THE CELL PHONE MISSION

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Overview

- Different access systems
  - FDMA, TDMA,CDMA, WCDMA
- The different types of technologies
  - GSM, GPRS,
  - 1G, 2G, 3G and future
- Phone comparison

Overview

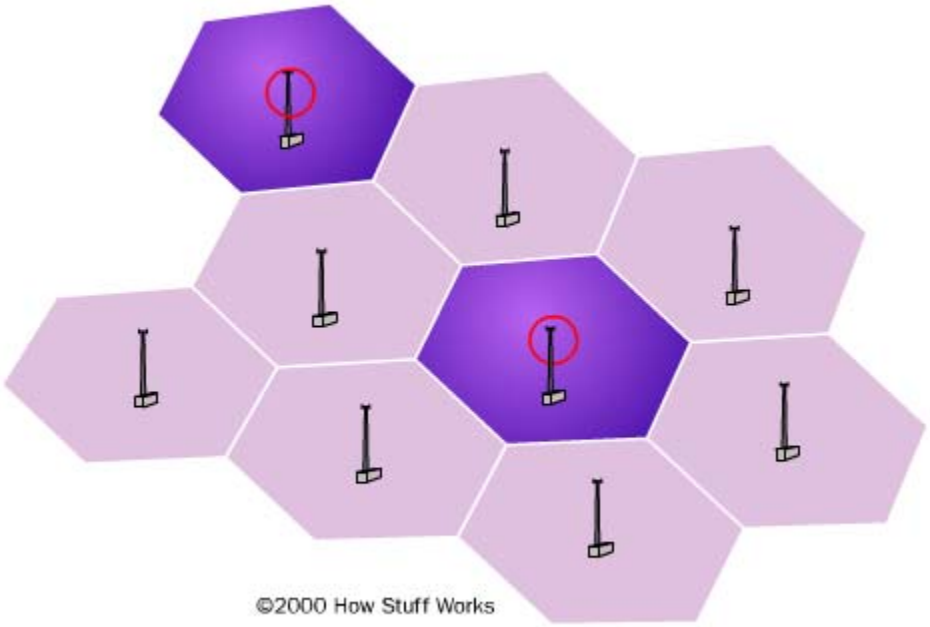
- Shawn: FDMA, TDMA, GSM and GPRS cell phone comparison
- Olja: CDMA and comparison, third-generation, WCDMA and future LEO technology
- Together: the cell phone overview and summary

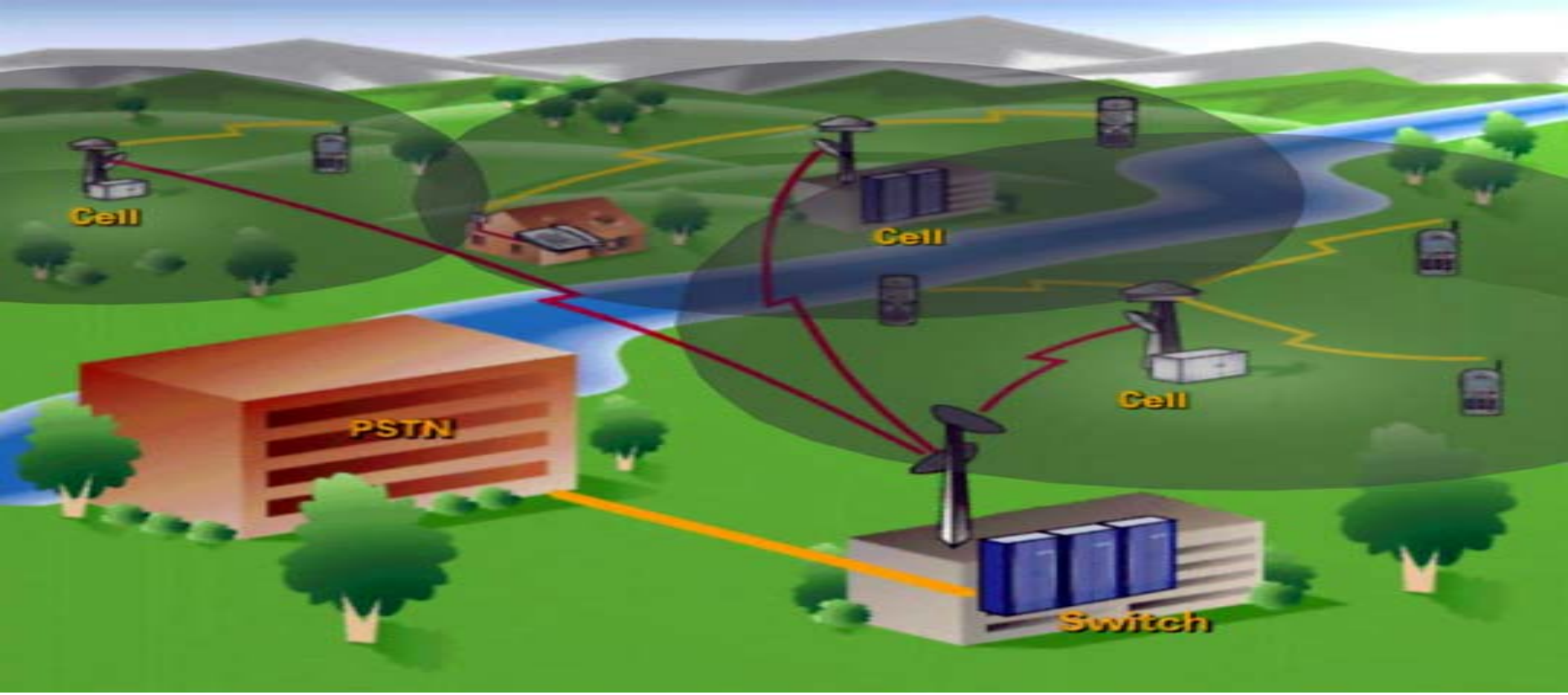
What is a cell phone?

- A cell phone is a very sophisticated radio
- It is used to talk to anyone on the planet from anywhere
- It can store contact information
- Used to send or receive emails
- Get information (news, entertainment, stock quotes..) from the Internet
- Used to play games

How does it work?

- A cell phone system is made up of many small "cells"
- Each cell represents the area served by one cell tower called a 'base station'

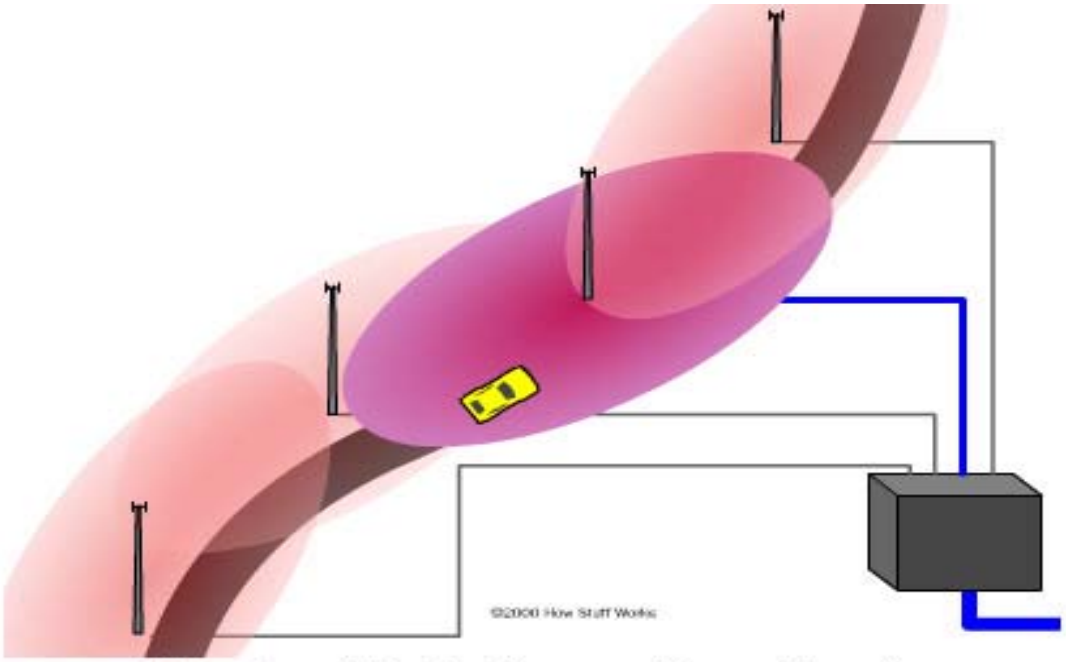




- Cell phones use high frequency radio signals to communicate with cell towers
- When a call is made, the phone sends a message to the tower asking for connection
- The “switch” patches the cell phone’s signal throughout to a channel on the Public Switched Telephone Network (PSTN)
- The call takes a wireless channel as well as a PSTN channel and will held it open until the call is completed

From cell to cell:

- Cells do overlap
- When a user travels between cells, they hand calls off to each other



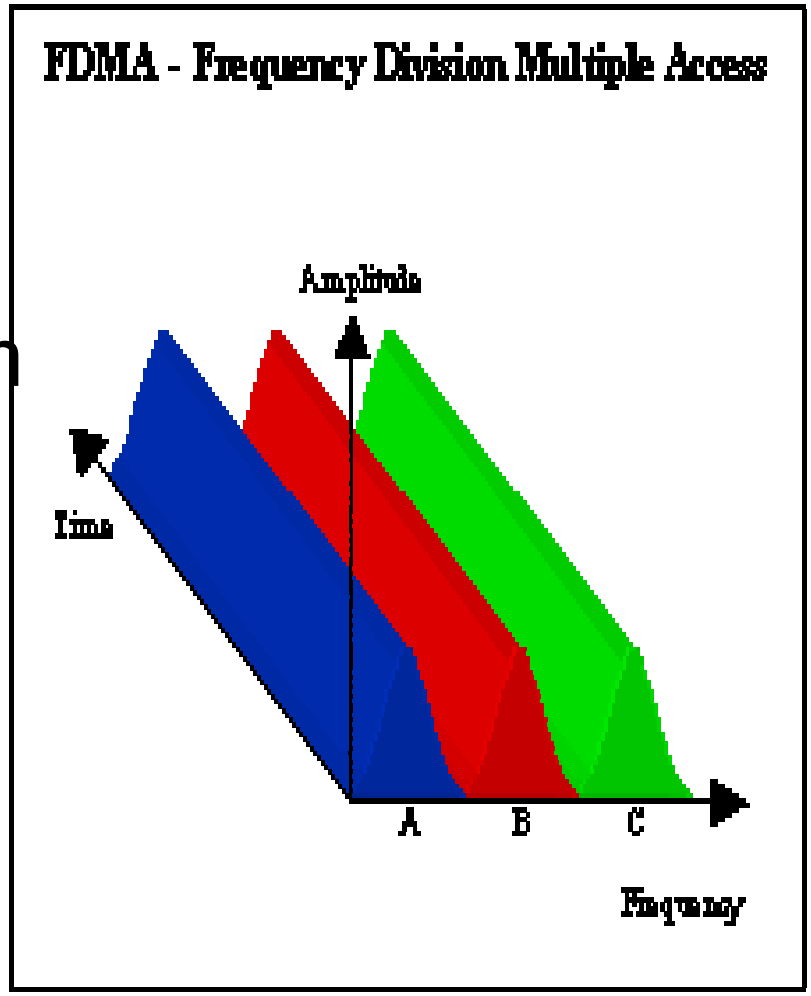
As you travel, the signal is passed from cell to cell.

Different access systems:

- Frequency Division Multiple Access
- Time Division Multiple Access
- Code Division Multiple Access
- Wideband-Code Division Multiple Access

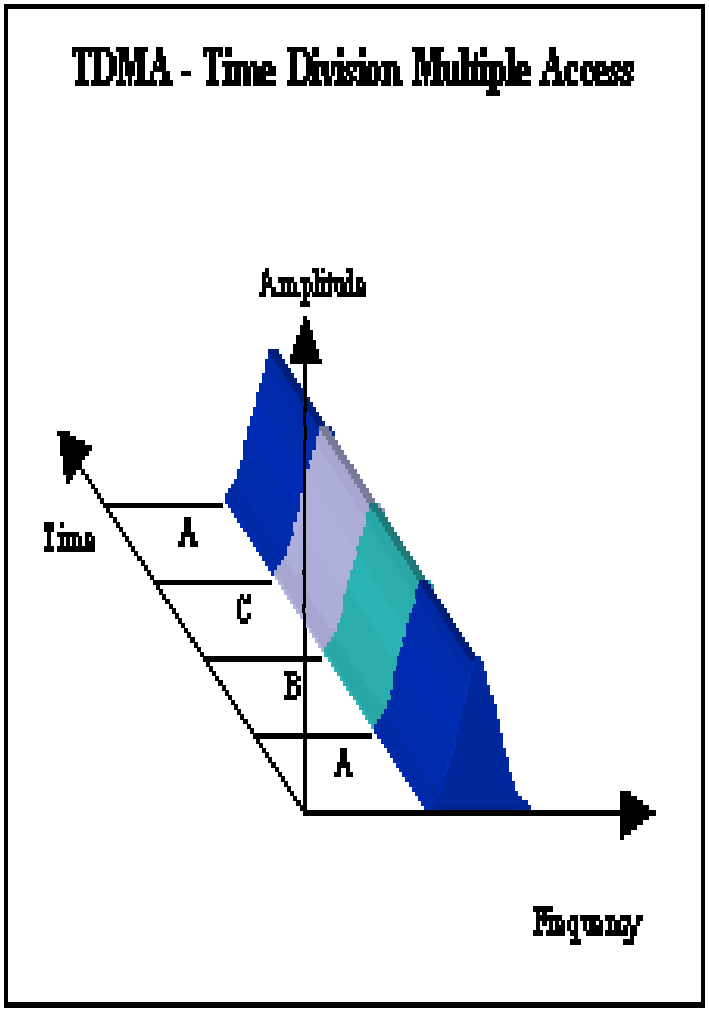
Frequency Division Multiple Access (FDMA)

- It is used in analog systems
- The frequency spectrum is divided into different channels.
- Each user reserves a separate channel



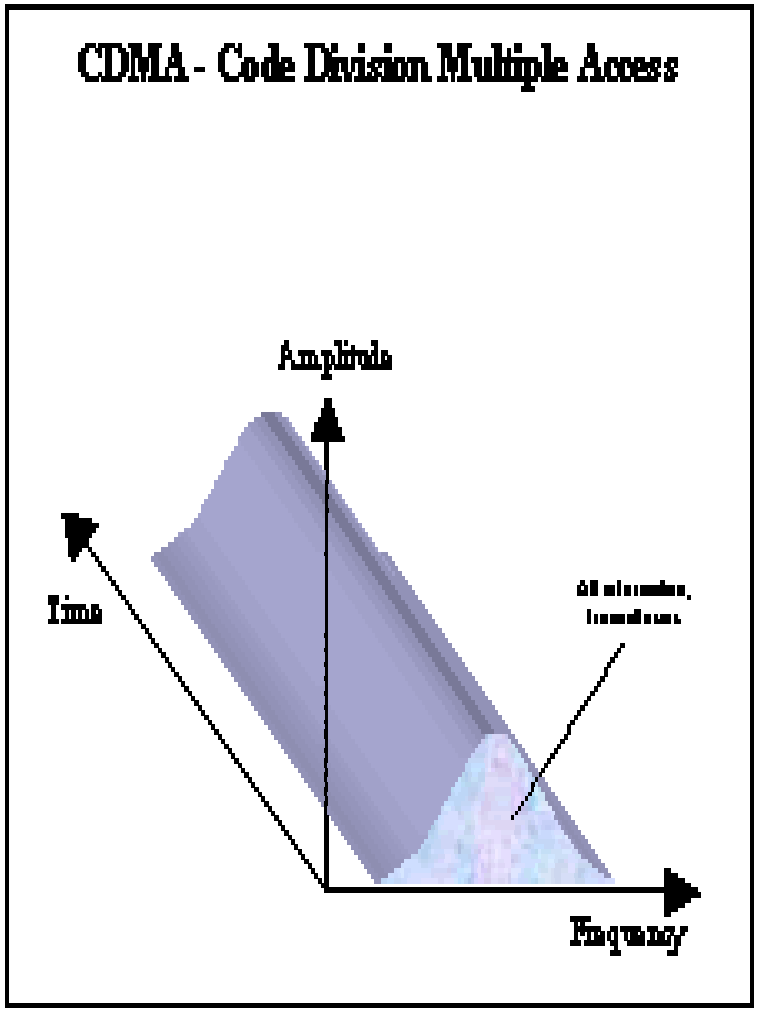
Time Division Multiple Access (TDMA)

- It is build on FDMA by dividing conversations by time.
- Each caller is assigned a specific time slot for transmission
- Used by the Global System for Mobile Communication (GSM)

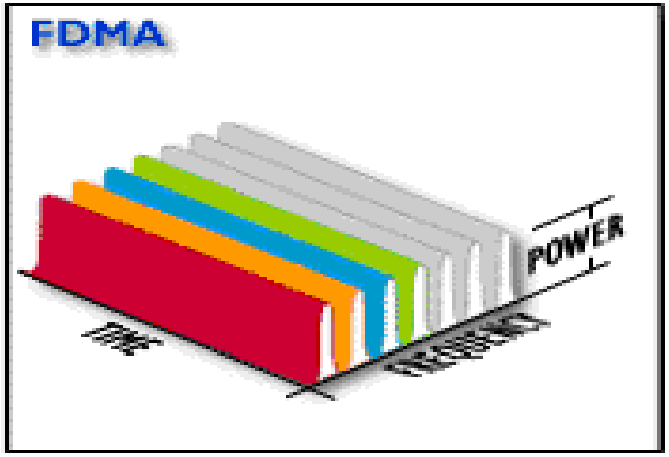


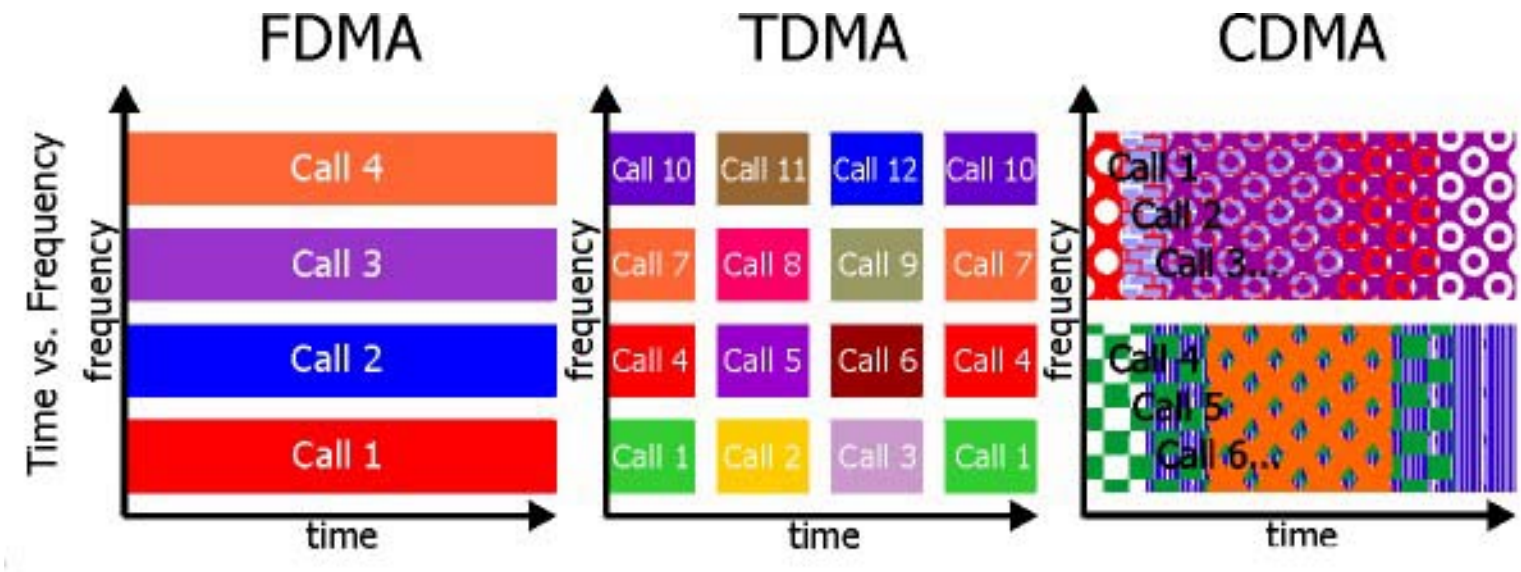
Code Division Multiple Access (CDMA)

- CDMA has no channels
- Everybody transmits on the same time over all the frequency spectrum but with different assigned codes
- It can accommodate more users per MHz of bandwidth than the other technologies

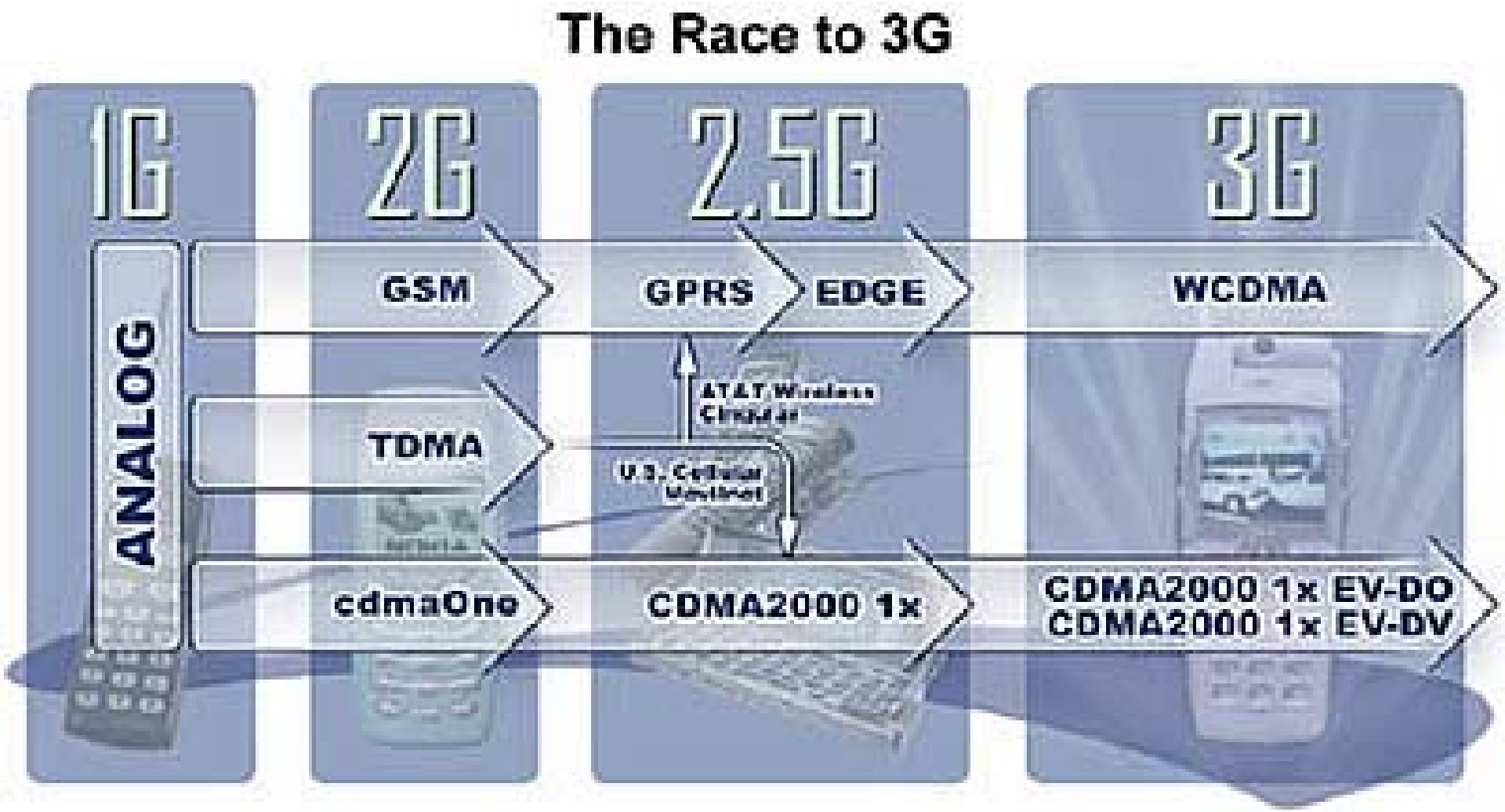


FDMA vs. TDMA vs. CDMA





The RACE to 3G



Global System for Mobile Communication (GSM)

- Developed by Conference of European Posts and Telegraphs (CEPT) in 1982
- 2-G generation technology
- built based on the TDMA protocol
- Delivers high quality mobile voice and data
- Delivers at speed of 9.6kbps
- Support for international roaming
- Use your cell phone anywhere in the world by using a SIMM card

General Packet Radio Service (GPRS)

- Implemented on the GSM network and 2.5G technology
- Does not require continuous connection to the internet
- More efficient than dial-up modem
- Send and receive data at a speed up 155 kbps

THIRD - GENERATION (3G)

- Flexible support of multiple services
  - Voice
  - Messaging – email, fax, etc.
  - Medium-rate multimedia – Internet access
  - High-rate multimedia – file transfer, video
  - High-rate interactive multimedia – video teleconferencing, telemedicine, etc.
- Frequency rates are up to and possibly higher than 2 megabits per second (Mbps)
- Global roaming: ubiquitous, seamless coverage

THIRD - GENERATION (3G) cont.

- Uses two different access systems:
  - WCDMA
  - CDMA2000 1X EV-DO or EV-DV

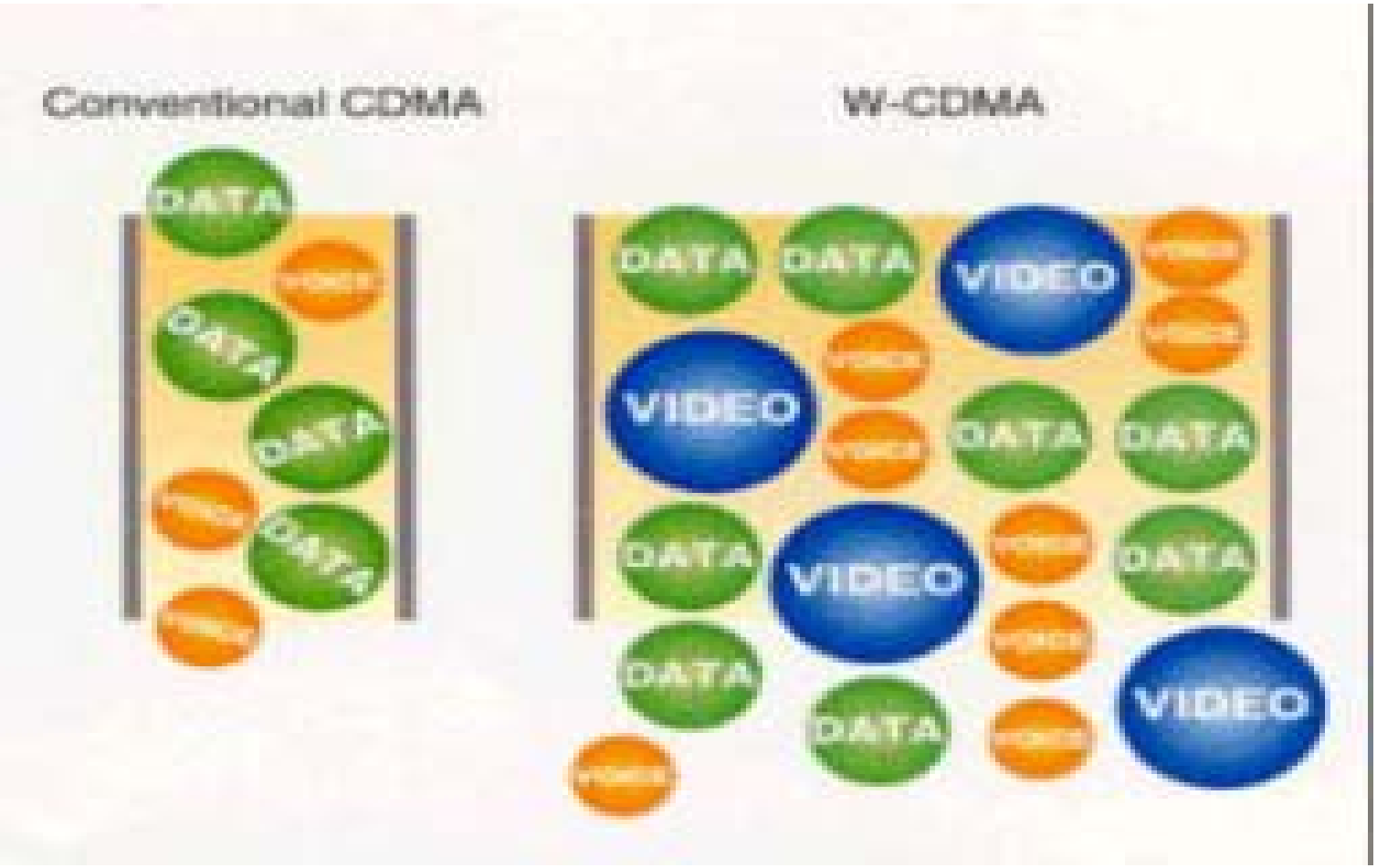
WCDMA vs. CDMA2000

- Chip rate
- Multi carrier spreading vs. single carrier
- Implemented in Europe vs. implemented in the U.S.
- Bandwidth per channel up to 20Mhz vs. 15MHz
- GSM compatibility vs. IS-95 compatibility

Wide-Band Code Division Multiple Access (WCDMA)

- A derivation from CDMA
- A 3rd- generation technology
- can reach speeds from 384 Kbps to higher than 2 Mbps
- adopted as a standard by the International Telecommunications Union (ITU) under the name "IMT-2000 direct spread"

Voice, images, data, and video are first converted to a narrowband digital radio signal. The signal is assigned a marker (spreading code) to distinguish it from the signal of other users. WCDMA uses variable rate techniques in digital processing and it can achieve multi-rate transmissions.



Cell Phone Comparison

- **Nokia 7160**

  - **Special features: games, music player features, downloadable ring tones and graphics, a personal information manager (PIM) and calculator**

- **Samsung SCH6100**

  - **Special features: phone book, appointment calendar, world clock, calculator and a personal information manager (PIM)**

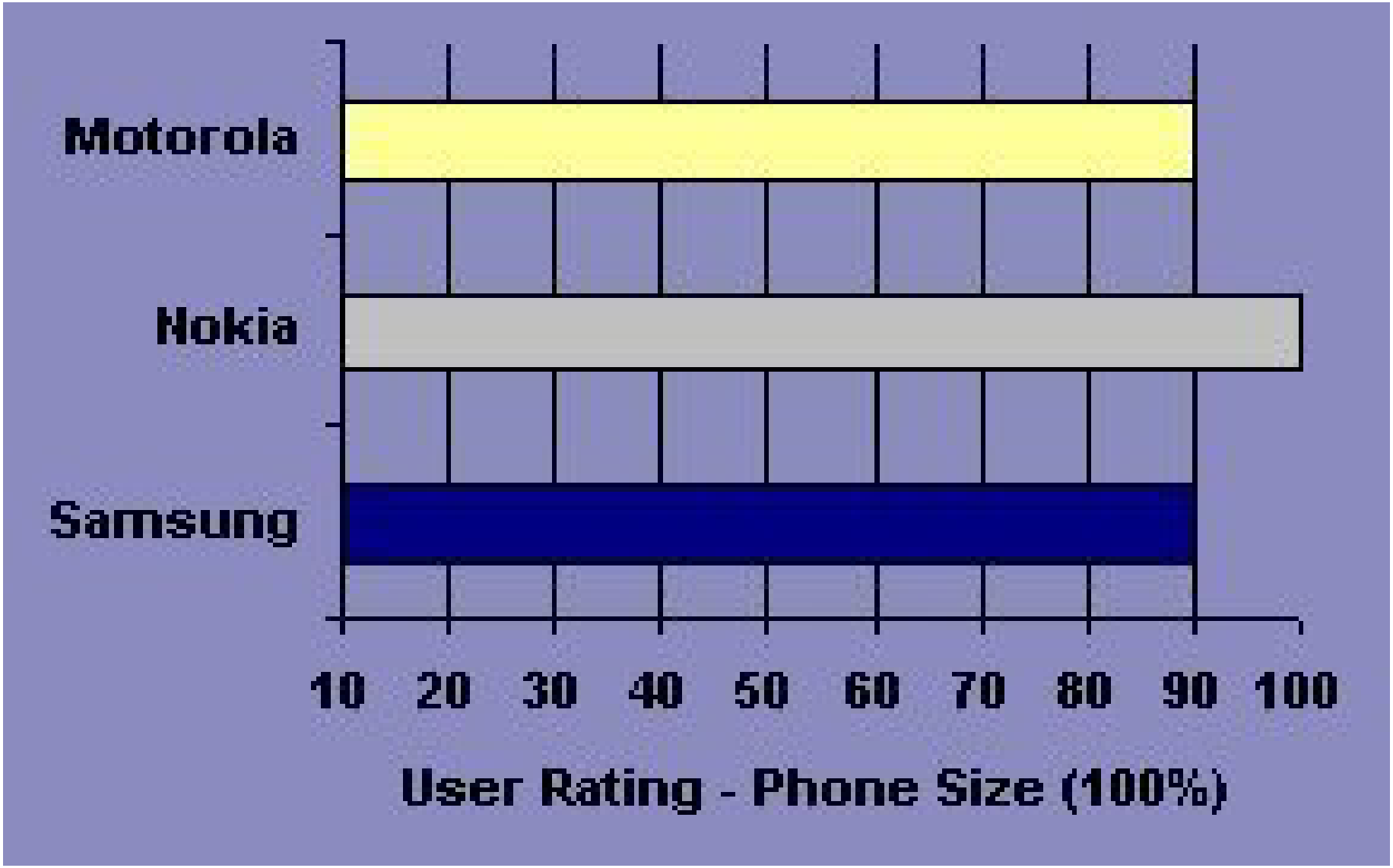
- **Motorola Timeport 280**

  - **Special features: personal information manager (PIM), calculator, world clock, a phone book, calendar, caller ID, and organizer with alarms**

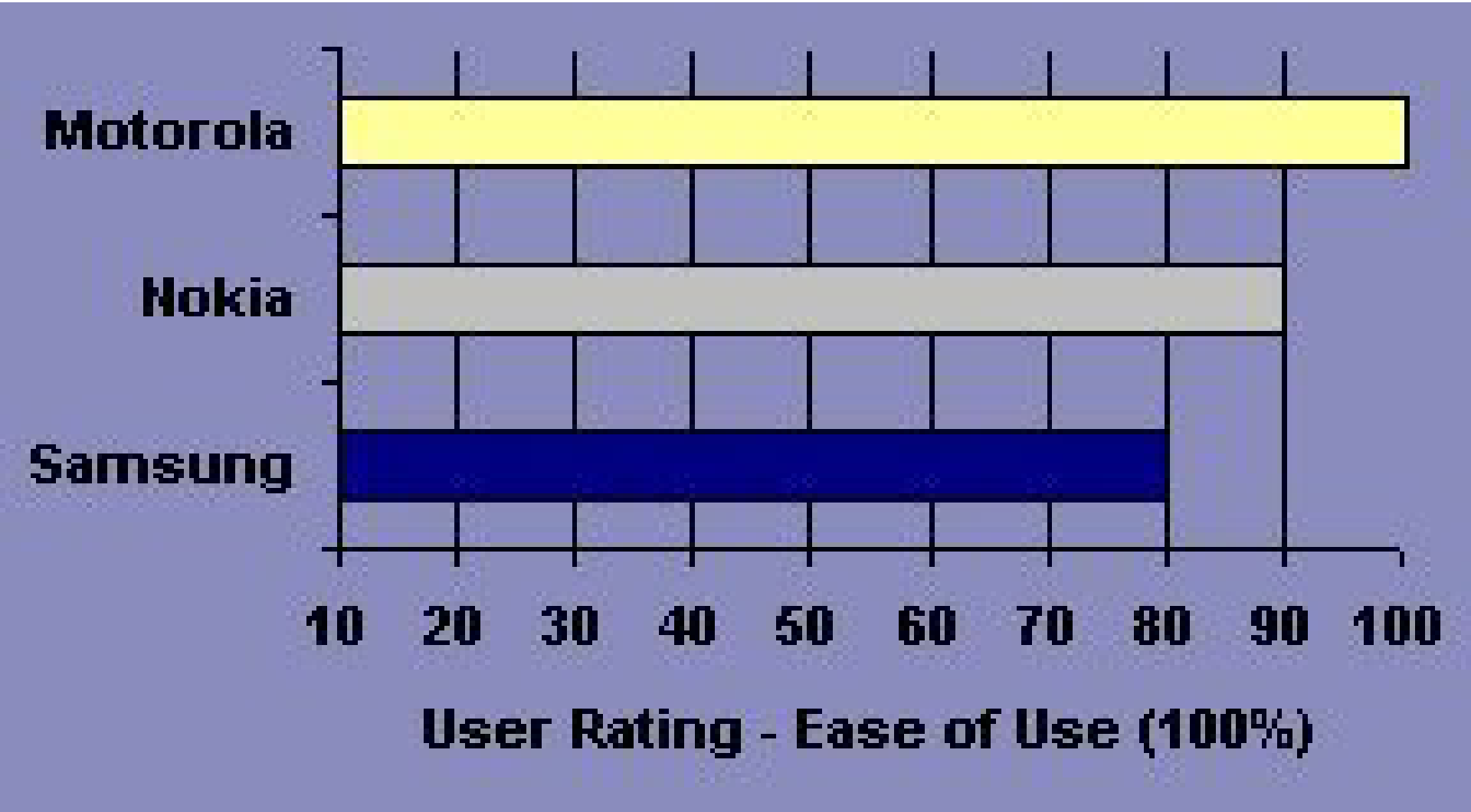
Cell Phone Comparison

	Nokia 7160	Samsung SCH6100	Motorola Timeport 280
Band Mode	Dual	Digital	Dual
Technology	TDMA	CDMA	GSM /GPRS
Weight	4.9 Oz	2.7 Oz	3.5 Oz
Talk Time	4 Hours	5 Hours	4 Hours
Standby Time	10 days	5 days	7 days
SMS	Yes	Yes	Yes
Games	Yes	No	No

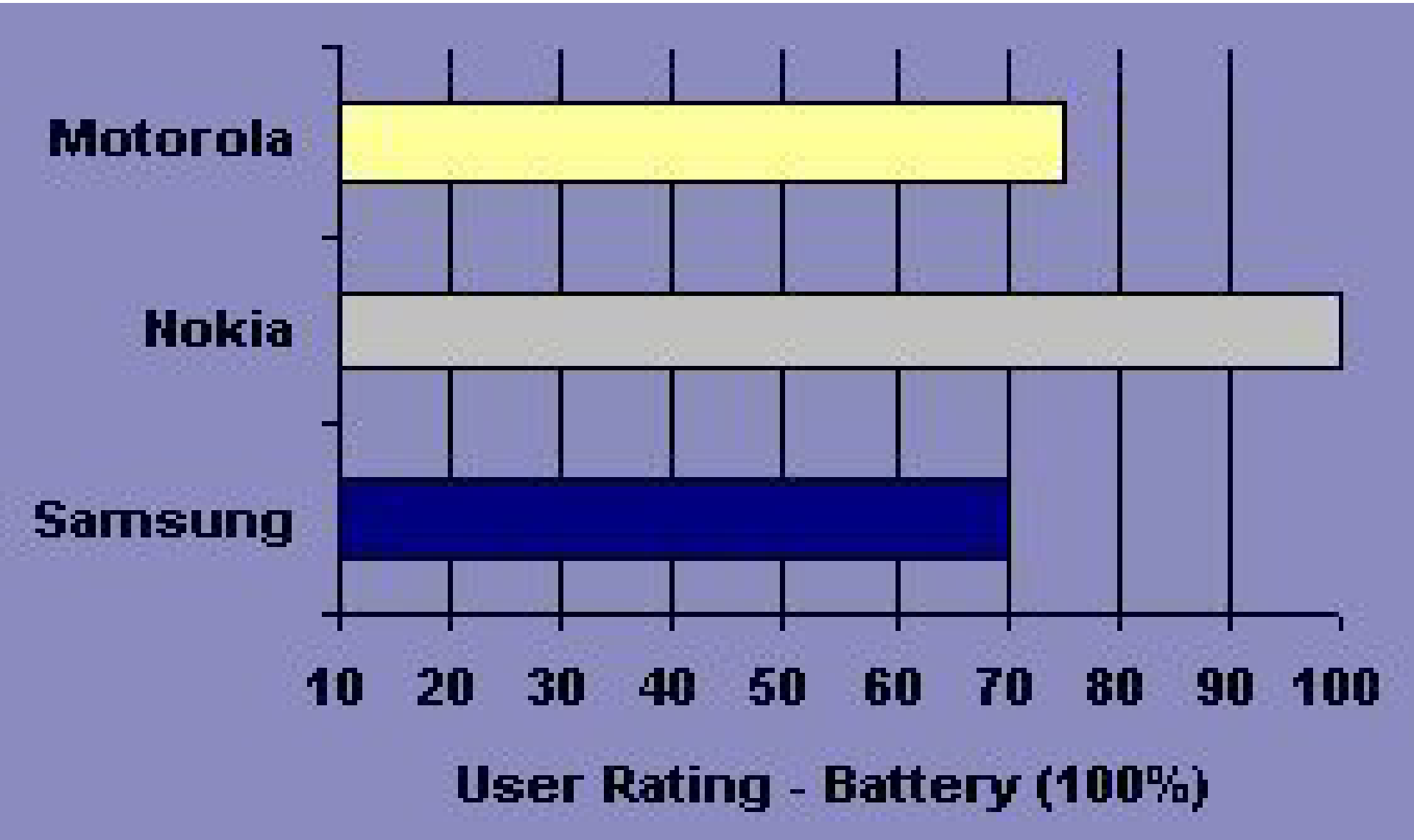
Cell Phone Comparison - Size and Appearance



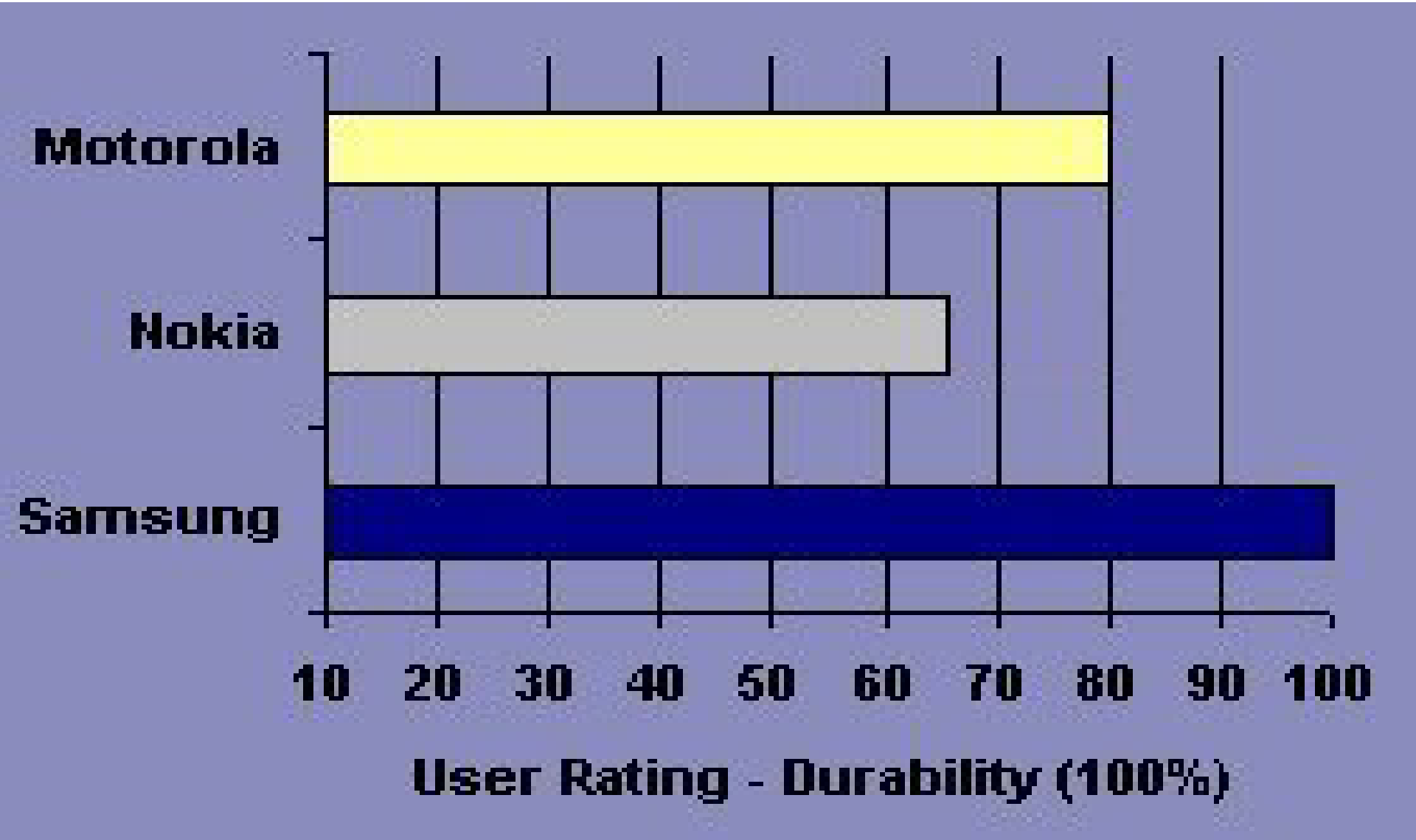
Cell Phone Comparison – navigation and menu used



Cell Phone Comparison – Battery and Power



Cell Phone Comparison – Durability



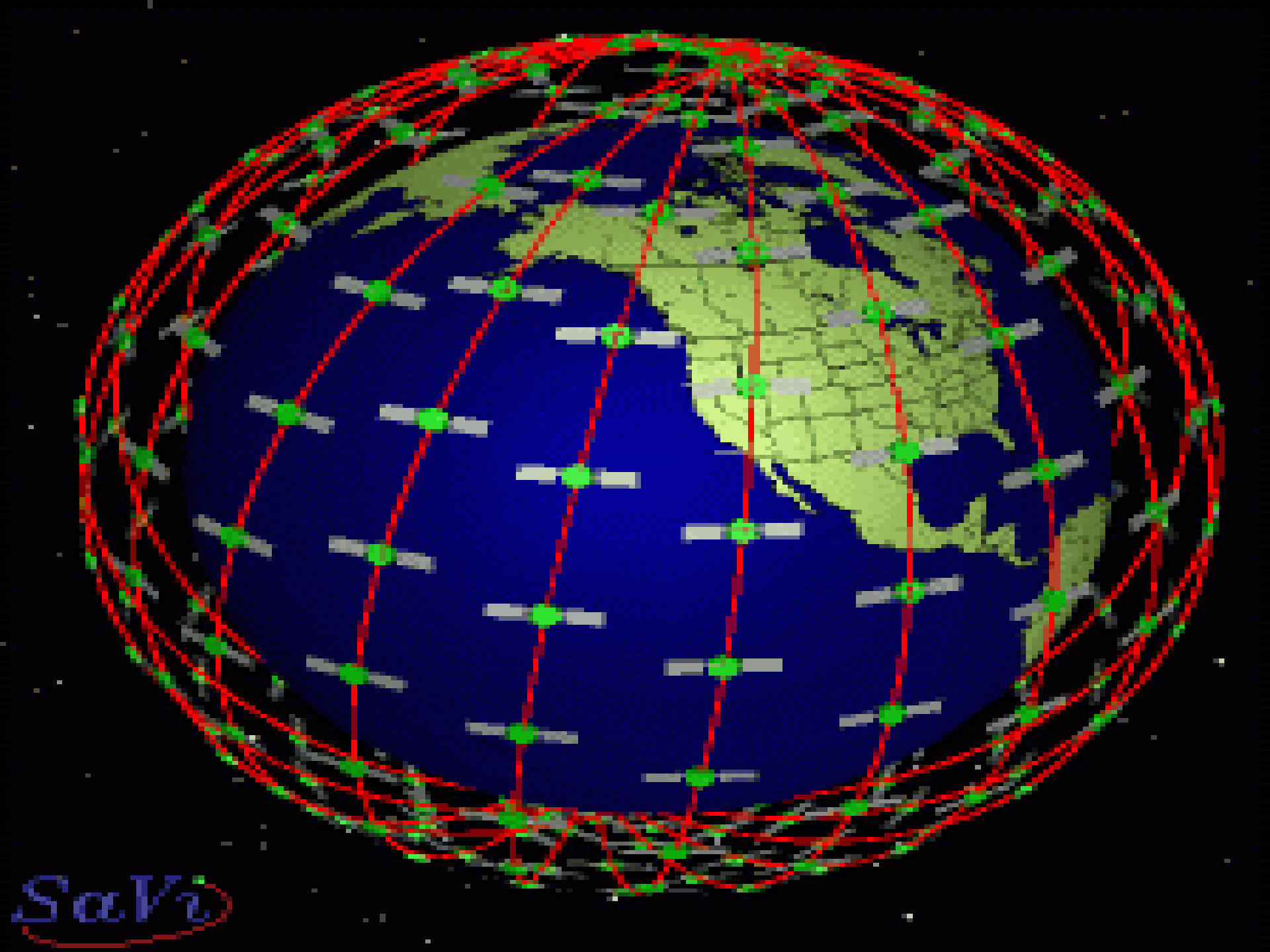
Cell Phone Comparison - Overall

- The Nokia 7160 won the comparison test in Size and apperance and Battery and Power
- The Samsung SCH6100 won the comparison test in Durability
- The Motorola Timeport 280 won the comparison test in navigation and menu used

FUTURE PHONES

LEO Satellites (low earth orbit)

- Satellites will orbit the earth in high speed in low altitude orbits
- Guarantee every area is covered by at least one satellite at all times
- Call handoff executed when satellite moves and not when person moves
- Motorola and Globalstar started implementing LEO with 66 and 48 satellites respectively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Summary

- Over 60 million subscribers use cell phones
- The cell phone technology is advancing everyday
- 3G, the newest technology, is using a more advanced CDMA system
- In the future (4G), they are trying to integrate the multi systems that exist into a single one (low-cost delivery world wide)

References

- www.webopedia.com/TERM/TDMA.html
- www.arcx.com/sites/cdmavstdma.htm
- www.3g-generation.com
- www.cdmaonline.com
- http://www.iec.org/online/tutorials/tdma/ (TDMA)
- www.webopedia.com/TERM/TDMA.html (TDMA)
- http://mars.cs.kent.edu/ksuthesis/node15.html (FDMA)
- http://www.cdmaonline.com/ (CDMA)
- http://www.cellular.co.za/cdma.htm (CDMA)
- http://www.ericsson.com/technology/ (GSM)
- http://www.gsmworld.com/index.shtml (GSM)
- www.3g-generation.com/what_is.htm (3G)
- http://cellphones.about.com/library/glossary/bldef_3g_wireless.htm?terms=FDMA (3G)
- http://cellphones.about.com/library/glossary/bldef_umts.htm (UMTS)
- http://cellphones.about.com/gi/dynamic/offsite.htm?site=http%3A%2F%2Fwww.ee.washington.edu%2Fclass%2F498%2Fsp98%2Ffinal%2Fmarsha%2Ffinal.html (Cool Pics and info)
- http://electronics.howstuffworks.com/cell-phone1.htm (More Cool Pics and info)