

Mobile Communications

Introduction

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- ♦ *What is the history of mobile communications?*
- ♦ *What types of wireless networks exist?*
- ♦ *How will the future of mobile communications look like?*
- ♦ *Where can I find information about mobile networks?*

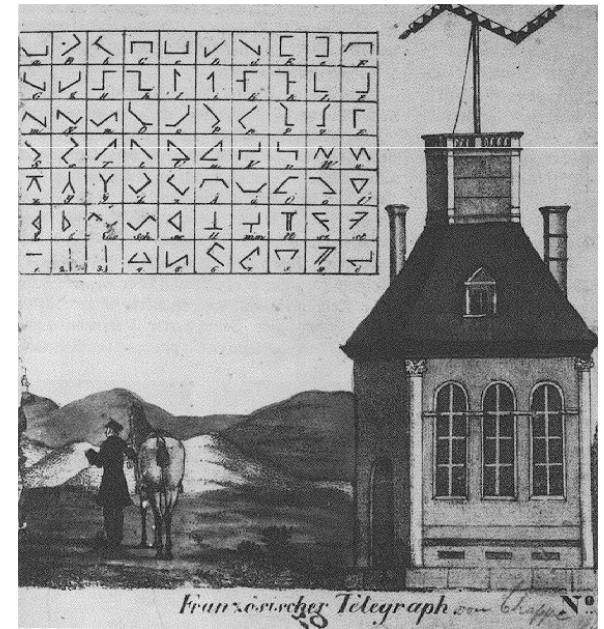
History – Past and Radio

◆ Past

- » Fire signal signals used to communicate the fall of Troy to Athens
- » 2nd century B.C., sets of torches to transmit characters
- » 1793, 3 part semaphores on top hills and towers
- » 1837, electric telegraph

◆ Radio transmission

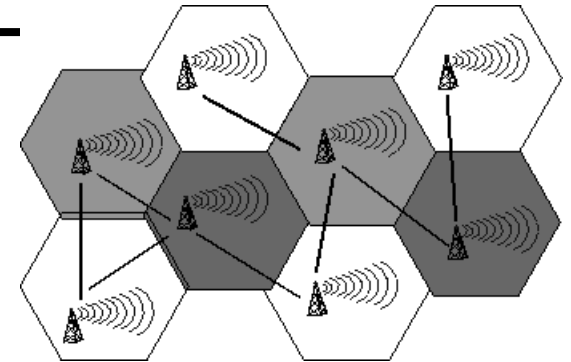
- » 1895, first radio transmission 29 km away
- » 1906, amplitude-modulated (AM) radio.
- » 1920, broadcast of radio news program
- » 1928, TV broadcast trials
- » 1933, frequency-modulated (FM) radio
- » 1946, Swedish police had the first radio phones installed in cars
- » 1950, mobile phone with direct dialling



History – Cell, 1st Generation

- ◆ Cellular topology
 - » 1950's, cellular network concept
 - power of transmitted signal falls with square of distance
 - 2 users can operate on same frequency at separate locations
 - » 1971, Finland, ARP, first public commercial cellular, mobile network

- ◆ 1st Generation ➔ Analogue, Frequency Division Multiplexing
 - » 1982, NMT network covering Finland/Sweden/Norway/Denmark
 - » 1983, AMPS in America
 - » 1985, TACS, Total Access Communications Service, in Europe



History – Packet Radio

- ♦ 1971, ALOHNET packet radio
 - » computers communicate with central HUB
- ♦ 1980's ad-hoc, self-configurable packet networks
- ♦ 1985, Wireless LANs authorized to use ISM bands
- ♦ 1997, first WLAN standard

History – 2nd and 3rd Generation

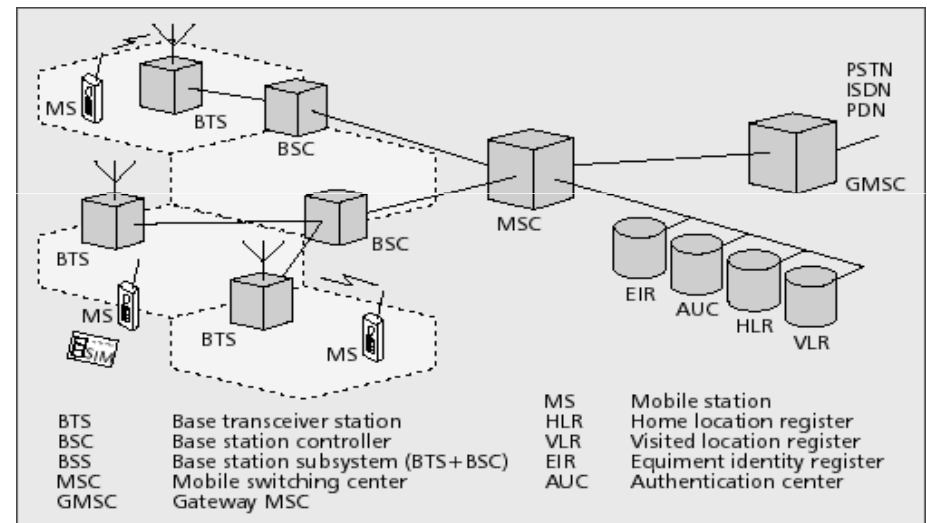
◆ 2nd Generation

digital transmission and signalling; ISDN based

» 1982, specification GSM is started

» Early 1990's

- Europe: GSM
- USA: D-AMPS, cdmaOne
- Japan: Personal Digital Cellular (PDC)



◆ 3G systems

aimed at multimedia communication

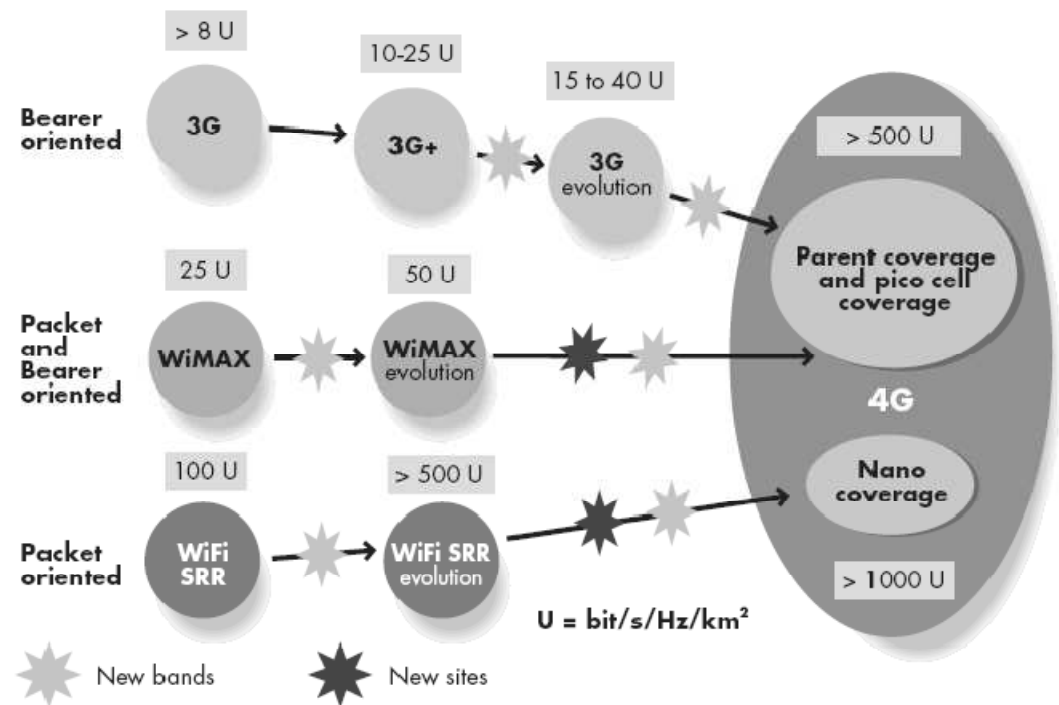
» 2001, Japan, first implementation of 3G systems

Type of Networks

- ◆ WPAN - Wireless Personal Area Networks
 - » short distances among a private group of devices
- ◆ WLAN - Wireless Local Area Networks
 - » areas such as an home, office or a group of buildings
- ◆ WMAN - Wireless Metropolitan Area Networks
 - » from several blocks of buildings to entire cities
- ◆ PLMN - Public Land Mobile Networks
 - » regions and countries
- ◆ Broadcast
 - » single direction, audio and video

Technologies Comparison

- $U = \text{bit/s/Hz/km}^2$
 - PLMN \rightarrow 10 to 40 U (based on UMTS)
 - WMAN \rightarrow 25 to 50 U
 - WLAN \rightarrow 100 to 500 U

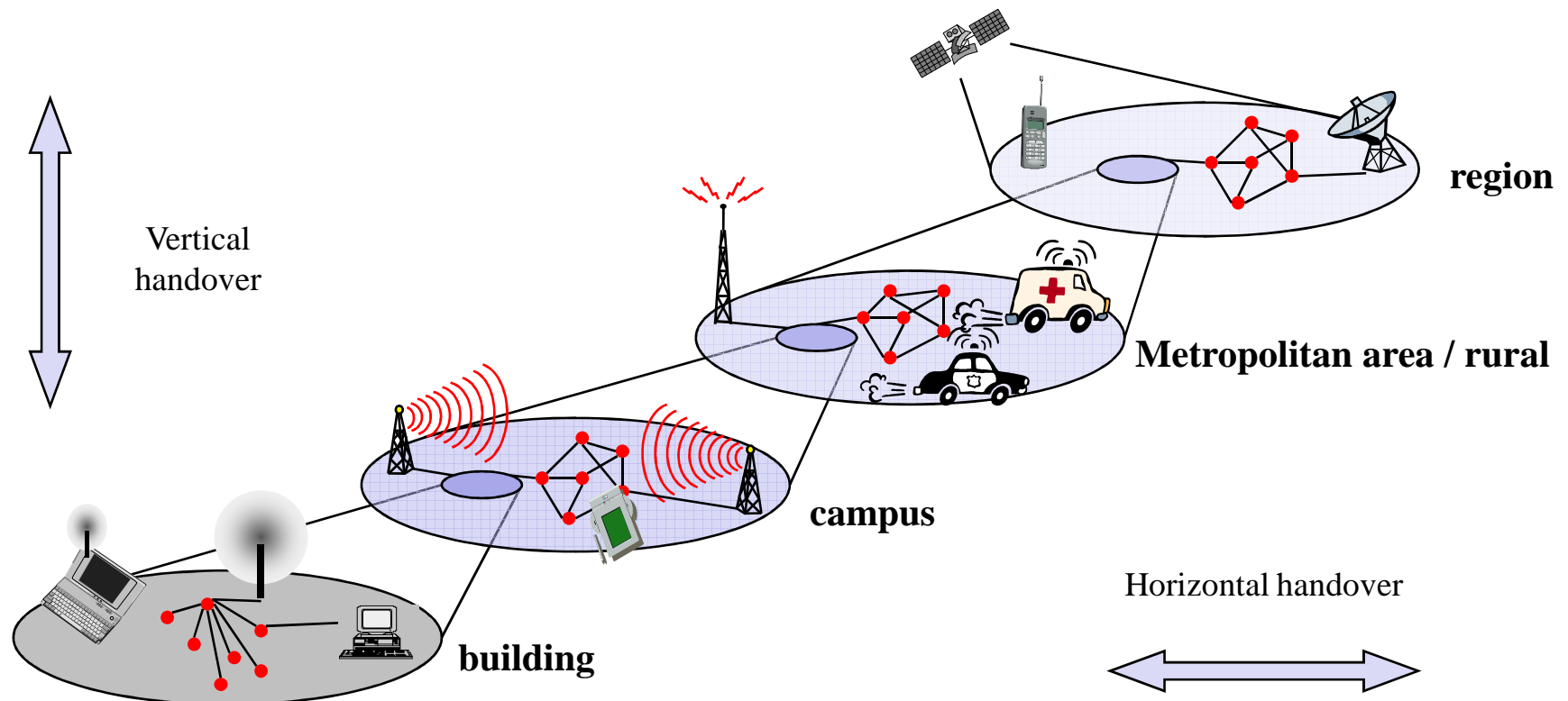


To Think About

- ♦ *What will the future wireless networks look like?*

Future of Mobile Networks

- ◆ 4th Generation of mobile communications.
 - » heterogeneous access networks aimed at transporting IP packets
 - » based on existing technologies: PLMN, WMAN, DVB-H, WLAN



Future

- ◆ But also
 - » ambient intelligence
 - » the network of things, which communicate wirelessly

Standard Organizations - IEEE

- ◆ IEEE - Institute of Electrical and Electronics Engineers
- ◆ 802 Standards for Local /Metropolitan Area Network, wired and wireless
 - » Wireless LANs (802.11)
 - » Wireless Personal Area Networks (802.15),
 - » Broadband Wireless Metropolitan Area Networks (802.16)
 - » Mobile Broadband Wireless Access (802.20)
 - » Media Independent Handoff Working Group (802.21)
 - » Wireless Regional Area Networks (802.22)

<http://standards.ieee.org/getieee802/index.html>



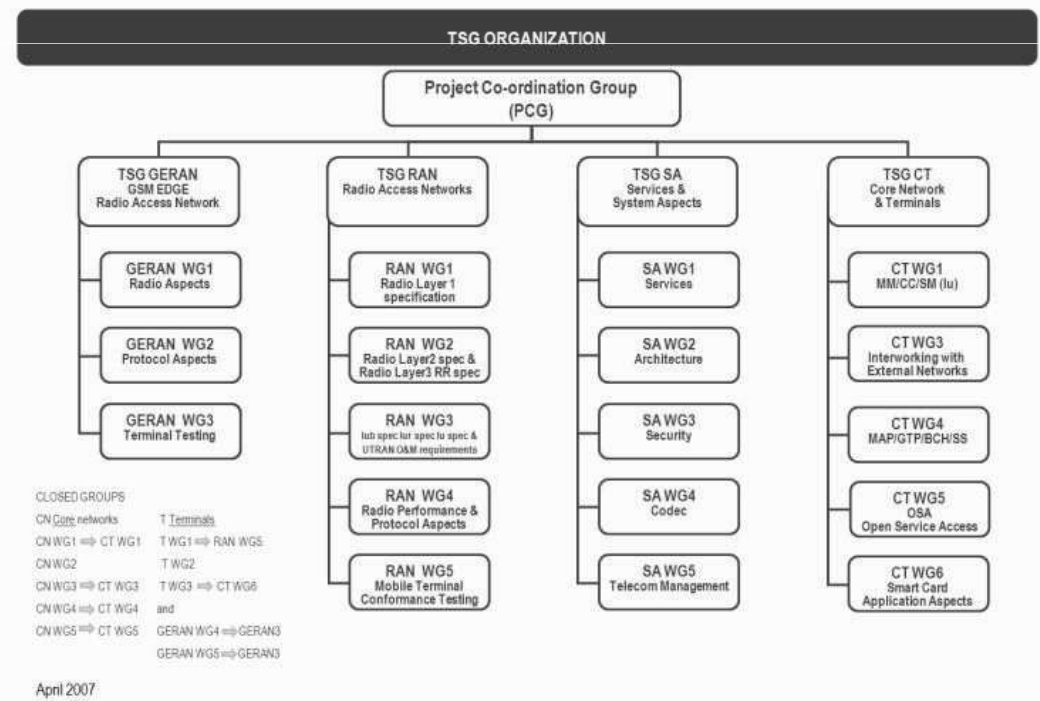
- ◆ Layers 1 and 2 of the OSI communications model
- ◆ Below the IP communications layer

Standards – 3GPP



- ◆ Scope of 3GPP
 - » Specifications for the 3rd Generation mobile system
 - » Maintain GSM, GPRS and EDGE
 - » Specifications developed by Technical Specification Groups

<http://www.3gpp.org>



Standards - IETF

<http://www.ietf.org>

- ♦ Defines standards for the Internet, including
 - » TCP/IP
 - » key services
 - » routing protocols
 - » deployment of IP over technologies



- ♦ Evolution of communications towards the ALL-IP
 - ➔ IETF work very important

Standards - Other

- ♦ ITU - Worldwide
- ♦ ETSI - Europe
- ♦ 3GPP2 – American 3GPP