Mobile Communication – An overview

Lesson 05

Introduction to 2G and 3G Data Communication Standards

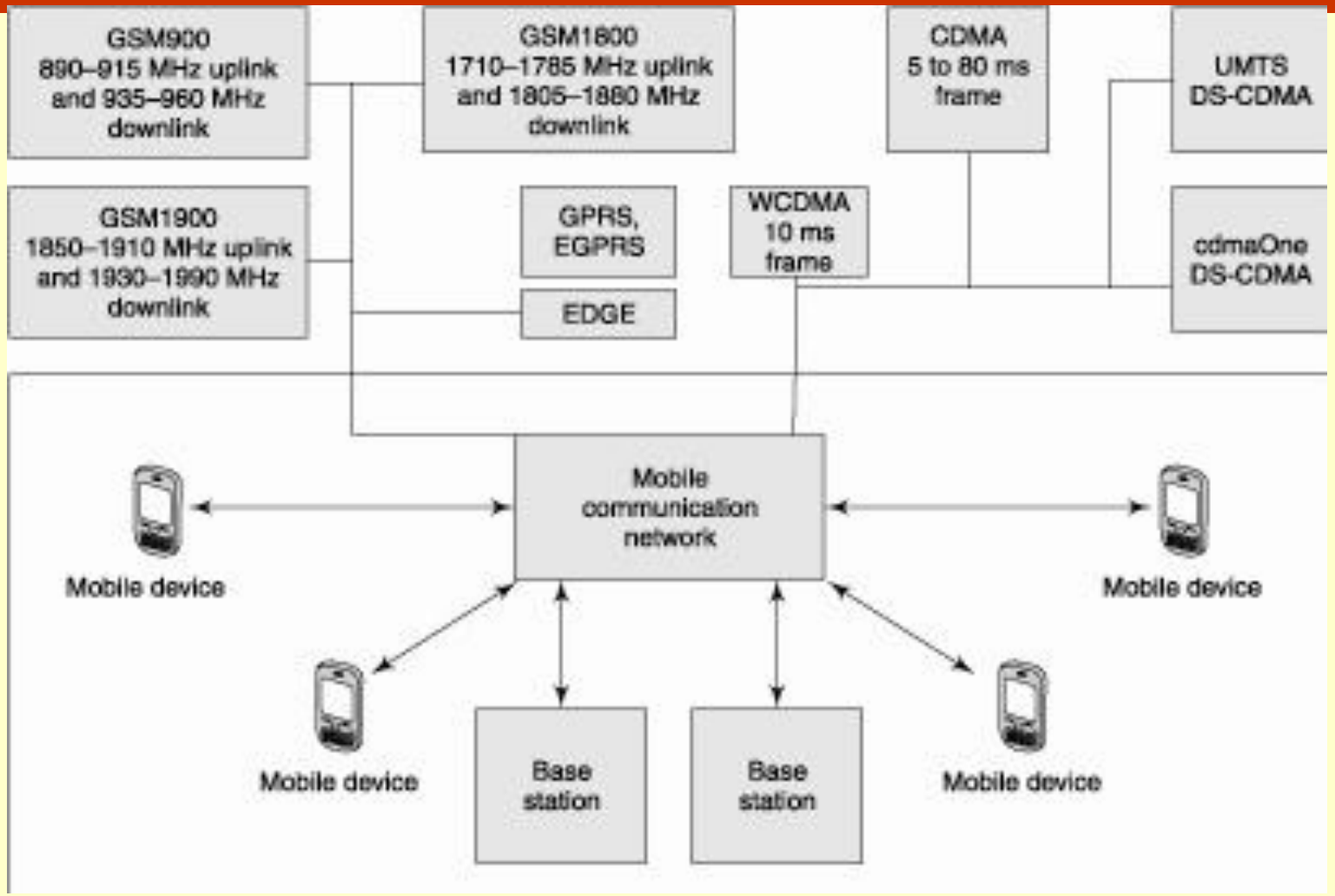
First and Second Generations (1G and 2G)

- First generation wireless devices only voice signals; Analog Cellular, Circuit Switching
- Second generation (2G) devices communicate voice as well as data signals have data rates of up to 14.4 kbps, 9.6 kbps, 19.2 kbps
- The 2.5G and 2.5G+ are enhancements of the second generation and sport data rates up to 384 kbps

Third generation (3G) mobile devices communication

- Higher data rates than 2G and support voice, data, and multimedia streams of 384 kbps onwards for long distance transmissions
- 3G, 3G+ and pre-4G Facilitates data rates of 2 Mbps to 100 Mbps
- Higher for short distances
- 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
- Each channel bandwidth = 200 kHz
- Eight radio-carrier analog-signals TDMA for user access in each deployed channel

GSM 900

- Users time-slices of 577 μs 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

- 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
- Supports cellular networks

CdmaOne

- 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 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
Introduction to 2G and 3G Data Communication Standards