



Lecture 2- Evolution of Mobile Communications

Brief overview about different mobile system generations

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Introduction

- The term Personal Communications System (PCS) refers to a wide variety of access and personal mobility services provided through a small terminal, with the goal of enabling communications at any time, at any place, and in any form.
- Business opportunities for such services are tremendous since every person (not just every home) can be equipped as long as the service is fairly inexpensive.
- Several PCS systems have been developed to meet rapid growth prompted by heavy market demand.

Introduction

- Examples of these systems include:
 - First Generation mobile systems
 - Second Generation mobile systems
 - Third Generation mobile systems
- The digital cellular systems include:
 - IS-136 TDMA based Digital Advanced Mobile Phone System (DAMPS)
 - GSM
 - IS-95 CDMA based cdma one system etc

[Introduction]

- 1 G is short for First Generation wireless telephone technology
- These were analog cell phone standards introduced in the 1980s and continued until being replaced by 2 G digital technology
- The main difference between 1 G and 2 G is that 1 G uses analog radio signals while 2 G uses digital radio signals
- First Generation Standards include:

1 G standards - NMT

- NMT (Nordic Mobile Telephone) used in the Nordic countries, Switzerland, Netherlands, Eastern Europe and Russia.
- NMT is based on analog technology
- Two variants exist: NMT-450 and NMT-900 (the numbers indicating the frequency band uses)
- The NMT specifications were free and open allowing many companies to produce NMT hardware and pushing the prices down
- Initial NMT phones were bulky and battery life was a big problem
- The introduction of digital mobile networks such as GSM reduced the popularity of NMT with the last services being suspended on December 31, 2007 in Sweden

[1 G standards - AMPS]

- operates in the 800 MHz
- AMPS is another 1G phone standard developed by Bell labs
- It was the primary analog mobile phone service in North America through the 1980s and into the 2000s
- AMPS is a 1G cellular technology that uses separate frequencies for each conversation
- It therefore requires considerable bandwidth for large number of users.

1G standards - TACS

- Total Access Communication System (TACS) is an obsolete variant of AMPS which was used in some European countries including the United Kingdom and Ireland.
- TACS is obsolete in Europe now having been replaced by GSM

2G standards - GSM

- Second Generation of mobile systems is based on digital technology
- Global System for Mobile communications (GSM) is a digital cellular system developed by Groupe Special Mobile of Conference Europeenne des Postes et Telecommunications (CEPT) and its successor European Telecommunications Standards Institute (ETSI).
- An important goal of the GSM development was to offer compatibility of cellular services among European countries.
- CEPT stands for European Conference of Postal and Telecommunications Administrations

[GSM]

- GSM uses both FDMA and TDMA
- With TDMA, the radio hardware in the Base Station (BS) can be shared among multiple users
- In GSM, a frequency carrier is divided into eight time slots
- GSM-900 and GSM-1800 are used in most parts of the world
- GSM-900 uses 890 - 915 MHz to send information from the Mobile Station to the Base Transceiver Station (uplink) and 935 - 960 MHz for the other direction (downlink)
- GSM-1800 uses 1710 - 1785 MHz to send information from the Mobile Station to the Base Transceiver Station (uplink) and 1805 - 1880 MHz for the other direction (downlink)

[IS-136 Digital Cellular System]

- Also referred to as digital AMPS (D AMPS)
- It supports a TDMA air interface similar to that of GSM
- Using TDMA, every IS-136 frequency carrier supports three voice channels
- Operate in the same frequency spectrum used by the existing AMPS system

IS-95 Digital Cellular System

- Based on CDMA technology
- CDMA allows many users to share a common frequency channel / time channel for transmission; the user signals are distinguished by spreading them with different codes.
- Channel bandwidth used is 1.25 MHz

2.5 G systems

- High Speed Circuit switched data (HSCSD)
- Wireless data transmission system for GSM users @ 38.4 kbps, four times faster than the standard GSM rate
- It is an evolutionary steps towards UMTS (3G)
- General Packet Radio Service (GPRS)
- It is a non-voice service added to the existing GSM network
- One of the 2.5G technology upgrades
- A big step towards 3G
- It uses the IP nature for transmission
- EDGE (Enhanced Data GSM Environment):
- Faster data transmission up to 384 kbps
- Enable the delivery of multimedia and other broadband applications to mobile phone and computer users

[3 G systems – IMT 2000]

- IMT stands for "International Mobile Telecommunications"
- IMT-2000 is simply a term used by the International Telecommunications Union (ITU) to refer to many third generation (3G) wireless technology, that provide higher data speed between mobile phones and base antennas

3G mobile systems

- UMTS specifies the bands 1900-2025 MHz and 2110-2200 MHz for 3G transmission
- The dream of 3G is to unify the world's mobile computing devices through a single, worldwide radio transmission standard
- Imagine being able to go anywhere in the world secure in the knowledge that your mobile phone is compatible with the local system, a scenario known as "global roaming".
- 3G technologies enable network operators to offer users a wider range of more advanced services while achieving greater network capacity through improved spectral efficiency
- Services include wide-area wireless voice telephony and broadband wireless data, all in a mobile environment. Typically, they provide service at 5-10 Mb per second.