### Cellular/PCS Structure

#### System Block Diagram

**Cellular/PCS**

- **BTS** (Base Transceiver Station)
- **BSC** (Base Station Controller)
- **MTSO/MSC** (Mobile Telephone Switching Office/Mobile Switching Center)
- **PSTN** (Public Switched Telephone Network)

**Radio Link**

- **Bearer Trunk**
- **Signaling Trunk**

### Signaling Channels

- **Dedicated Control Channels (CC)**
  - System information
- **Paging Channels (PC)**
  - Used to initiate calls to a mobile
- **Access Channels (AC)**
  - Used to initiate calls from a mobile

### Hand-Off
Call Handoff

- Base Stations monitor the signal strength
- If strength drops below hand-off level, all base stations are asked to look for the mobile; strongest becomes new BS
- MTSO instructs the new base station to activate a voice channel to receive the handoff.

Call Handoff cont....

- MTSO sends command to mobile giving the new channel assignment.
- Hard Handoff
  - Mobile tunes to the new channel
- Soft Handoff
  - Mobile combines both signals for a time

Call Handoff cont...

- Hard Handoff
  - “Break before Make”; i.e. disconnect the current path and the establish the new one.
- Soft Handoff
  - Specific to CDMA
  - Forward Station combines signals from multiple base stations
  - Reverse: BSCs select the better frame after decoding

Mobile Handset

- ESN - Electronic Serial Number
- Programmable NAM (Number Assignment Module)
- Contains among other things
  - System ID
  - First control channel to scan
  - System selection preferences
  - MIN (Mobile Identification Number)
Mobile Identification Number

- **MIN1** - Mobile System Id (3 digits)
  - US: Area Code
  - International: Mobil Carrier Identification
- **MIN2** - Station Number
  - US: NXX and line number
  - International: internal mobile number

Roaming

Roaming Details

Example: IS-41C

- Mobile and AC share a secret authentication key (A-Key)
  - installed during provisioning
  - used in challenge/response authentication
- Two SSDs (Shared Secret Data)
  - Temporary secret keys computed from A-key, MIN, ESN, and a random seed
  - Used for temporary authentication and channel encryption.
Intersystem Hand-Off

The “Shoe-Lace” Effect

Multi-System Tandem

The “Trombone” Effect