Cellular Mobile Communication

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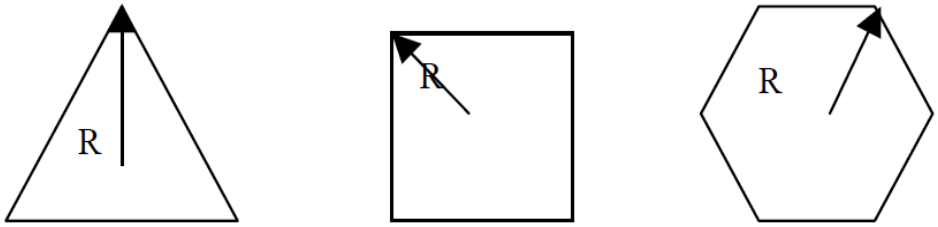
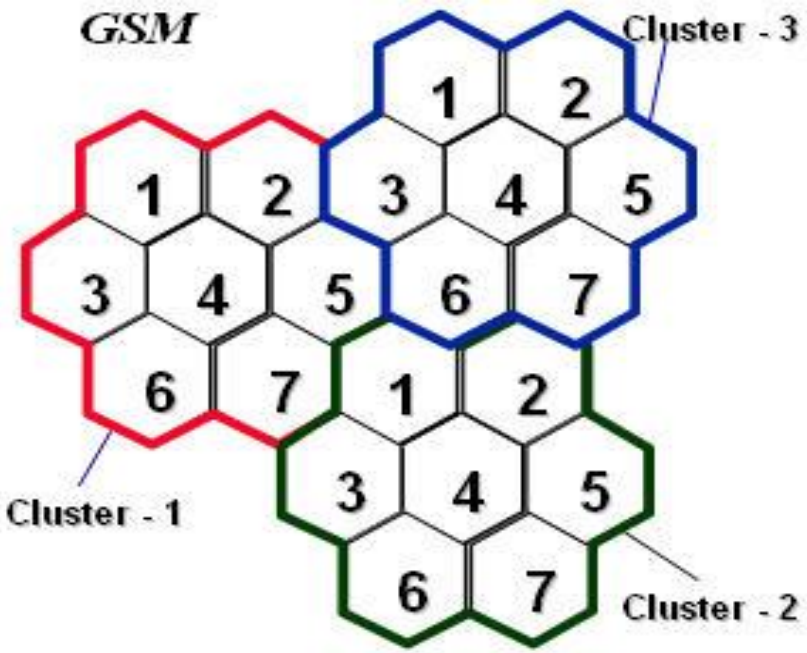
Cell Structure

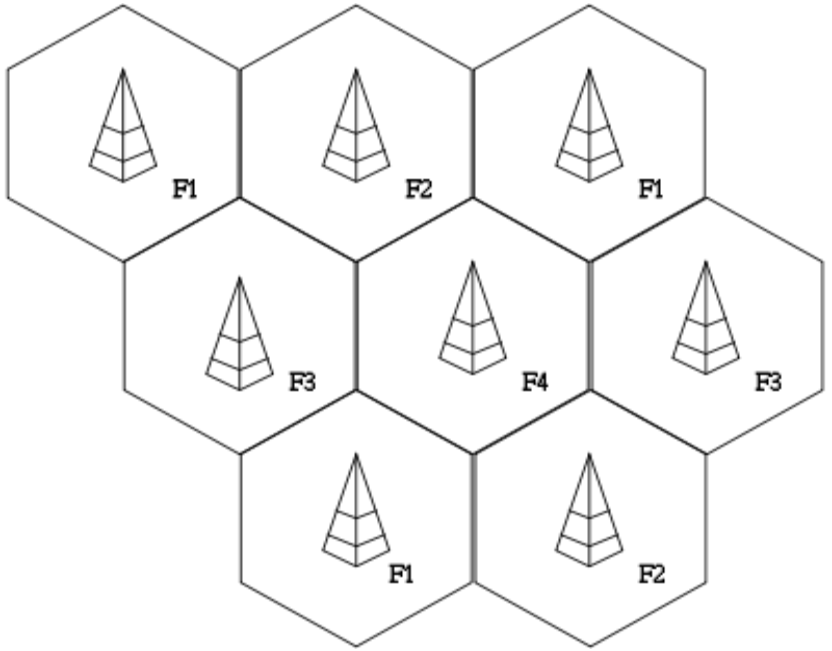
- The actual radio coverage of a cell is known as the cell footprint.
  - It has the most sides that can fit together without gaps.
  - The frequecncy reuse become possible using this shape.
  - The radiation pattern of the antennas used is 60 degree which means 6 are required for the full 360 degrees coverage which is the same no. of sides the hexagon consists.
- http://cdn.intechweb.org/pdfs/14752.pdf



$$A_{tri} = 1.3R^2 \qquad A_{sq} = 2.0R^2 \qquad A_{hex} = 2.6R^2$$

Frequency Reuse





Comparison

Generation→ Features↓	1G	2G	3G	4G	5G
Deployment	1970 – 1980	1990 - 2001	2001-2010	2011	2015-20 onwards
Data Rates	2kbps	14.4-64kbps	2Mbps	200 Mbps to 1 Gbps	1Gbps and higher
Technology	Analog Cellular Technology	Digital Cellular Technology: Digital narrow band circuit data Packet data	Digital Broadband Packet data: CDMA 2000 EVDO UMTS EDGE	Digital Broadband Packet data: WiMax LTE Wi-Fi	wwww Unified IP seamless combination of broadband LAN PAN MAN WLAN
Service	Analog voice service No data service	Digital voice with higher clarity SMS, MMS Higher capacity packetized data	Enhanced audio video streaming video conferencing support Web browsing at higher speeds IPTV support	Enhanced audio, video streaming IP telephony HD mobile TV	Dynamic Information access, Wearable devices with AI Capabilities
Multiplexing Switching	FDMA	TDMA, CDMA	CDMA	CDMA	CDMA
Core Network	PSTN	PSTN	Packet N/W	Internet	Internet
Standards	MTS AMTS IMTS	2G:GSM 2.5:GPRS 2.75:EDGE	IMT-2000 3.5G-HSDPA 3.75G:HSUPA	Single unified standard LTE, WiMAX	Single unified standard
WEB Standard		www	www(IPv4)	www (IPv4)	wwww (IPv6)
Handoff	Horizontal only	Horizontal only	Horizontal & Vertical	Horizontal & Vertical	Horizontal & Vertical
Shortfalls	Low capacity, Unreliable handoff, Poor voice links, Less secure	Digital signals were reliant on location & proximity, required strong digital signals to help mobile phones	Need to accommodate higher network capacity	Being deployed	Yet to be implemented

Key Points

- PSTN - public switched telephone network
- MTS -Mobile Telephone Systems
- AMTS -Advance Mobile Telephone Systems
- IMTS- Improved Mobile Telephone Systems
- Horizontal handoff
  - between two same wireless mobile network technologies.
- Vertical handoff
  - between two different wireless mobile network technologies.

Key Points

- SMS-Short Message Service
- MMS-Multimedia Messaging Service
- GSM -Global System for Mobile communication
- GPRS -General Packet Radio Service
- EDGE -Enhanced Data for Global Evolution
- UMTS -Universal Mobile Telecommunications Service
- HSDPA -High-Speed Downlink Packet Access
- HSUPA -High-Speed Uplink Packet Access
- LTE- Long Term Evolution

Summary

- Cellular networks
- Comparison of 1G – 5G

Test Your Knowledge?

- Why the cell structure is preferred to be hexagonal shape?
- ------- uses the cellular network to enable high speed internet connections ti devuces wutg built-in compatible technology such as smart phones

a) Cellular radio b) bluetooth c)wi-fi

Reference

- Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt. Ltd, New Delhi – 2012.
- Jochen H. Schller, "Mobile Communications", Second Edition, Pearson Education, New Delhi, 2007.