CISC 7332X T6
C06b: Multiplexing

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Outline

- Discussed
  - Digital modulation
    - Baseband transmission
      - Line codes
      - Design considerations
    - Passband transmission
      - Digital modulations
- Multiplexing
  - FDMA, TDMA, and CDMA
- Switching
 - Circuit switching and packet switching

Multiplexing

- Channels are often shared by multiple signals

- The schemes that allow multiple signals to share a channel

Schemes of Multiplexing

- Frequency Division Multiplexing

- Time Division Multiplexing
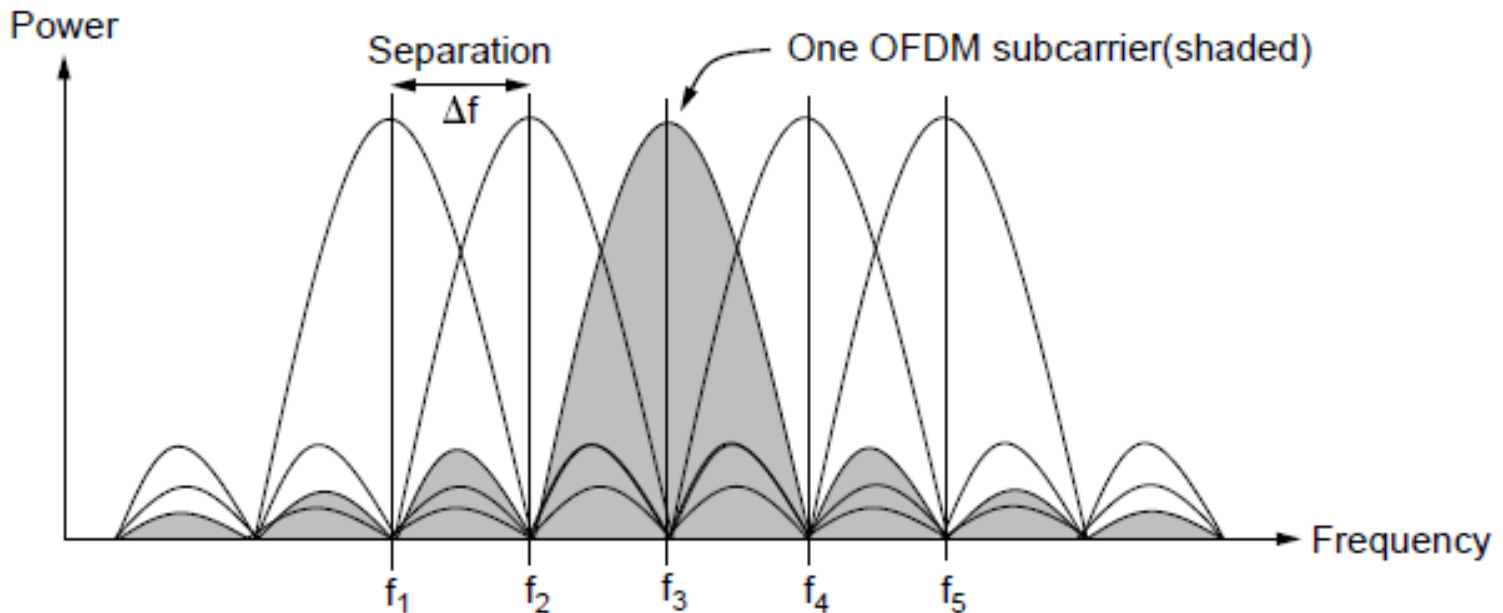
- Code Division Multiple Access

Frequency Division Multiplexing

- FDM (Frequency Division Multiplexing) shares the channel by placing users on different frequencies:

Overall FDM channel
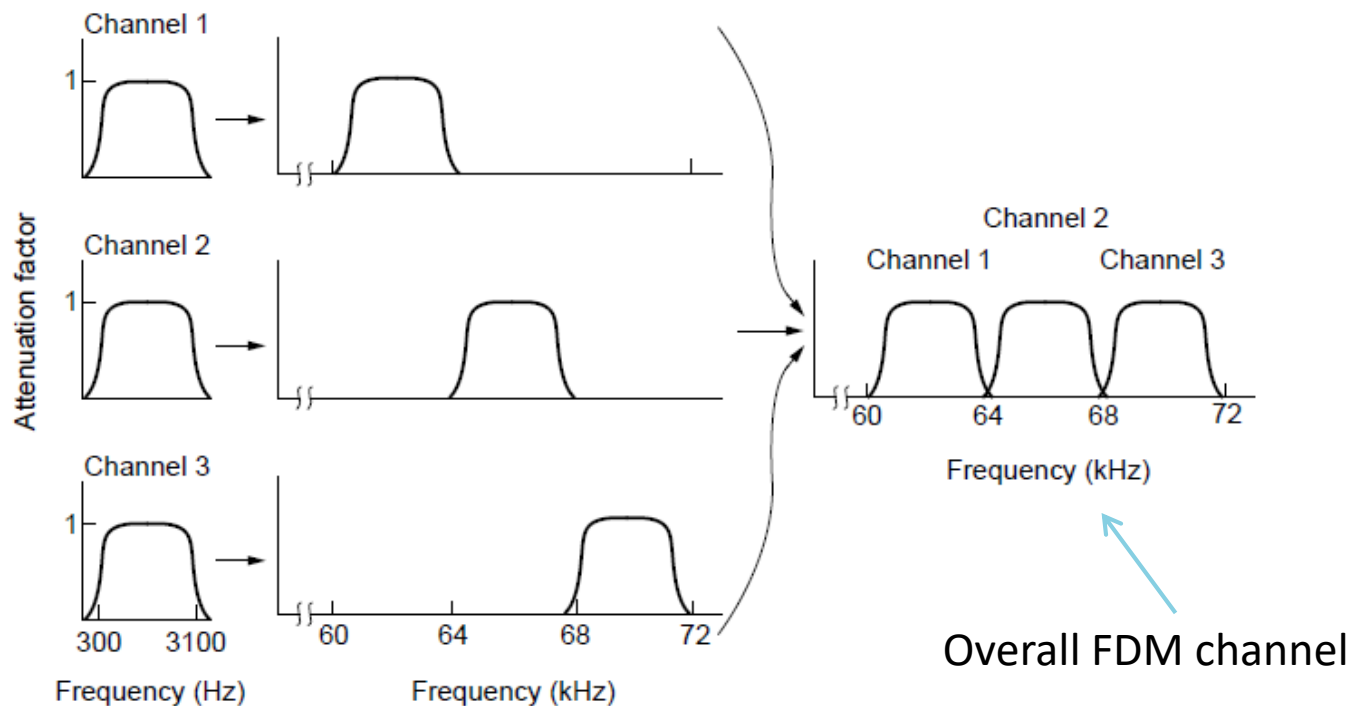
Orthogonal FDM (OFDM)

• an efficient FDM technique used for 802.11, 4G cellular and other communications

Time Division Multiplexing (TDM)

- Time division multiplexing shares a channel over time:

  - Users take turns on a fixed schedule; this is not packet switching or STDM (Statistical TDM)

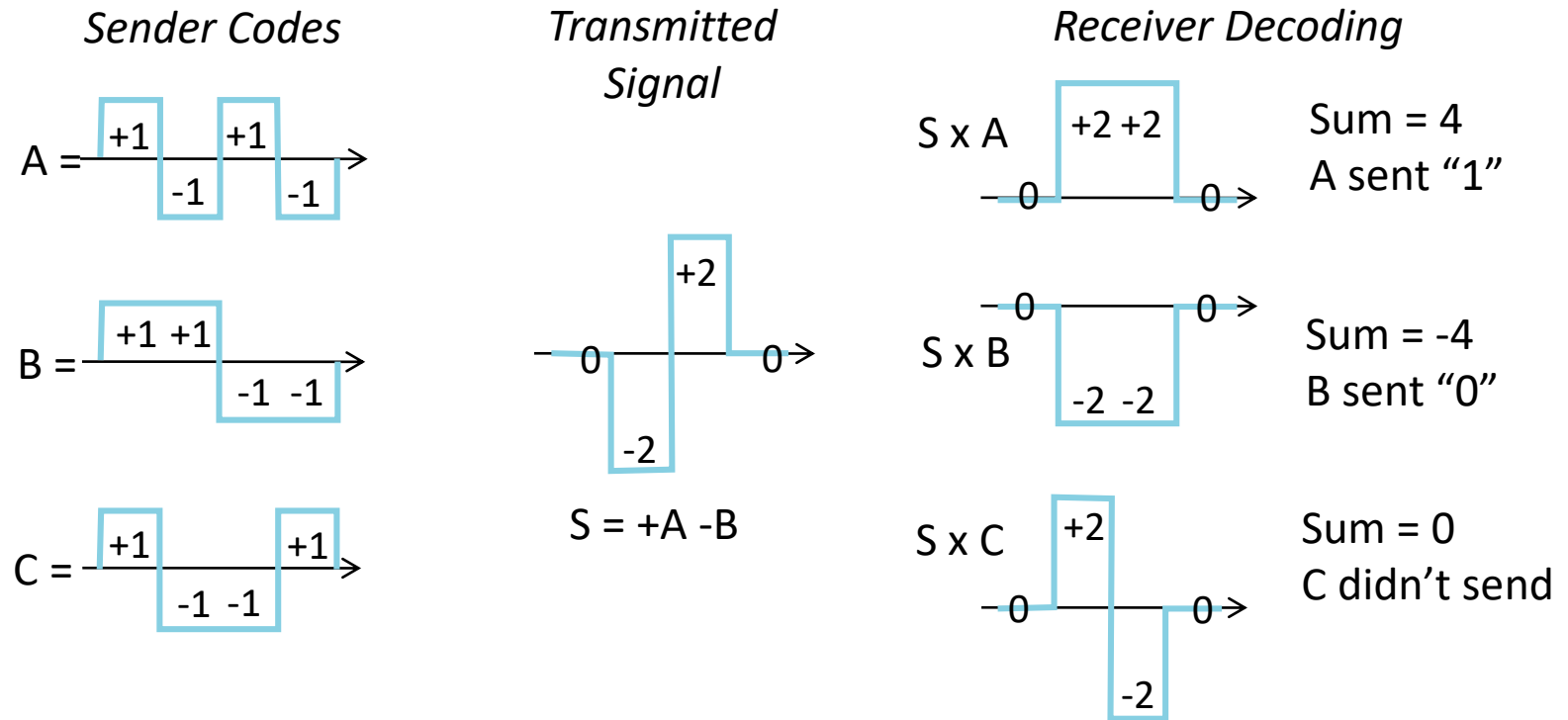 - Widely used in telephone / cellular systems
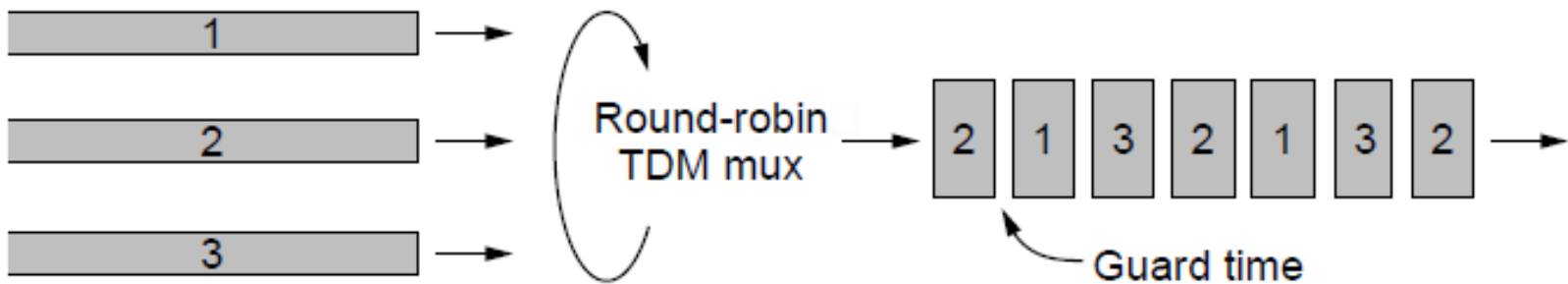
Code Division Multiple Access (CDMA)

- CDMA shares the channel by giving users a code

  - Codes are orthogonal; can be sent at the same time

  - Widely used as part of 3G+ cellular communication networks

CDMA: Example

- Each has a chip code. 1, chip code; 0, – chip code

Sender Codes

A =
+1 +1
-1 -1

B =
+1 +1
-1 -1

C =
+1 +1
-1 -1

Transmitted Signal

+2
0   0
-2

S = +A -B

Receiver Decoding

S x A
+2 +2
0   0

Sum = 4
A sent "1"

S x B
0   0
-2 -2

Sum = -4
B sent "0"

S x C
+2
0   0
-2

Sum = 0
C didn't send

Questions?

- Concept of multiplexing
- FDMA and ODMA
- TDMA
- CDMA