Introduction to Mobile Computing and Communications

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for
Overview of Computers (OC), UG1 Course
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Received Signal Strength Indicator (RSSI)

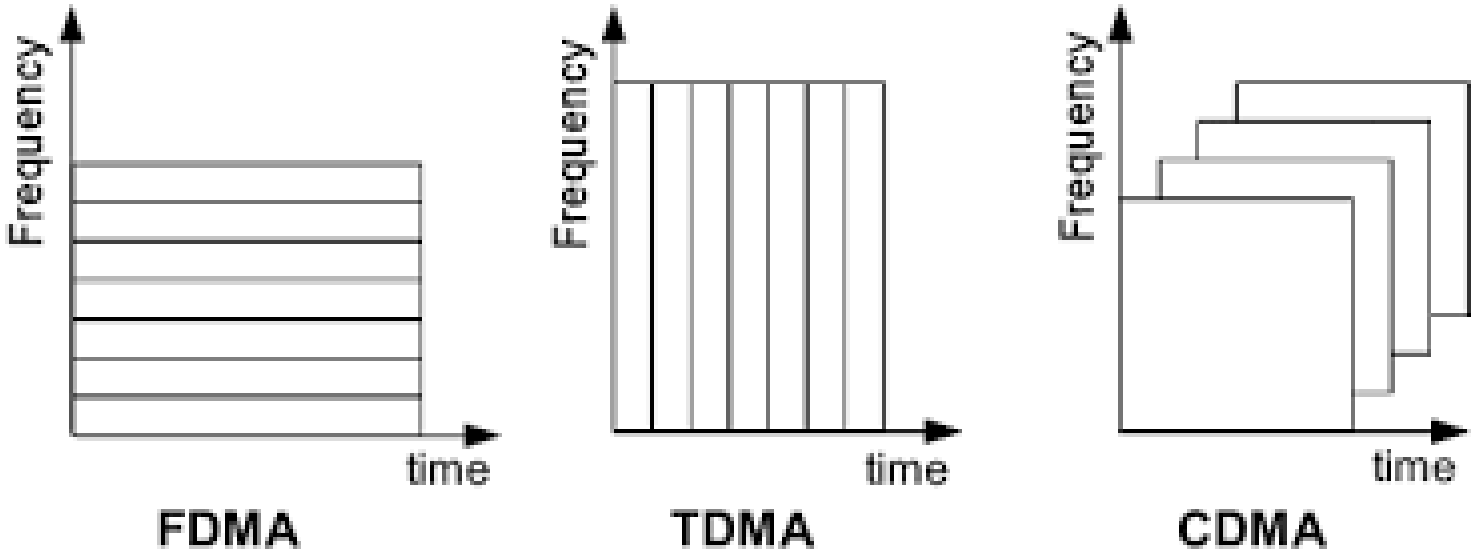
- **What's considered strong or weak cell signal?**

  Wireless signal strength drops exponentially (as compared to wired)

Power level	Signal strength
Greater than –60 dBm	Excellent (you're very close to a cell tower)
–60 to –75 dBm	Very good (usually this is the best it gets)
–76 to –90 dBm	Good (you're in an area with decent coverage)
–91 to –100 dBm	Fair (coverage is spotty and may be slow)
–100 to –110 dBm	Poor (very weak—you may be having connectivity problems)
Less than –110 dBm	No signal (you're probably unable to make or complete a call)

Generation of Mobile Phone

- 1G – Analog Mobile Phone System (AMPS)
- 2G – TDMA with FDMA
- 3G – CDMA
- 4G – LTE (OFDM based)



Limitations of 1G

- Poor Voice Quality.
- Poor Battery Life.
- Large Phone Size.
- No Security.
- Limited Capacity.

2G – GSM (Global System for Mobile)

- 2G network use digital signals.
- Data speed was upto 64kbps.
- Combination of TDMA and FDMA

CDMA for 3G – Based on Unique Codes

- Each user communicates at same time using same frequency
- Subscribers are differentiated using codes
- Example – Walsh Hadamard Code

$$\begin{bmatrix} 1 & 1 \\ -1 & 1 \end{bmatrix} \qquad \begin{bmatrix} 1 & 1 & 1 & 1 \\ -1 & 1 & -1 & 1 \\ -1 & -1 & 1 & 1 \\ 1 & -1 & -1 & 1 \end{bmatrix}$$

- Several Users communicate at same time at same frequency; as long as there are unique codes
- **Soft limit** on the maximum number os subscribers that can be supported

<u>Disadv:</u> Solution is mostly proprietary (Viterbi, Qualcomm); so expensive fee
High Bandwidth requirement

LTE – Long Term Evolution

- Combination of several technologies
- Base technology is to use – OFDM (Orthogonal Frequency Division)
- Others include:
  - **Multihop**
  - **Network Optimization**
  - Only packet-based switching (No circuit based switching)
  - Voice over IP (Internet Protocol)
  - MIMO (Multiple Antennas) in every mobile

    And many more

Comparison of 3G and LTE

Technology	3G	4G
Data Transfer Rate	3.1 MB/sec	100 MB/sec
Internet Services	Broadband	Ultra Broadband
Mobile - TV Resolution	Low	High
Bandwidth	5-20 MHz	100MHz
Frequency	1.6-2 GHz	2-8 GHz
Download and upload	5.8 Mbps	14 Mbps

Applications of High Speed thru LTE

- Internet of Things (IoT)
- Internet of Everything
- Remote Connectivity for Medical and Health-care
- Industry 4.0 (ICT for faster and centrally-controlled manufacturing process)

Thank you very much

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