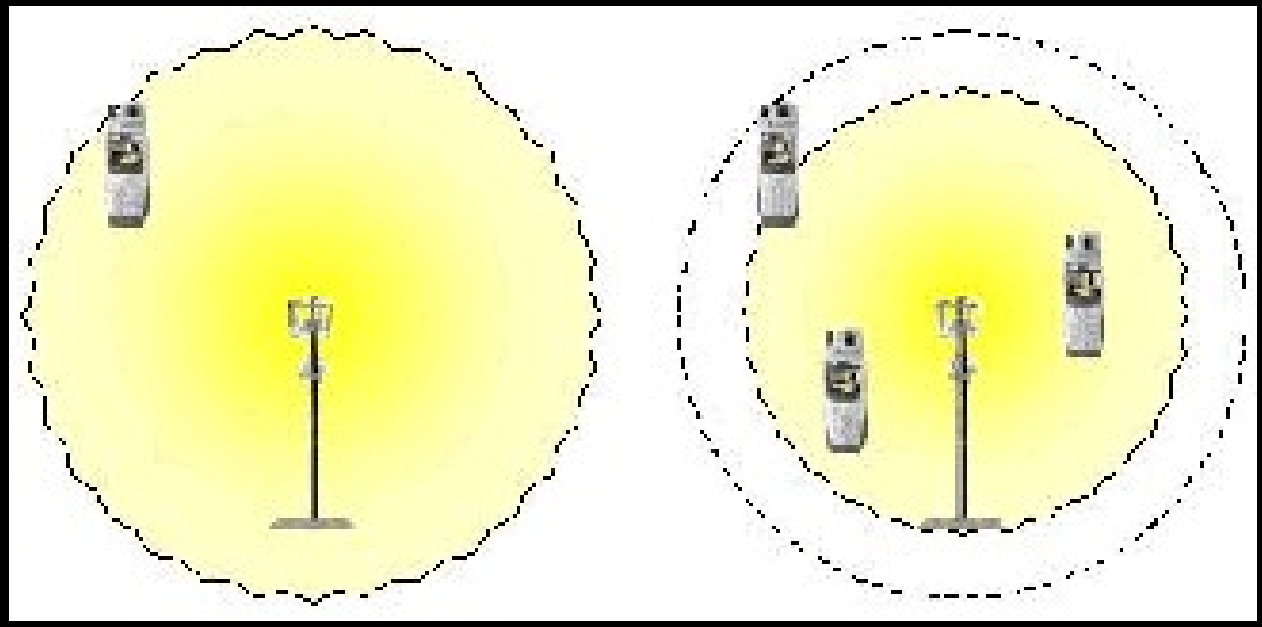

- Cellular system operator is interested in providing to subscribers many special features in addition to basic telephone service
  - call forwarding
  - call waiting
  - voice mail box
  - automatic roaming
- Some customers may not be willing to pay extra charges for special services

# Breathing cell

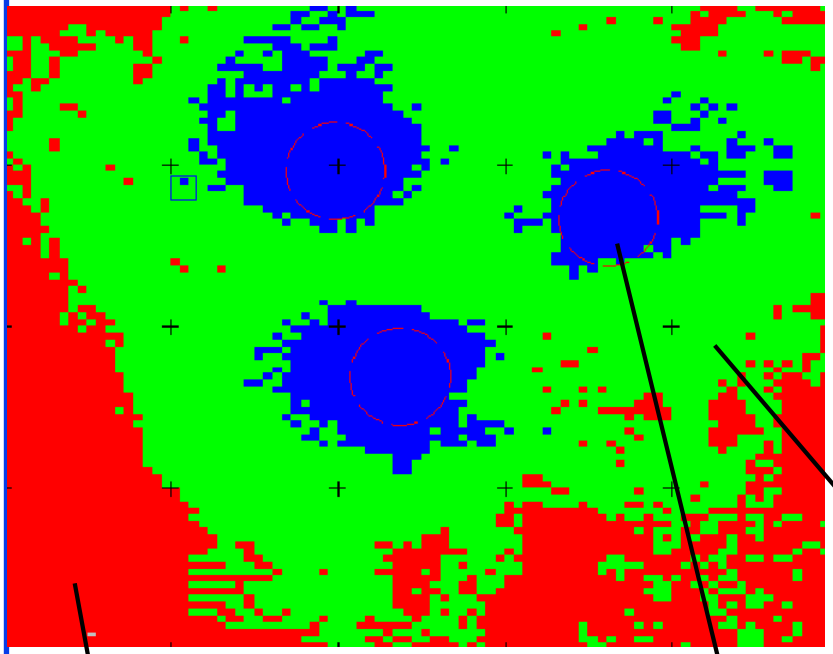


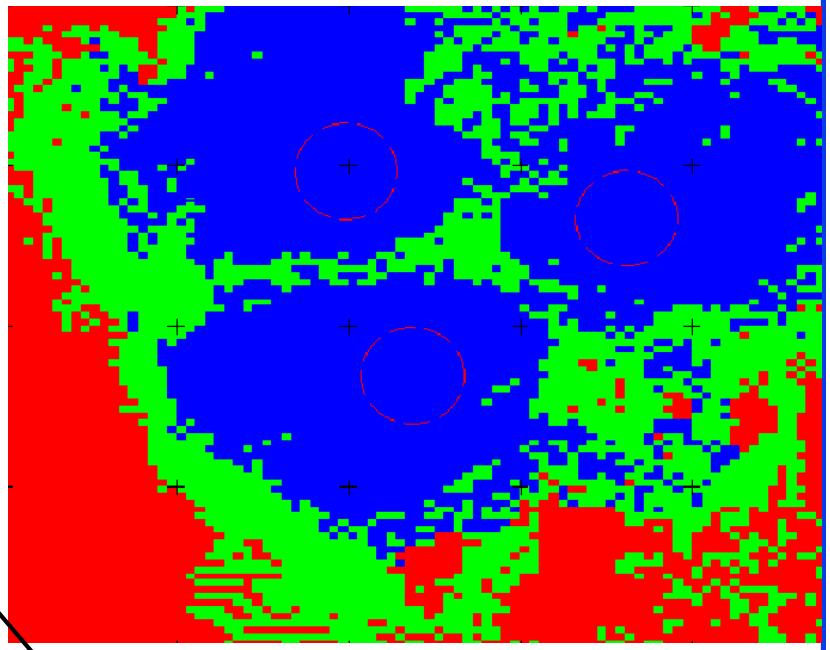
Cells grow as the number of users shrinks and shrink as the number of users increases

# The Change of Scope due to phenomenon of cell shrinking (cell breathing).



# Cell Breathing: CDMA networks





Case 1: 20 users

Case 2: 10 users

*-10 < C/I < -5 dB*

*-15 < C/I < -10 dB*

*-15 < C/I < -50 dB*

Dynamic cell range: f(# users)

○ cells

# Cell Breathing

- **Cell size controlled by pilot channel power**
- **Cell/sector overloaded? reduce pilot channel power**
- **Mobile stations at border will handoff to neighbor Base stations and drop connection to loaded cell/sector**

Before

After

Why does UMTS suffer from cells getting larger and smaller whereas GSM cells do not normally have this problem ?

# 8 Breathing cell concept !

## @ TDMA

In TDMA systems , when specific radio channels are in use,

Coverage region

Interference levels

} are well defined

# @ CDMA

- The CDMA system has

**Dynamic**

**Time varying**

} **Coverage region**

- This coverage region varies depending on

  **Instantaneous No: of users**

  On the CDMA radio channel.
- This effect is known as

# Breathing cell

# Near Far Problem

- All users transmit on the same frequency
- Signal from near users cause high interference to far users
- Reverse link power control is crucial
- Also saves phone battery


THANK YOU VERY MUCH