SNS COLLEGE OF TECHNOLOGY

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

19ECT311 / Wireless Communication

III ECE/ VI SEMESTER

Unit III - **CELLULAR NETWORKS**

Topic 2: CDMA

2G CDMA Cellular

IS-95 is the best known example of 2G with CDMA

Advantages of CDMA for Cellular

- Frequency diversity – frequency-dependent transmission impairments have less effect on signal
- Multipath resistance – chipping codes used for CDMA exhibit low cross correlation and low autocorrelation
- Privacy – privacy is inherent since spread spectrum is obtained by use of noise-like signals
- Graceful degradation – system only gradually degrades as more users access the system

Drawbacks of CDMA Cellular

- Self-jamming – arriving transmissions from multiple users not aligned on chip boundaries unless users are perfectly synchronized

- Near-far problem – signals closer to the receiver are received with less attenuation than signals farther away

- Soft handoff – requires that the mobile acquires the new cell before it relinquishes the old; this is more complex than hard handoff used in FDMA and TDMA schemes

Types of Channels Supported by Forward Link

- Pilot (channel 0) - allows the mobile unit to acquire timing information, provides phase reference and provides means for signal strength comparison

- Synchronization (channel 32) - used by mobile station to obtain identification information about cellular system

- Paging (channels 1 to 7) - contain messages for one or more mobile stations

- Traffic (channels 8 to 31 and 33 to 63) – the forward channel supports 55 traffic channels

Forward Traffic Channel Processing Steps

- Speech is encoded at a rate of 8550 bps

- Additional bits added for error detection

- Data transmitted in 2-ms blocks with forward error correction provided by a convolutional encoder

- Data interleaved in blocks to reduce effects of errors

- Data bits are scrambled, serving as a privacy mask

- Power control information inserted into traffic channel

- DS-SS function spreads the 19.2 kbps to a rate of 1.2288 Mbps using one row of 64 x 64 Walsh matrix

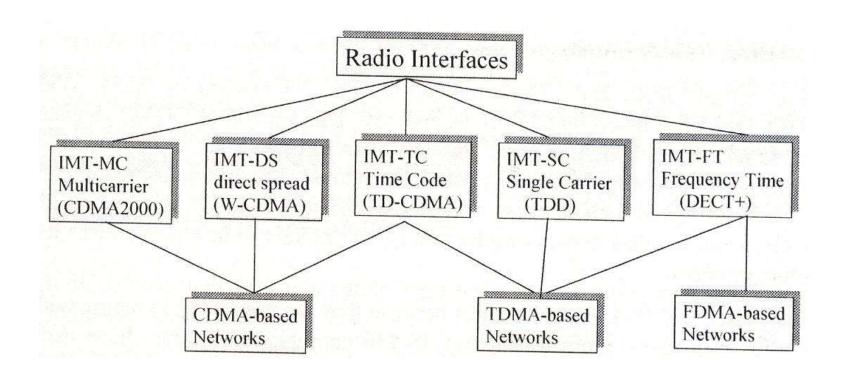- Digital bit stream modulated onto the carrier using QPSK modulation scheme

Table 8-3: Summary of Cellular Data Services (Source: www.pccdata.com)

Core Technology	Service	Data Capability	Generation
GSM (TDMA-origin) Family	Circuit-switched data based on the standard GSM 07.07 (based on TDMA)	9.6 Kbps or 14.4 Kbps	2G
	General Packet Radio Service (GPRS)	IP and X.25 communications over Kbps	2.5G
	Enhanced Data Rates for GSM Evolution (EDGE)	IP communications to 384 Kbps. Roaming with IS-136 networks possible.	2.75G
	TD-CDMA (also known as IMT-TC)	Combines CDMA and TDMA	3G
	Wideband CDMA (WCDMA)	Similar to EDGE but adds 2 Mbps indoor capability. Increased capacity for voice.	3G
CDMA-origin Family	Circuit-switched data based on the standard IS-707	9.6 Kbps or 14.4 Kbps	2G
	IS-95B	IP communications to 64 Kbps	2.5G
	CDMA2000 – 1XRTT	IP communications to 144 Kbps	2.5G
	Wideband CDMA (WCDMA)	Similar to EDGE but adds 2 Mbps indoor capability. Increased capacity for voice.	3G
	CDMA2000 – 3XRTT	IP communications to 384 Kbps outdoors and 2 Mbps indoors	3G

ACTIVITY

Activity: Draw a logo which may describe your character or things you like.

IMT 2000 Vision

- Common spectrum worldwide (2.8 – 2.2 GHz band)

- Multiple environments, not only confined to cellular, encompasses: cellular, cordless, satellite, LANs, wireless local loop (WLL)

- Wide range of telecommunications services (data, voice, multimedia, etc.)

- Flexible radio bearers for increased spectrum efficiency

- Data rates of: 9.6Kbps or higher for global (mega cell), 144Kbps or higher for vehicular (macro cell), 384Kbps or higher for pedestrian (micro cell) and up to 2Mbps for indoor environments (pico cell)

- Global seamless roaming

- Enhanced security and performance

- Full integration of wireless and wireline

Major 3G Technologies Proposed for IMT 2000

- W-CDMA backward compatible with GSM (called UMTS by the ETSI)

- The IS-95 standard (CDMAOne) is evolving its own vision of 3G: CDMA2000

- The IS-136 standard is evolving its own migration to 3G, Universal Wireless Communications, UWC-136 or IS-136 HS

IMT 2000 Services

- All what 2G support including:
  - Registration, authentication and encryption
  - SMS
  - Emergency calling
- Bit rates:
  - 144Kbps or higher for vehicular (macro cell),
  - 384Kbps or higher for pedestrian (micro cell) and
  - up to 2Mbps for indoor environments (pico cell)
- Billing/charging/user profiles
  - Sharing of usage/rate information between service providers
  - Standardized call detail recording
  - Standardized user profiles

Assessment

- **1. The rainbow pattern seen on a CD is an example of**
  1. Reflection
  2. Refraction
  3. Diffraction
  4. None of the above

- **2. Fresnel Reflection Coefficient is a factor of**
  1. Polarization of the wave
  2. Properties of the material at which reflection occurs
  3. Angle of incidence of wave
  a. 1) and 2) are correct
  b. All the three are correct
  c. 1) and 3) are correct
  d. 2) and 3) are correct.

- **3. Diffraction, at high frequencies, depends upon**
  1. Geometry of the object
  2. Polarization of the incident wave
  3. Amplitude of the incident wave
  4. Frequency of the incident wave
  a. 1) and 2) are correct
  b. 1), 2) and 3) are correct
  c. 2) and 3) are correct
  d. All are correct