

How Cell Phones Work (Cell Phones 101)

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Senior Instructor
Technical Operations Division



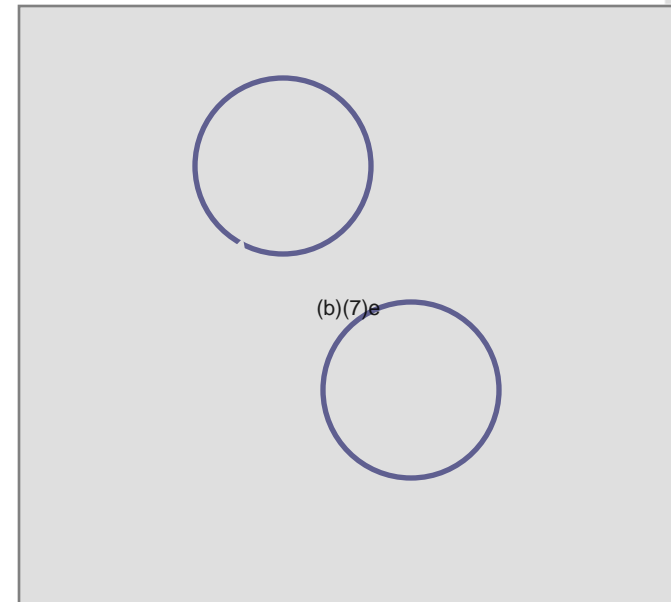
Objective

- Identify the basic technology features which enable cell phone communication
- Identify resources for more advanced study of cell phone technology

Cell Phones: The Basics

- Each Cell Carrier is provided (by FCC) 832 frequencies per geographic area.
 - Of these, 42 are used by the carrier for system control
- These frequencies are distributed via “cells”, each of which is typically from 1 to 10 square miles in area.
- Distributed through a cluster of seven cells

Typical Cell



**These Two Cells
Share Frequencies**

Cell Phones: The Basics

- **Each cell is assigned 56 voice channels.**
 - A 'channel' is comprised of two frequencies: one to transmit; one to receive
 - Called 'Duplexing'
- **When users move from cell to cell, frequencies change without noticeable interruption.**

Pages 5 through 6 redacted for the following reasons:

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Cell Phones: The Basics

- By using multiplex technology (e.g.: 'Spread Spectrum') the 56 assigned cell channels can provide substantially more simultaneous conversations.
- For example, TDMA technology can interlace three conversations on a single channel.
- CDMA can typically interlace 10 or more communications on a single channel.

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Cell Phones: The Evolution

Current Cell Technology

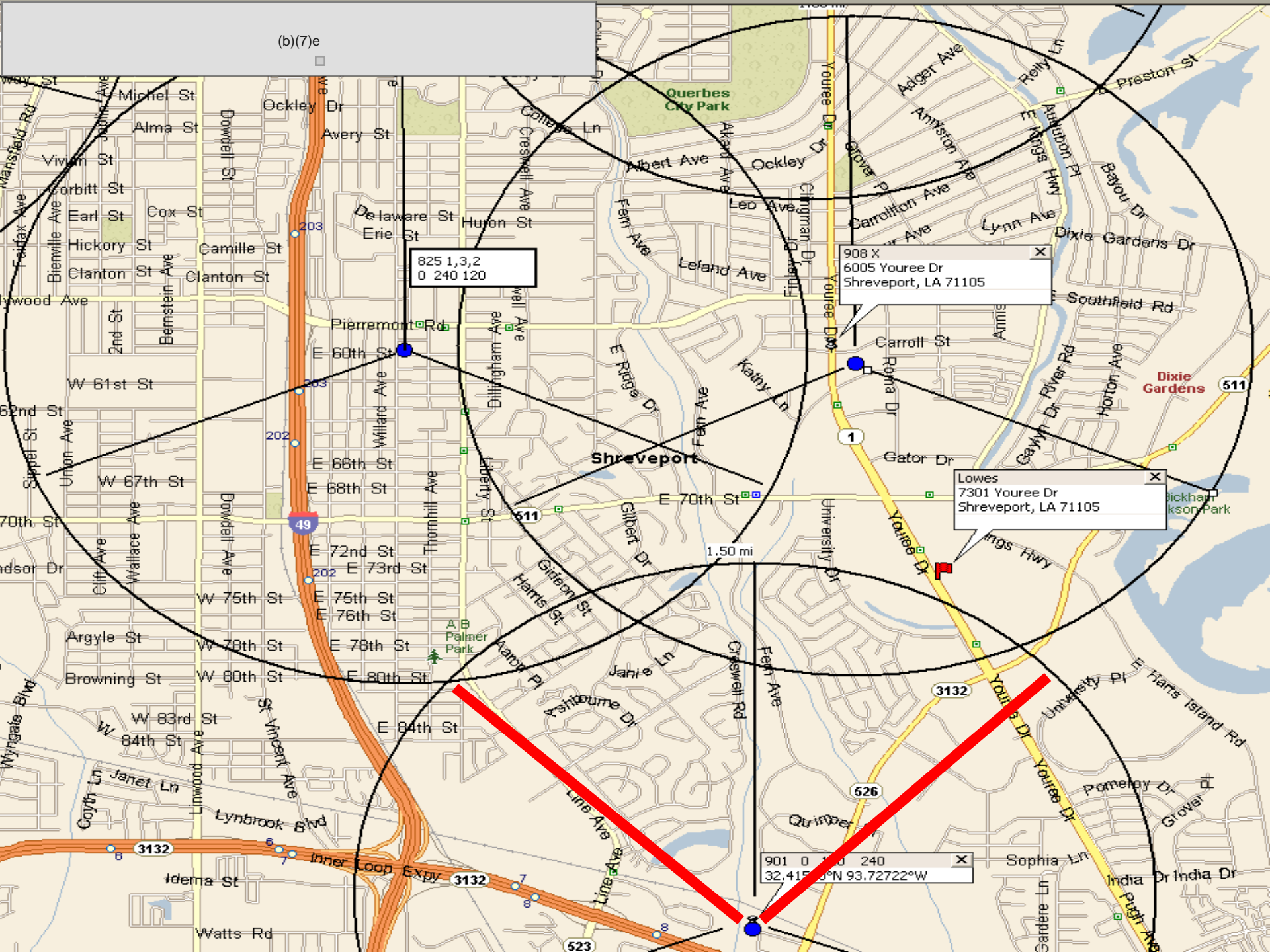
- **TDMA**
 - Voice Only. Oldest digital technology.
- **CDMA**
 - Voice as well as other data (photos, email, etc.)
- **GSM (Global Systems for Mobile Communications)**
 - The standard in 168 different countries
 - Allows for cell communications when you travel to (e.g.) Botswana
 - Identifying feature: It requires a SIM memory card

Handoffs

- When a registered phone moves closer to a stronger tower, the call is 'handed off'.
- The call is then routed through the new tower.
- This handoff is fully automatic and is generally transparent to the user.
- Sometimes, for technical reasons, a call may be routed to a weaker tower.

Towers

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825 1,3,2
0 240 120

908 X
6005 Youree Dr
Shreveport, LA 71105

Lowes
7301 Youree Dr
Shreveport, LA 71105

901 0 100 240
32.4150°N 93.72722°W

Welcome to Dallas/Ft. Worth

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Dallas/Ft. Worth Towers

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Can You Spot the Towers?

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Can You Spot the Towers?

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Can You Spot the Towers?

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Senior Instructor FLETC/TOD

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Appreciation to the U.S. Secret Service for some of these visuals