Wireless Mobile Devices

Mobile devices have evolved from the familiar desktop computers and while the hardware architecture (microprocessor, memory, input and output mechanism) is essentially similar, the difference lies in the *ease* of portability. To be considered truly mobile the device should be easily portable and its comfortable use possible in a standing position holding the device. In addition some kind of connectivity to larger systems for data exchange is also desirable. For example Wireless PANs (IrDA, Bluetooth), Wireless LANs (802.11), Wireless WANs (Cellular or Satellite Networks), a wired connection to such networks or synchronization with a desktop computer. Cellular phones, PDAs and various other devices are good examples. As ubiquitous computing becomes a reality these handheld devices are slowly becoming an essential part of our lives.

1. Evolution of Mobile Devices

Mobile devices for communications, computation, data storage, information exchange, and entertainment have existed for many years though as separate devices. Their integration into one easily portable device is a recent phenomenon. A brief overview of evolution of different devices based on their function is as follows:

Communication

Early wireless communication systems (including car phones by AT&T) though mobile were not really *portable*. Their form factor and weight did not enable true portable and mobile use. The first real handheld mobile phone is attributed as the Motorola DynaTAC and was first used in 1973[1]. Cellular technologies had existed for many years however this started the first real handheld mobile phone. The First Generation (1G) communication devices started in the 1980s and were analog based. Through the 1990s the Second Generation (2G) devices based on the GSM, TDMA and CDMA protocols became popular using digital networks and packet switching. We are now in what is popularly know as 2.5G generation where GPRS technologies are being augmented on existing 2G networks to allow data communication. Significant capital investment is required to move to Third Generation (3G) networks such as UMTS and CDMA2000. These would provide significant bandwidth for mobile devices and allow streaming multimedia applications on mobile devices. This evolution of networks has spurred the creation of devices that operate on them.

Computation

Electronic handheld calculators have come a long way from humble simple mathematical calculators to complex devices with specialized functions (graphing, programmable features, scientific functions, etc) for accountants, engineers, students and other users. The first handheld calculators came out in the 1970s[2] and were arge bulky. They were prohibitively expensive and provided the four basic mathematical functions, however they continued to improve and add functionality and the cost is now very low. Canon,

[1] http://en.wikipedia.org/wiki/History_of_mobile_phones
[2] http://www.vintagecalculators.com/html/hand-held_calculators.html

Casio, Sanyo, Sharp, Hewlett-Packard and Texas Instruments are major manufacturers and they continue to innovate.

Data Storage/Information Exchange
Personal Digital Assistants (PDAs) have been available since the early 1990s and provide features like address books, calendars, task lists, notepads, schedulers etc. They provide means to store data and can be synchronized with desktop computers via cables, infra-red ports, Bluetooth or other networks. Increasingly on newer and more powerful devices word processing and spreadsheet applications are also available. Also if internet connectivity is available data may be exchanged as email as well.

Entertainment/Multimedia
Entertainment devices like the Sony Walkman (using magnetic tapes) were very popular when they first appeared in 1979. Such devices became digital and have transitioned from to using optical media (e.g. Discman) and now magnetic discs (e.g. iPod) and flash memory (e.g. iPod Shuffle). Pocket transistor radios tuning into AM and FM frequencies have also been very popular. Compact players for Video including the legacy VHS tapes have also been around and now you can play VCDs and DVDs. Cameras present another big aspect of entertainment and mobile device usage. They used chemically processed films; however that is being slowly replaced by digital cameras. Handheld gaming consoles are also very important. Single game devices have been around since the 1970s however with Nintendo Game Boy[3] (1989) multi-game cartridge games really became popular. There are many popular consoles from Sega, Atari and Sony with thousands of game titles. This availability of mobile entertainment devices has a significant influence on the current trend of integration of devices.

Other
Other features like using the Global Positioning System (GPS) present some specialized applications that are now available to almost anyone.

Convergence of Devices
We now have truly portable and relatively inexpensive devices that can perform all functions listed here! For example, a photo viewer in an iPod, cameras in phones, MP3 players in phones, video gaming in phones (Nokia N-Gage) etc. However it does not guarantee best of all worlds. For instance a camera phone's picture quality is not comparable to a standalone camera though this example may change over time. Another more important question is if this convergence is really required? Probably the lower cost of converged devices compared to individual ones and marketing gimmicks will prevail.

2. Typical Features of Mobile Devices

In the context of current devices the following are some features of mobile devices

- Portability: No power cables, long battery life, untethered network connectivity
- Size: Small, easily carried in a pocket, bags not required

[3] http://www.nintendo.com/corp/history.jsp

- Weight: Light, easy portability
- Processor: Not as powerful when compared to desktop computers, optimized to conserve power
- Memory: Currently 512Mb is considered generous, expansion storage as SD, CF cards or other technologies available in the magnitude of gigabytes
- Display: Typically 240x320 or 320x320 pixels
- Input: Touch Screen (Stylus), small keypad, external keyboard or voice recognition (limited)

Mobile devices allow access to various data and information services 'on the go.' They also allow communication and collaboration, for example the use of email and limited functionality and use of applications like word processors and spreadsheets.

3. Mobile Microprocessors

Most microprocessors for mobile devices are based on the 32-bit ARM[4] architecture. For example Intel's implementation is supplied under the name XScale[5]. Power consumption is a major factor in the design of microprocessors for mobile devices. Battery life is of critical importance and achieving an acceptable tradeoff between performance and power consumption is desired.

4. Mobile Operating Systems

The choice of operating system to develop for impacts many of our application features, functionality and user base. Some popular OS are listed here.

Windows CE[6] – Available as Windows Mobile 2003 for Pockets PCs and Smart Phones and supported by Microsoft. It is a multi-tasking OS and gives the look and feel of a Windows Desktop, including common word processing and spreadsheet application (Word, Excel). This familiarity is helpful in promoting user satisfaction.

Palm OS[7] – The current version does not support multi-tasking which in my opinion is a big drawback for users compared with Windows. It is however popular for PIMs and Palm devices and a number of user applications are available.

Symbian OS[8] – This OS is especially popular on phones and promoted by Nokia, Panasonic, Samsung and Sony Ericsson. The OS is licensed by various vendors and each develops its own look and feel, very customizable and currently the leading OS on mobile devices.

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[4] http://en.wikipedia.org/wiki/ARM_architecture
[5] http://www.intel.com/design/intelxscale/index.htm
[6] http://www.microsoft.com/windowsmobile/default.mspx
[7] http://www.palmsource.com/palmos/
[8] http://www.symbian.com/technology/technology.html

Others – BlackBerry and open source operating systems based on micro Linux kernels are also available though not as popular.