Introduction to cdmaOne

Introduction:

- Frequency spectrum is a finite resource
- Task is to accommodate more users in the same frequency spectrum with less interference
- CDMA Technology is one of the technique used for sharing frequency spectrum
- CDMA – based on Spread Spectrum Technology

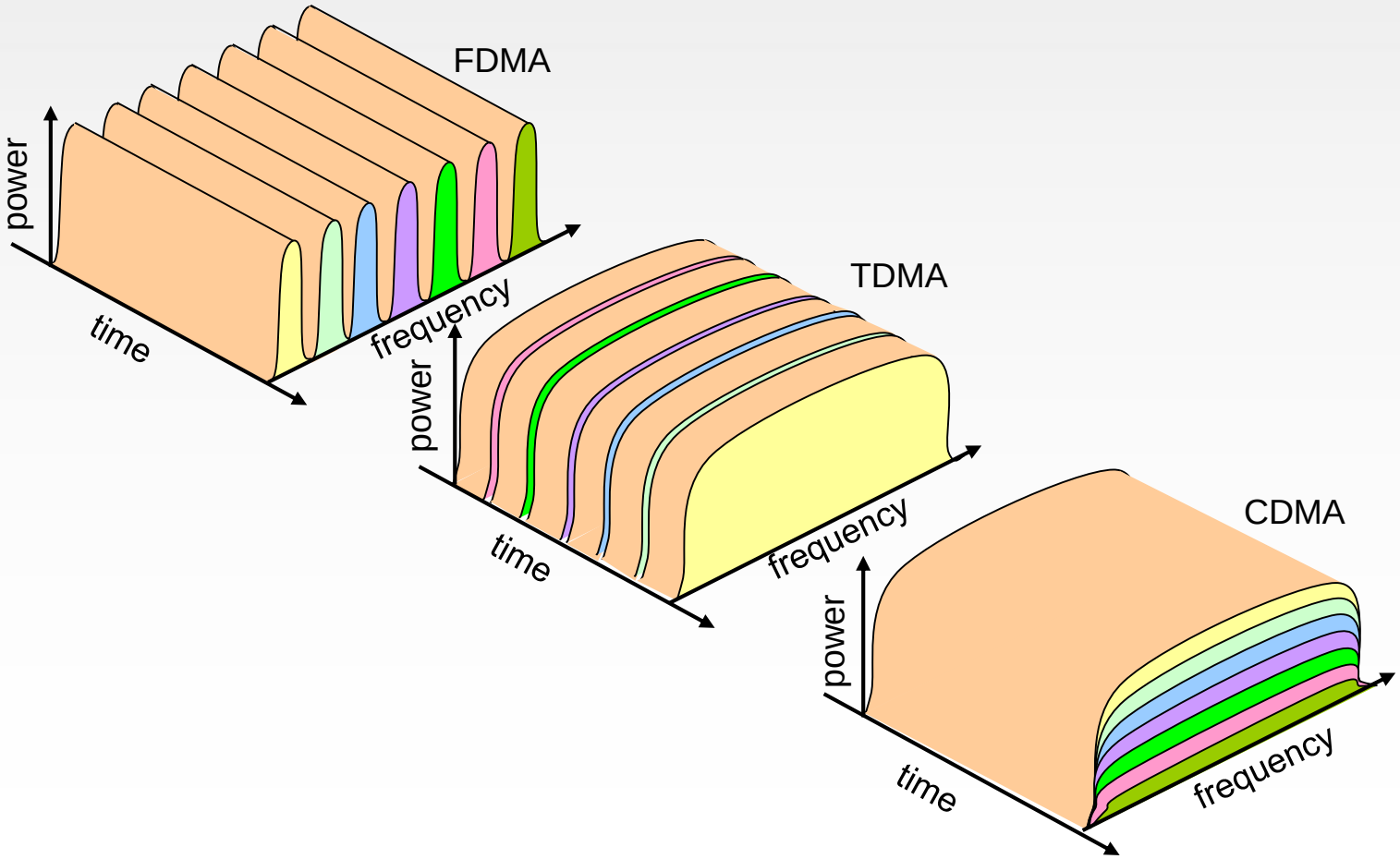
Introduction:

- Many CDMA Implementations:
  - cdmaOne
  - CDMA2000 and others
- **cdmaOne:**
  - TIA/EIA IS-95 standard
  - Term cdmaOne for end to end wireless system
  - Provides services such as cellular, fixed wireless/WLL etc for voice and data
  - 2G Technology

Introduction:

- **CDMA2000:**
  - Improvement in TIA/EIA IS-95 standard
  - Significant improvement in voice and expanded data capabilities
  - Backward compatibility with IS-95 handsets
  - Circuit as well as Packet Switched environments
  - 3G Technology

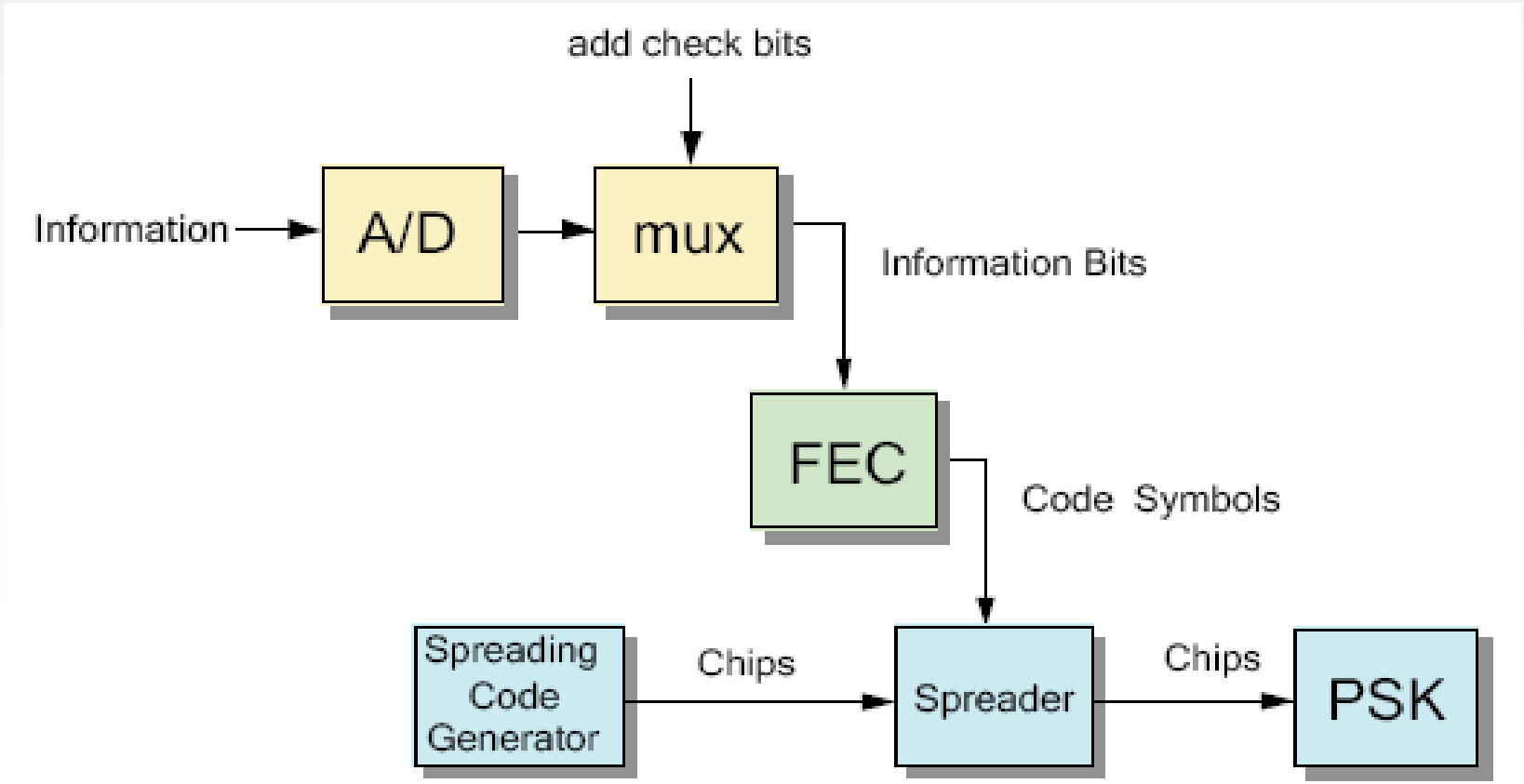
FDMA/TDMA/CDMA:



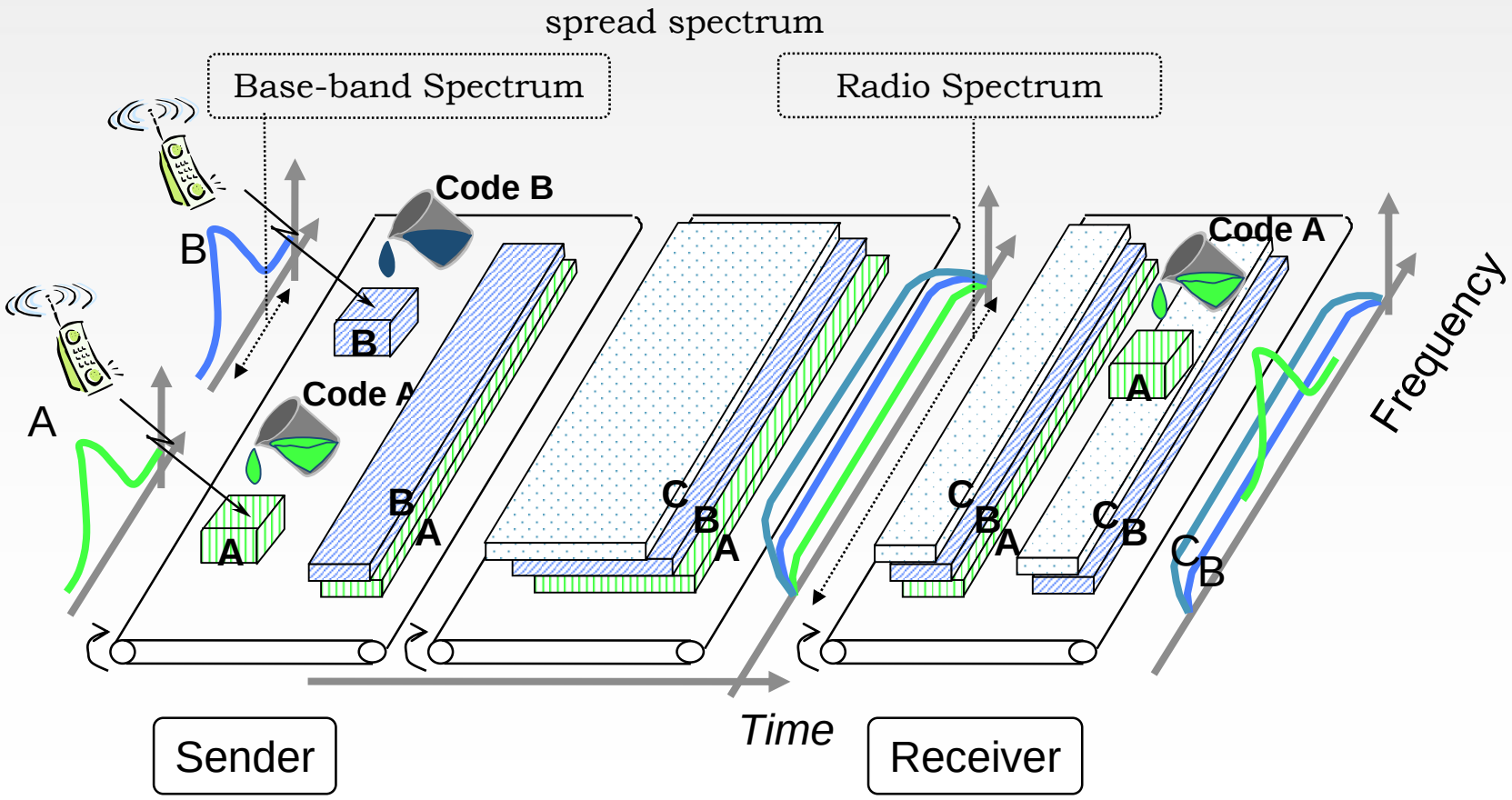
CDMA:

- **CDMA: Code Division Multiple Access**
  - Method in which users occupy the same time and frequency allocations
  - Unique codes are allocated users
  - Receiver can complete processing of only the desired signal (not others because of their unknown codes)
  - Was developed by QUALCOMM and standardised by TIA in 1993 (IS-95/cdmaOne)

cdmaOne Modulation:



CDMA:


spread spectrum
Base-band Spectrum
Radio Spectrum
Code B
Code A
B
A
C
Frequency
Time
Sender
Receiver

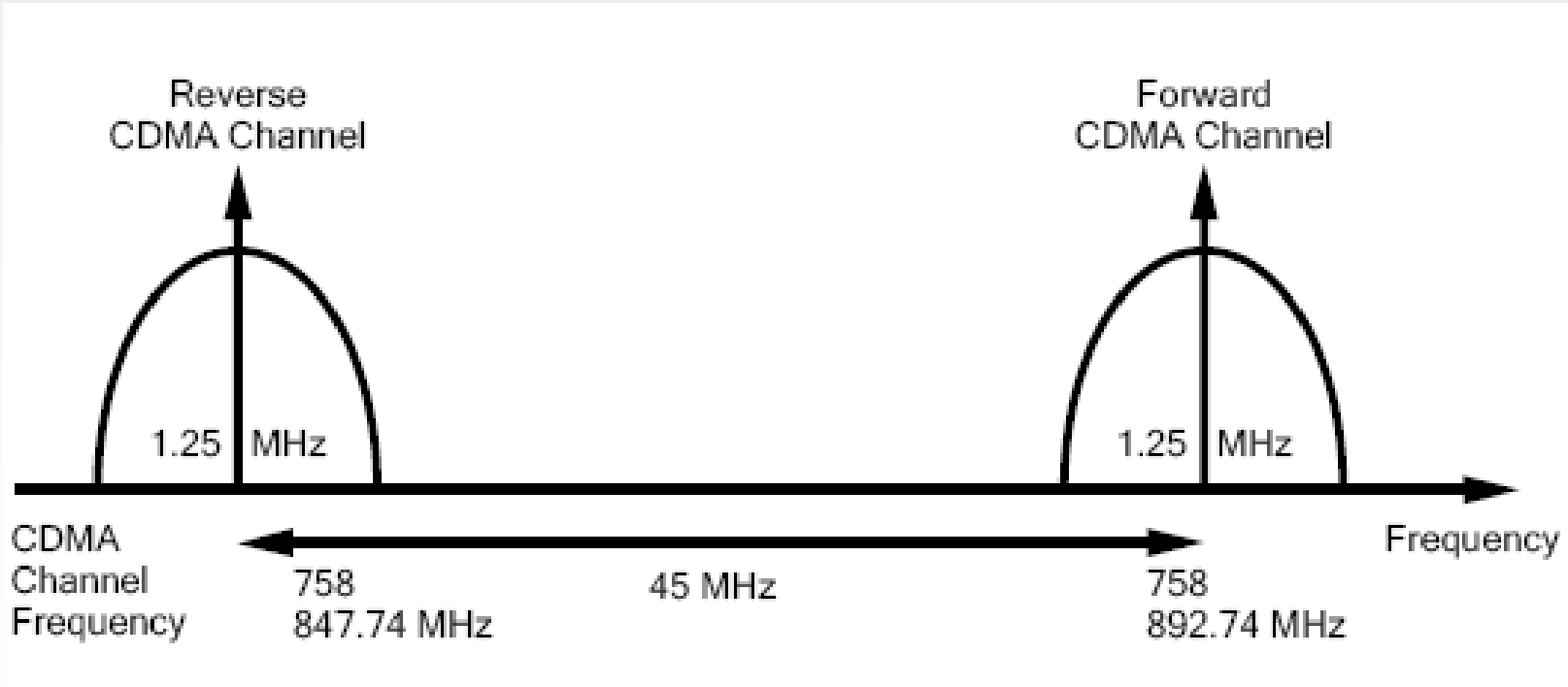
Codes:

- Orthogonal codes:
  - All pairwise cross correlations are zero
  - Fixed and variable length codes used in CDMA systems
  - For CDMA applications, each mobile user uses one sequence from the set as a spreading code
    - Provides zero cross correlation among all users
- Types:
  - Walsh codes
  - Variable-Length Orthogonal codes

Cellular CDMA Channels:

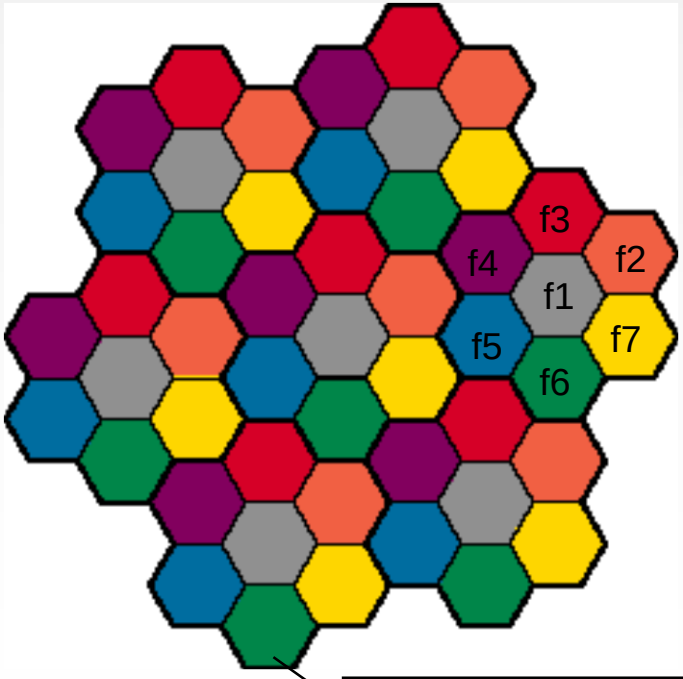
- Each CDMA channel is ~ 1.25 MHz wide
- No guard bands required between adjacent channels
- Guard bands established between a CDMA system and any other system.
- A CDMA channel is a pair of frequencies 45 MHz apart.

Cellular CDMA Channels:



Frequency Allocation:

In FDMA or TDMA, radio resource is allocated not to interfere among neighbor cells

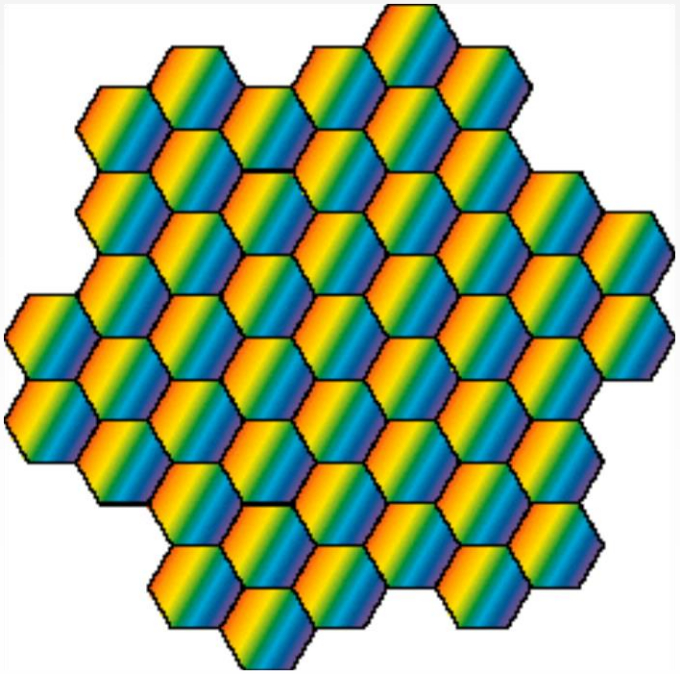


cell :
a “cell” means covered area by one base station.

- **Neighbor cells cannot use the same (identical) frequency band (or time slot).**
- **The left figure shows the simple cell allocation with seven bands of frequency.**
- **In actual situation, because of complicated radio propagation and irregular cell allocation, it is not easy to allocate frequency (or time slot) appropriately.**

Frequency Allocation:

In CDMA, identical radio resource can be used among all cells, because CDMA channels use same frequency simultaneously.



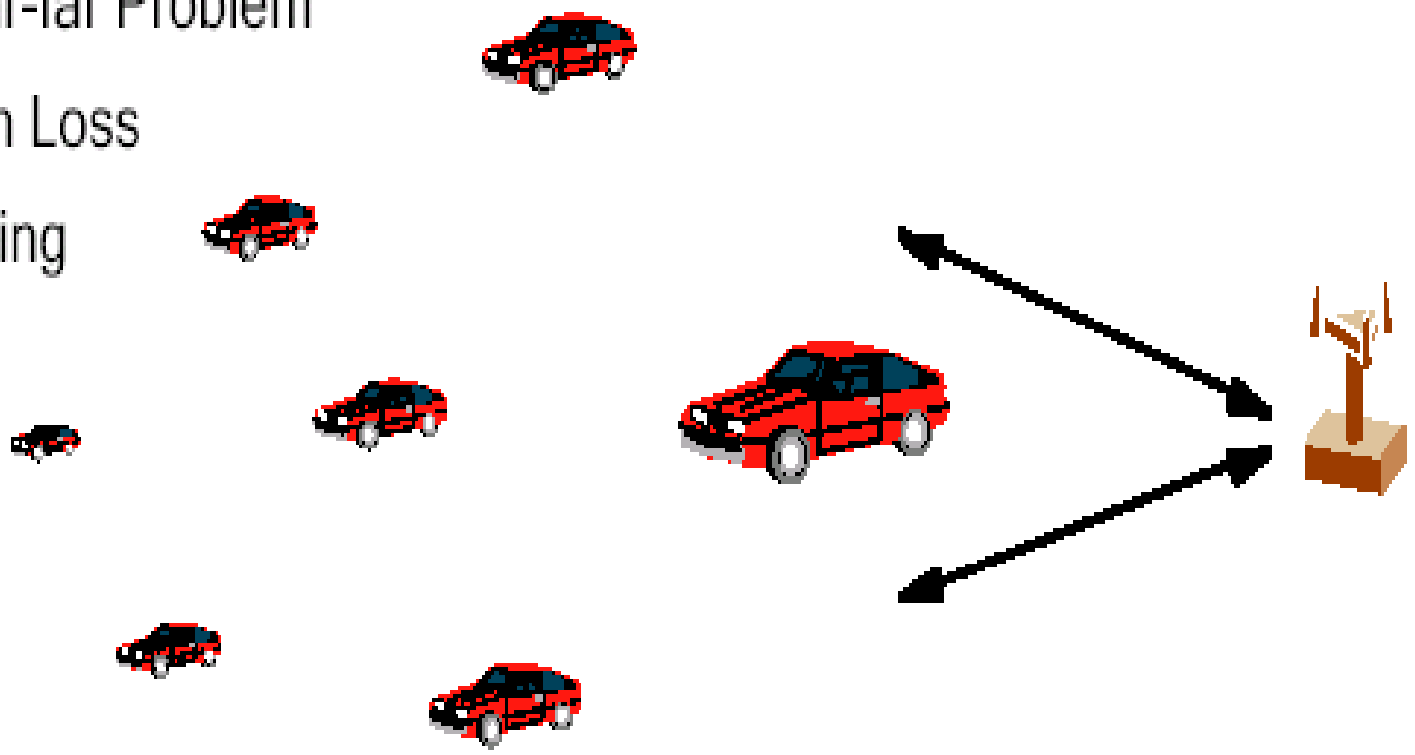
- **Frequency allocation in CDMA is not necessary.**
- **In this sense, CDMA cellular system is easy to be designed.**

Universal Frequency Reuse:

- **Universal Frequency Reuse**
  - The principal attribute of a CDMA system is that *all subscribers can use the same frequency*.
  - With spread spectrum, universal frequency reuse applies not only to users in the same cell, but also to those in all other cells.
  - The advantage here is that complicated reuse patterns are not necessary.

Power Control:

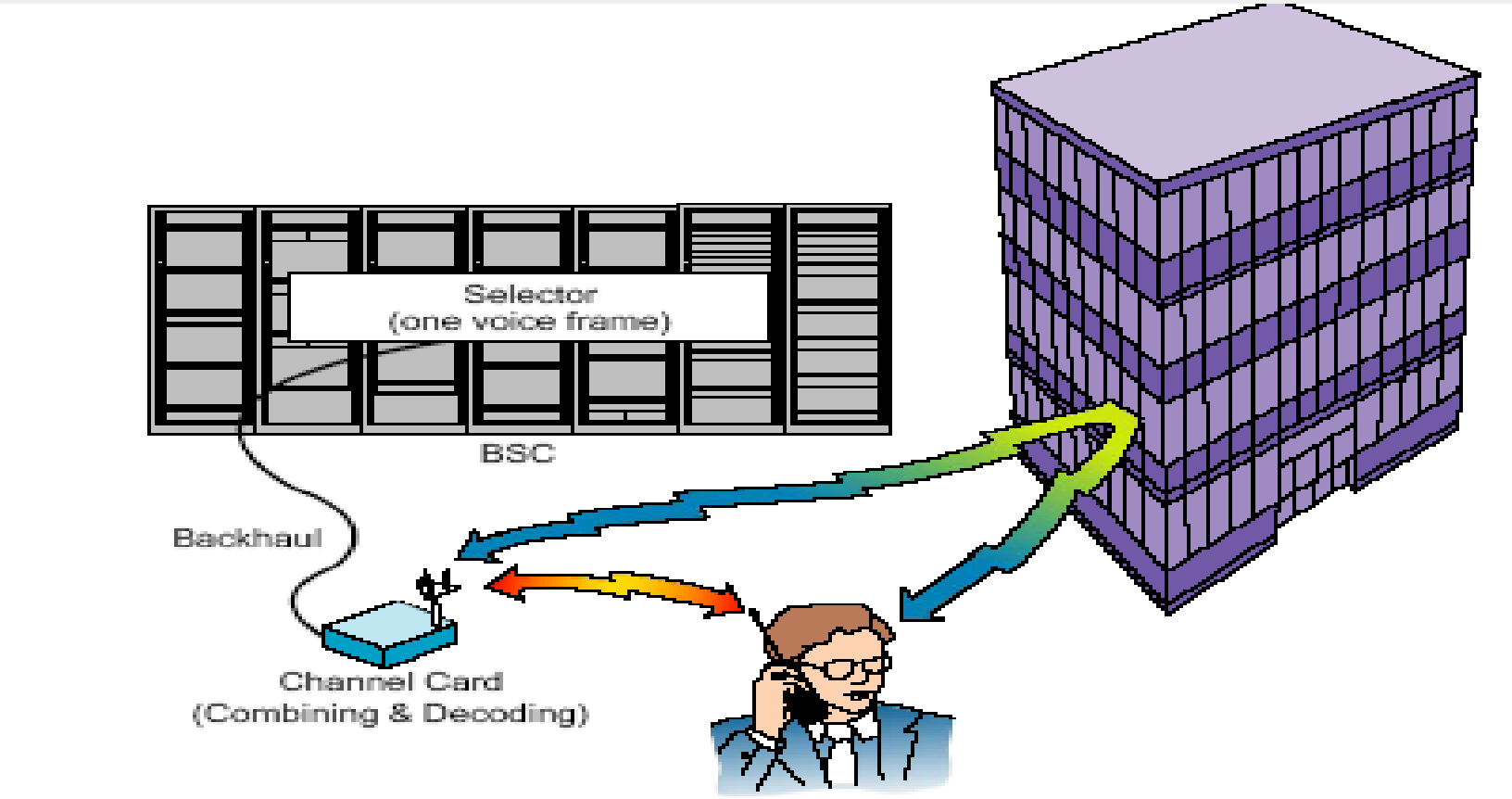
- Near-far Problem
- Path Loss
- Fading



Soft handoffs:

- Refers to the state where the mobile is in communication with multiple Base Stations at the same time.
- Soft handoff is a make-before-break type of handoff
  - a mobile acquires a target code channel before breaking an existing one.
- Soft handoff is a special attribute of CDMA that is enabled by universal frequency reuse.

Traffic Channels Handoff (Softer):



Traffic Channels Handoff (Soft and Softer):