Lesson 05
Introduction to 2G and 3G Data Communication Standards
First and Second Generations (1G and 2G)

- First generation wireless devices only voice signals
- Second generation (2G) devices communicate voice as well as data signals have data rates of up to 14.4 kbps
- The 2.5G and 2.5G+ are enhancements of the second generation and sport data rates up to 100 kbps

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Third generation (3G) mobile devices communication

- Higher data rates than 2G and support voice, data, and multimedia streams
- Facilitates data rates of 2 Mbps
- Higher for short distances
- 384 kbps for long distance transmissions.
- Enable transfer of video clips and faster multimedia communication
GSM and CDMA based standards
GSM standards

• A set of standards and protocols for mobile telecommunication
GSM Standard

• A global system for mobile (GSM) was developed by the Groupe Spéciale Mobile (GSM)
• Founded in Europe in 1982
• Support cellular networks
GSM 900

- GMSK modulation
- FDMA for 124 up channels and 124 down channels
- 890-915 MHz for uplink and 935-960 MHz
- Channel of bandwidth 200 kHz
- 8 radio-carrier analog-signals TDMA for user access in each deployed channel
GSM 900

- Users time-slices of 577 $\mu$s each
- Maximum 14.4 kbps
EGSM (extended global system for mobile communication)

- An additional spectrum of 10 MHz on both uplink and downlink channels
EGSM 900/1800/1900 MHz tri-band

- An additional spectrum of 10 MHz on both uplink and downlink channels
- GSM 1800 1710–1785 MHz for uplink and 1805–1880 MHz for downlink
- GSM 1900 1850–1910 MHz for uplink and 1930–1990 MHz for downlink
GPRS (general packet radio service) — GSM 2G+ (2.5G)

- Packet-oriented service for data communication of mobile devices
- Utilises the unused channels in the TDMA mode in a GSM network
EDGE (enhanced data rates for GSM evolution)

- An enhancement GSM Phase 2.5G+
- 8PSK communication to achieve higher rates of up to 48 kbps per 200 kHz channel
- High compares to up to 14.4 kbps in GSM.
- Using coding techniques the rate can be enhanced to 384 kbps for the same 200 kHz channel
EGPRS and HSCSD

- (enhanced general packet radio service) is an extension of GPRS using 8PSK (phase shift keying) modulation
- Enhances the data rate EGPRS based on EDGE
- Used for HSCSD (high speed circuit switched data)
CDMA

- Evolution of CDMA from 2.5G in 1991 as cdmaOne (IS-95)
- CDMA supports high data rates
- 3G.
- Voice as well as data and multimedia streams.
- CDMA 2000, IMT-2000, WCDMA and UMTS
- Support cellular networks
Founded in 1991
QUALCOM, USA
Belongs to 2G+
IS-95 (interim standards 95)
Operates at 824–849 MHz and 869–894 MHz.
CDMA channel transmits analog signals from multiple sources and users
WCDMA

- Supports asynchronous operations
- 10 ms frame length with 15 slices.
- Smaller end-to-end delay in the 10 ms frame as compared to 20, 40, or 80 ms frames
- Each frame length is modulated by QPSK—both for uplink and downlink
WCDMA

- DSSS CDMA
- Supports a 3.84 Mbps chipping rate
- Both short and long scrambling codes are supported, but for uplink only
- 3G partnership project (3GPP)
CDMA2000 and CDMA 2000 1x (3GPP2)

- For voice communication
- Circuit as well as packet switched communication
- Internet protocol (IP) packet transmission
- Multimedia and real time multimedia applications
- 3G partnership project 2
UMTS (universal mobile telecommunication system)

- Supports both 3GPP (3G partnership project) and 3GPP2
- Communicates at data rates of 100 kbps to 2 Mbps
CDMA2000 and CDMA 2000 1x

• Chipping rates are in multiples of $f_s = 1.2288$ Mbps
• 3G IMT 2000 carrier frequency $f_{c0} = 2$ GHz
• Included in UMTS
• CDMA 2000 1x $f_s = 1.2288$ Mbps
• Also backward compatible to 2.5G cdmaOne IS-95
Summary

- Mobile voice, data and multimedia communication standards
- GSM 900/1800/1900
- 2.5G+
- GPRS
- CdmaOne
- WCDMA
- CDAM 2000
End of Lesson 05
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