2. Mobile and Ubiquitous User Interfaces

Literature:
- Scott Weiss: Handheld Usability, Wiley 2002
- Steve Love: Understanding Mobile Human-Computer Interaction, Elsevier 2005
- Ch. Lindholm/ T. Keinonen/ H. Kiljander: Mobile Usability, McGraw-Hill 2003

Definition: Mobile Computing

- ***Mobile Computing*** is a generic term describing the application of small, portable, and wireless computing and communication devices. This includes devices like laptops with wireless LAN technology, mobile phones, wearable computers and Personal Digital Assistants (PDAs) with Bluetooth or IRDA interfaces, and USB flash drives.
(Wikipedia, May 19, 2007)

- **Mobile computing** is a generic term describing one's ability to use technology while moving, as opposed to portable computers, which are only practical for use while deployed in a stationary configuration.
(Wikipedia, Nov. 17, 2009)

It has been suggested that this article or section be merged with *Portable computer*. (Discuss)

Definition: Mobile Computing

- ***Mobile***, or "untethered," ***computing*** means that the computing device is not continuously connected to the base or central network. Mobile devices include PDAs, laptop computers, and many of today's cell phones (aptly called "smart phones"). These products may communicate with a base location with or without a wireless connection. An example of a wireless mobile application is using a modem-equipped PDA to receive text messages via satellite technology. A non-wireless mobile example could involve sending data from a laptop to a central database or network server over a temporary dial-up connection. In the latter example, the laptop can still be used as a mobile device regardless of whether or not it ever connects to another computing device.
(Texas Department of Information Resources)

Mobile Computing as a Future Trend

Industry News

Mobile computing market to reach $88.9 billion by 2011

Posted : April 19, 2007

(United States) BCC Research, in its latest technical market report, 'The Future of Mobile Computing' estimates that the global market for mobile computing will reach more than $88.9 billion by 2011. One of the key growth drivers is laptop computers, which are expected to account for almost 96 percent of the total market share or $69.2 billion. Smart phones have the highest growth potential of 15.7 percent, based on a compounded annual growth rate (CAGR) amounting to almost $17.8 billion.

This uptrend in mobile computing market is greatly influenced by the increasing demand on office-related, communications-based, and global positioning applications installed in handheld devices and mobile phones.

The constant demand for more portable and multifunction devices to keep up with the fast-paced lifestyles of many, ensures the steady growth of the mobile computing industry.

(www.computerproducts.globalsources.com)

- The global market for mobile computing was almost $55.6 bln in 2005 and $63.5 bln in 2006. (http://blogs.zdnet.com/ITFacts/index.php?p=12576)
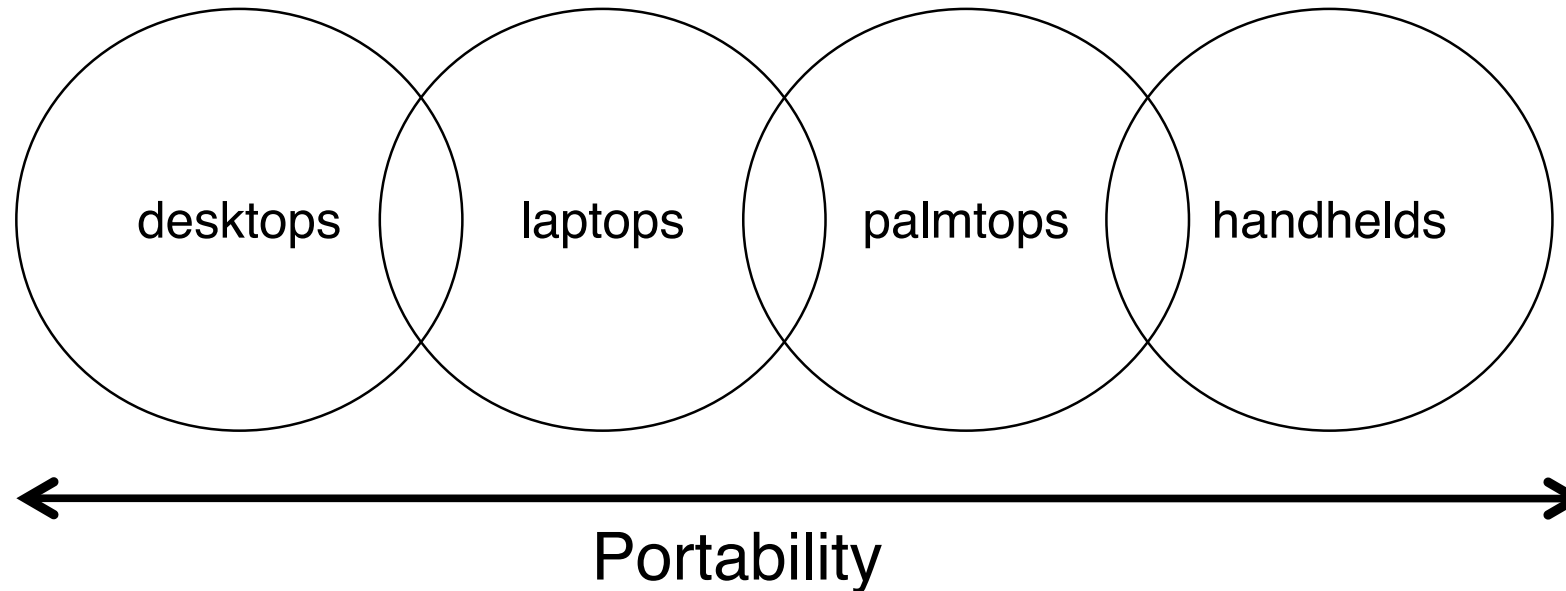
Dynabook Vision

Alan Kay, late 1960s
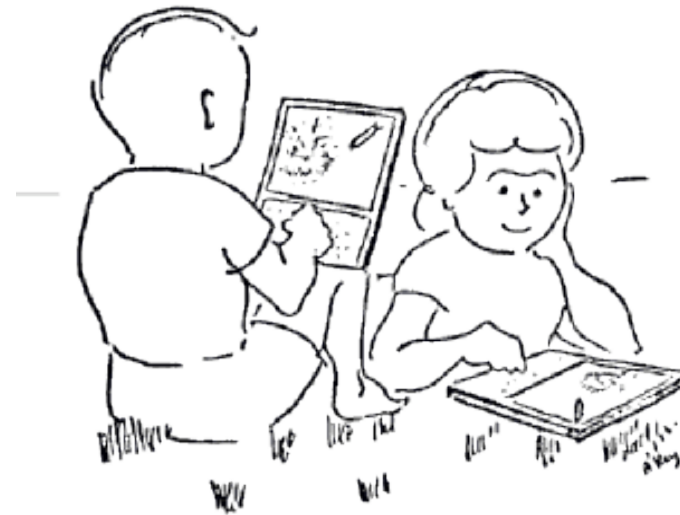
- Handheld
- Wireless connectivity
- Multimedia capabilities
- Support for programming

The Personal Computing Continuum

Parallel to handhelds, other forms of high portability/local adaptation evolve:
- Wearable computing systems (e.g. intelligent jackets)
- Embedded computing systems, e.g. in cars, homes

Scott Weiss p. 3

Apple Newton
Commercial Handheld Computer

- Recognition Architecture
    - Recognizes handwriting--printed, cursive, or a mixture of the two--with the assistance of a 93,000-word, built-in word list
    - Lets you add up to 1,000 words
    - Includes four pop-up keyboards: typewriter, numeric, phone, and time/date
    - Recognizes graphics and symmetrical objects
- 320 by 240 pixels Display
- Sold from 1993

http://applemuseum.bott.org/sections/computers/omp.html

Itsy
Pocket Computer
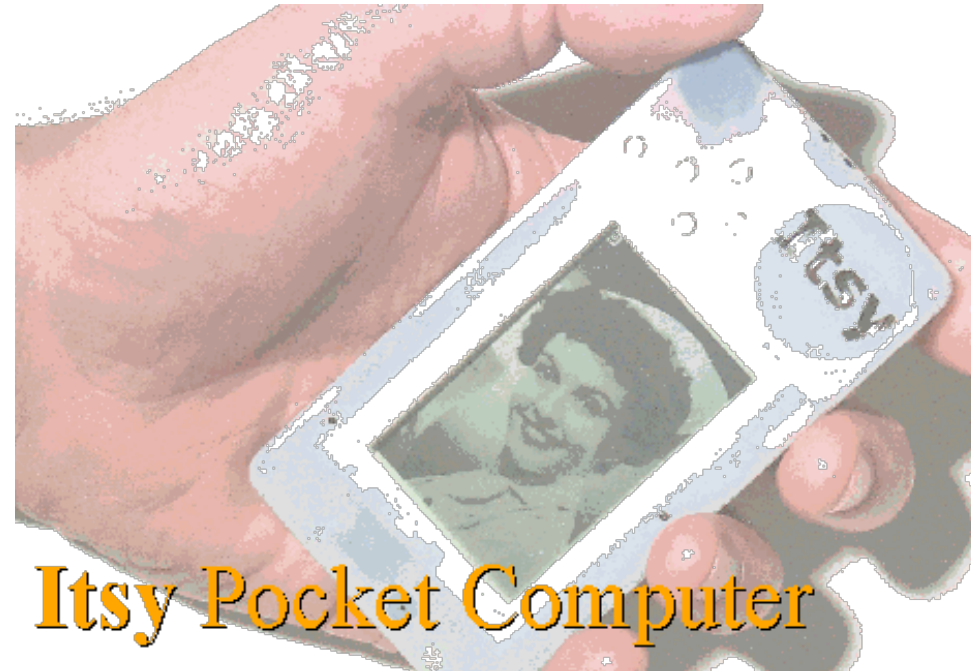
Itsy Pocket Computer

- Research platform (1998)
- Gesture and speech interaction
- *tilt-to-scroll* and *Rock 'n' Scroll* to include the use of gestures to issue commands.

http://www.hpl.hp.com/downloads/crl/itsy/index.html

Itsy Motherboard

- 206 MHz StrongARM
- 32 MB DRAM
- 32 MB Flash
- 2-axis accelerometer
- Microphone
- Jacks:
  - headset
  - docking: USB, power, serial
- Daughtercard connector

FRONT   BACK

60 mm

83 mm

Experiment	Clock Speed (MHz)	Processor Idle (%)	System Power (mW)	Battery Lifetime (h)
system idle, idle mode	206	95	107	22.8
system idle, idle mode	59	95	77	28.3
system idle, idle mode, low voltage	59	95	62	35.2
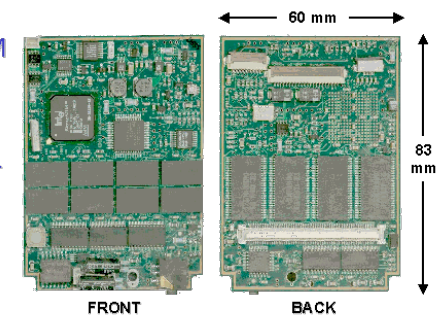
Relevant Communication Technologies
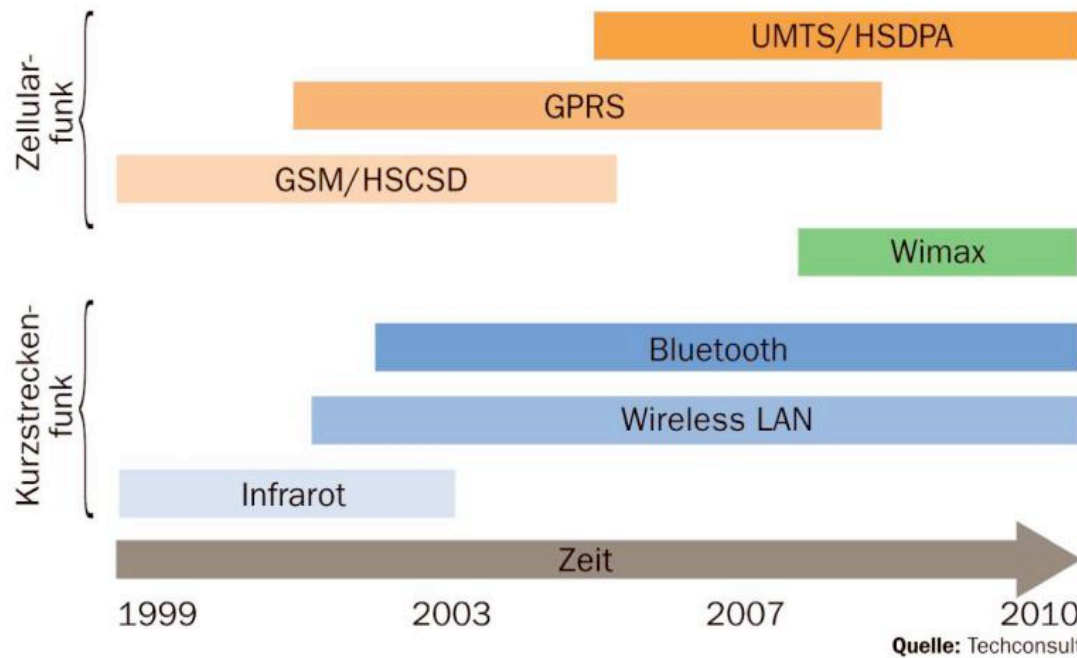
Frank Heuer, in
Computerwoche, Sep 06

http://www.3gamericas.org/
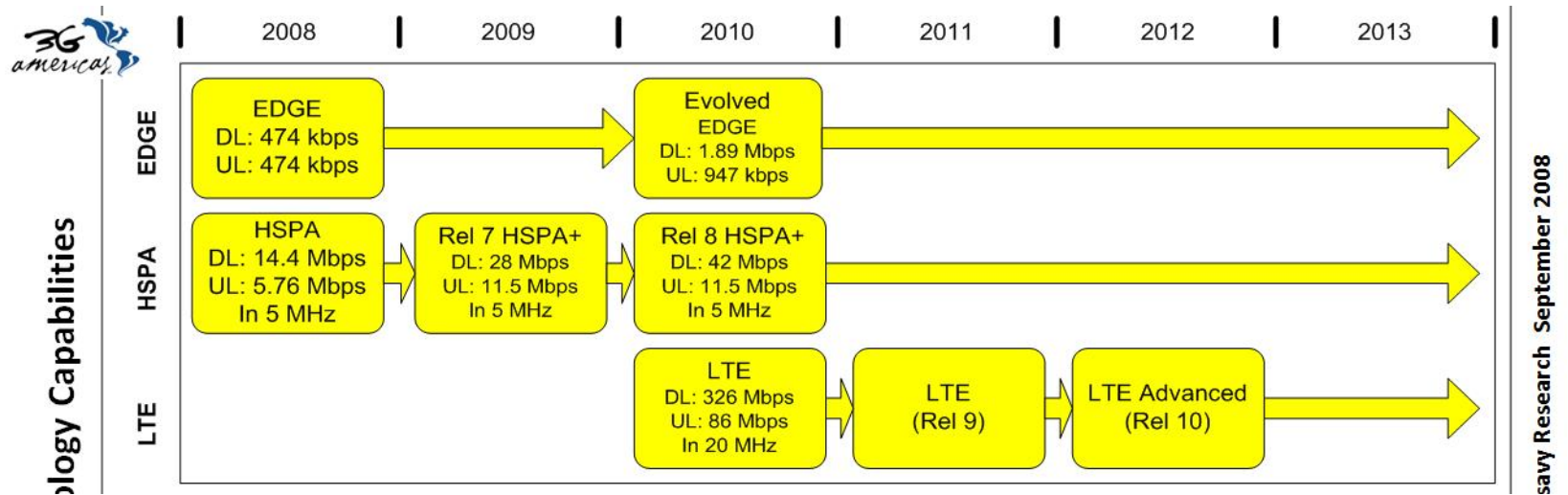
Key Differences Fixed – Mobile Systems

	Fixed	Mobile
Purpose	Lengthy information processing tasks, Web browsing, email	On-the-go lookup an entry of information, quick communication
Form	Requires table, best used when seated	Less than DIN A4, often fits into shirt pocket or even invisible
Power	Requires power connection	Relies on battery life - has to deal economically with power
Connec-tivity	Fast and reliable connectivity	Slow and unreliable connectivity, but improving...
Input	Input by keyboard and mouse	Challenged input, but also new options (gestures, speech)
Display	Large display	Small display
Memory	Large working memory (Gigabytes)	Small working memory (Megabytes, in good cases)
Storage	Extensive storage options including large hard disks	Sometimes none, often limited to removable media (e.g. 1 GB)

Example: Internet Use Differences

- Surf vs. hunt
  - Wireless users hunt for their information, do not easily get side-tracked
- Unlimited use vs. cost per unit
- Open landscape vs. walled garden
  - Location of "Open URL" in Web and handset browser
- Bookmarking
  - Who uses bookmarks on mobile devices?
- Privacy & security
  - Mobile devices are considered very private property
    - » E.g. local password storage is likely too be used
  - Mobile devices are easily lost, are attractive theft targets

Evolution of Mobile Devices

- Example: Nokia mobile phones (Lindholm et al., till 2007)

Model	1011	2110	6110	6210	6610	8800	N97
Year	1992	1994	1997	2000	2002	2007	2009
Display	2 x 8 chars	3 x 10 + 2 x 6 chars	84 x 48 px	96 x 60 px	128 x 128 px	208 x 208 px	640 x 360 px
# Keys	22	23	21	21	23	21 (?)	full querty (touch scr.)
# Display texts	406	378	1719	2777	3085	?	?
Volume (ccm)	340	170	130	95	71	67	88
Weight (g)	475	240	140	114	84	134	150