Outline

Introduction

- Type of Multiplexing
- FDMA
- TDMA
- CDMA
- Future Work

Introduction

The multiplexing is used to combined a number of independent signals into a composite signal suitable for transmission over a common channel

Type of Multiplexing:

- 1. Frequency-Division Multiple Access (FDMA).
- 2. Time-Division Multiple Access (TDMA).
- 3. Code-division Multiple-Access (CDMA)



Frequency-Division Multiple Access (FDMA)

➢ It is a communications technique that divides a communications channel into a number of equally spaced frequency bands



Time-Division Multiple Access (TDMA)

It is a digital transmission technology that allows a number of users to access a single radio-frequency (RF) channel without interference by allocating unique time slots to each user within each channel.



is a wireless communications technology that uses the principle of spread spectrum communication.

There are three ways to spread the bandwidth of the signal:

- Frequency hopping
- Time hopping
- Direct sequence

CDMA is a Direct Sequence Spread Spectrum system CDMA Features:

- o All users use same frequency and may transmit simultaneously
- o Narrowband message signal multiplied by wideband spreading signal, or codeword
- o Each user has its own pseudo-codeword (orthogonal to others).
- o Receivers detect only the desired codeword. All others appear as noise.
- o Receivers must know transmitter's codeword.



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Spreading	
Bit0	Bit 1
PN Code Chip - F Start of Epoch	
Spread Signal	
(No phase shift)	(180° phase shift)
	Time

Pseudo-Noise Spreading



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Processing Gain:

$$G_p \equiv rac{f_c}{f_i}$$



is the processing gain





is Information Frequency (the bit rate of the digital data).

System Capacity:

The capacity of a system is approximated by :

$$C_{\max} = \frac{G_p}{\frac{E_b}{N_0}} \cdot \frac{1}{1+\beta}$$



 G_p

is the maximum number of simultaneous calls

- is the processing gain
- E, No

β

- is the total signal to noise ratio per bit
- is the inter-cell interference factor.

Advantages:

- o Increased capacity
- o Improved voice quality
- o Eliminating the audible effects of multipath fading
- o Enhanced privacy and security
- o Reduced average transmitted power
- o Reduced interference to other electronic devices

Disadvantages:

- o Wide bandwidth per user required
- o Precision code synchronization needed