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MOBILE DEVICES OVERVIEW

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Abstract- Now a day's mobile devices are multi-functional devices capable of hosting a broad range of applications for both business and consumer use. Personal Digital Assistants (PDA) and the ever-growing category of smart phones allow people to access the Internet for e-mail, instant messaging, text messaging and Web browsing, as well as work documents, contact lists and more. This paper presents an overview of mobile devices and also the operating systems used in the devices.

Key Words: Mobile Devices, PDA, Smart Phones, Web

1. INTRODUCTION TO MOBILE DEVICES

Now a day's mobile devices are multi-functional devices capable of hosting a broad range of applications for both business and consumer use. Personal Digital Assistants (PDA) and the ever-growing category of smart phones allow people to access the Internet for e-mail, instant messaging, text messaging and Web browsing, as well as work documents, contact lists and more. Mobile devices are often seen as an extension to your own PC. Work done on the road, or away from the office can be synchronized with your PC to reflect changes and new information.

Types of Mobile Computing Devices

The term mobile device covers a wide range of consumer electronics. Usually mobile device describes the devices that can connect to the Internet. However, some people classify digital cameras and standard MP3 players as mobile devices as well. The category of mobile devices include the following devices, as well as others:

- **Personal Digital Assistant:** Sometimes called pocket computers, PDAs combine elements of computing, telephone/fax, Internet and networking in a single device. A typical PDA can function as a cellular phone, fax sender, Web browser and personal organizer. Unlike portable computers, most PDAs began as pen-based, using a stylus rather than a keyboard for input. This means that they also incorporated handwriting recognition features. Some PDAs can also react to voice input by using voice recognition technologies. PDAs of today are available in either a stylus or keyboard version (called a datapad).
- **Smartphone:** Smartphones combine both mobile phone and handheld computers into a single device. Smartphones let you store information (e.g., e-mail) and install programs, along with using a mobile phone in one device. For example, a Smartphone could be a mobile

phone with some PDA functions integrated into the device or vice versa.

- **Tablet PC:** Tablet PCs are a type of notebook computer that has an screen display on which you can write using a stylus. The handwriting is digitized and can be converted to standard text through handwriting recognition, or it can remain as handwritten text. The stylus also can be used to type on a pen-based key layout where the lettered keys are arranged differently than a standard QWERTY keyboard. Tablet PCs also typically have a keyboard and/or a mouse for input.

2. MOBILE OPERATING SYSTEMS (MOBILE OS)

Like a computer operating system, a mobile operating system is the software platform that determines the functions and features available on your device, such as thumbwheel, keyboards, wireless security, synchronization with applications, e-mail, text messaging and more. The mobile operating system will also determine which third-party applications you can install on your device. Some of the more common and well-known Mobile operating systems include the following: Symbian OS Symbian OS has become a standard operating system for smartphones, and is licensed by more than 85 percent of the world's handset manufacturers. The Symbian OS is designed for the specific requirements of 2.5G and 3G mobile phones.

Windows Mobile

The Windows Mobile platform is available on a variety of devices from a variety of wireless operators. You will find Windows Mobile software on Dell, HP, Motorola, Palm and i-mate products. Windows Mobile powered devices are available on GSM or CDMA networks.

Palm OS

Since the introduction of the first Palm Pilot in 1996, the Palm OS platform has provided mobile devices

with essential business tools, as well as capability to access the Internet or a central corporate database via a wireless connection.

3. MOBILE DEVICES AND INTERCONNECTIVITY

Mobile devices such as PDAs, mobile/smart phones, and mobile computers are becoming increasingly ubiquitous and transforming everyday lives both at home and in the office. They profoundly diminish the distinctions between communication and media creation, in-person interaction and telecommunication, and real and virtual environments. Additionally, because of recent advances in wireless networking technologies such as Wi-Fi, mobile data services and Bluetooth, these new mobile devices have potential uses that greatly surpass previous intentions.

3.1 MOBILE DEVICE CATEGORIES

Mobile Phones

A mobile phone is essentially a micro-computer, which is battery-powered, and contains one or more wireless transmitters and receivers optimized for voice input and output. Even the simplest model has a keypad, an LCD display, and a general purpose computing platform, typically Java Mobile Edition or .NET Compact Framework. More advanced models come with an integrated camera, a few gigabytes of local storage, and multiple wireless interfaces including Bluetooth and even Wi-Fi [1]. In addition to mobile communication, mobile phones support an array of functions ranging from that of a simple digital organizer to that of a low-end personal computer.

Since they are designed for mobility, they are lightweight and compact enough to carry in a pocket. Despite the numerous different models found on the market, most mobile phones have a group of comparable features and capabilities. They have a microprocessor, read only memory (ROM), random access memory (RAM), a communication module, a digital signal processor, a microphone, a speaker, a keypad, and a display. A mobile phone also has an operating system (OS) which resides on ROM along with some system and registry files. RAM, which is generally used to store a user's information, is kept alive by battery power. When the battery fails, the information in the RAM can be lost [2].

Modern mobile phones are generally equipped with system level microprocessors, which cut down on the number of supporting chips, and they help to decrease the overall power requirements of devices. Built-in support of memory expansion cards, and interfaces for additional specialized peripherals are among the features of latest mobile phones. Wireless communication interfaces may also be found on

mobile phones including Bluetooth, Wi-Fi or infrared. The line that separates mobile device categories has been blurring recently. Some mobile phones include other devices such as GPSs (Global Positioning System) and media players.

Independent of the type of a mobile phone, virtually all mobile phones offer text and voice messaging services, and fundamental PIM applications including an address book and a calendar. Most of the mobile phones also provide means to synchronize personal information with other mobile devices and personal computers. More improved models support multimedia messaging, enable direct browsing of the Internet with built in web browsers, let users exchange emails, and instant messaging.

PDA

PDAs (Personal Digital Assistant) are highly portable and personal computing appliances, which can be carried around and used anytime and anywhere. PDAs can be used for a variety of functions: calculation, a clock and calendar, accessing the Internet, sending and receiving emails, video recording and storing data, typewriting and word processing. They can be used as an address book, used to make and write on spreadsheets, used as a radio or stereo, as well as for playing computer games, recording survey responses, and GPS (Global Positioning System) receivers. Newer PDAs also have both color screens and audio capabilities, enabling them to be used as web browsers, or portable media players.

Many PDAs can access the Internet, intranets or extranets via Wi-Fi, or WWANs (Wireless Wide-Area Networks). One of the most significant PDA characteristics is the presence of a touch screen [3]. Modern PDAs are very small in size, fit comfortably in a pocket and generally have good battery life, which can be recharged at night or when at the office. A PDA usually includes a small screen, which is often bigger than a digital phone but smaller than the smallest notebook computer, and a small QWERTY keyboard that is made for thumb typing and a stylus which is a metal or plastic pen to input data or communicate with the device by a touch pad screen.

A PDA might also include handwriting recognition software, voice recognition, and a digital voice recorder. While components and specifications differ among models, recent PDAs have more in common. They come equipped with lots of RAM, storage in either miniature hard drives or flash memory cards or sticks. Newer models have USB interfaces which support a variety of peripherals to use with PDAs. Some models come with a suite of software programs preinstalled, while others offer optional programs if desired. A PDA might also incorporate mobile phone functionality and wireless local area network (LAN)

capability. It can connect to the Internet in order to check email, send messages, or even monitor the stock market. With flash card capability, a PDA can store, access, and transfer virtually any kind of data, including maps, spreadsheets, presentations, and dockets. Some experts insist that the rising popularity of smartphones means an end for PDAs, relying on the argument that consumers want one device that does it all. While there are many PDAs in current use, the trend shows that PDAs are merging with cell phones. In the near future, this might eliminate PDAs as a distinct class of devices [4].

Smart Phones

Technological improvements in the mobile phone market have created a new type of mobile device called smartphone. The most significant features of a smart phone include Internet access, e-mail access, scheduling software, built-in camera, contact management, and the power to run a wide variety of general and special-purpose applications as well as occasionally the ability to read business documents in a variety of formats such as reports, slides and spreadsheet files. Some smartphones add extra features such as touch screen displays and tethered modem capabilities on top of the default phone characteristics. A rich email support is an indispensable and a characteristic key feature found in a smartphone. Mobile phones whether basic or advanced typically use a vendor proprietary operating system. Smartphones generally run on one of the following operating systems: Palm OS, Windows Mobile (phone edition), RIM OS, Symbian OS, or Linux. These operating systems support multi-tasking and they are designed to match the capabilities of smartphones. They often provide Java Virtual Machine support or native application support using a SDK (software development kit) for a programming language [2]. As innovations allow mobile handheld devices to add more functions to their feature sets, the difference between these two gadgets becomes less clear. The differences between mobile phones, smart phones and PDAs are somewhat blurred. This has complicated efforts for reaching commonly accepted definitions.

PC/Notebook

Given that wireless connectivity is available everywhere, laptop computers are being used as truly mobile devices. In order to describe a laptop/notebook as a mobile device, it must have some standard features. A mobile computer must be light enough to carry all around, it must do all of the things which can be done with a desktop computer, and it should be able to use the same software as its counterpart, the desktop computer [5].

Notebook computers, or simply notebooks, normally run on a single battery or from an external power supply which also charges the battery while

supplying power. Notebooks contain similar components that are found in desktop computers. They characteristically have LCD screens and built-in keyboards, and many of them are equipped with a touchpad which is an input device that enables one to move the cursor through finger motions. In addition, an external mouse can be attached. The components of a notebook computer generally are reduced in size and optimized for mobile use and efficient power consumption. Integrated modems and network adapters, standard serial and parallel ports on a notebook computer make it easier to work on mobile when away from office or home.

Wi-Fi network adapters make notebooks as easy to use with peripherals as a desktop computer and help sustain mobility. Since there are no universal standards for notebook computer design and parts, it becomes very difficult and costly to upgrade their basic components. Furthermore, to save space and cost, manufacturers generally produce notebooks with many of the standard elements already integrated on the motherboard. Some exceptions to this include RAM modules, hard drives and batteries. These issues hinder the upgradeability of notebook computers, thus creating higher costs in the long run.

Despite the limitations as compared to the desktop computers, notebooks remain the preferred choice of mobile users who require data intensive applications. PDAs and smart phones provide convenient access to corporate information such as email and personal information, but these devices can not compete with notebooks because of their tiny screens, convoluted user interfaces and restricted keypads that prevent heavy traffic from power users. In spite of the recent improvements on other mobile devices, notebooks will still be the most important mobile device for remote users. Notebooks have advanced in their power and battery utilization as well as their size and weight. Finally, by embedding mobile broadband, manufacturers make notebook computers truly mobile which are no longer bounded by fixed-line connections such as Ethernet or even by Wi-Fi hotspots, which still tether users to a location.

Handheld Computers

Handheld computers constitute another subcategory of mobile devices. A handheld computer often fits in a pocket and it comes with a tiny keyboard for user input, a relatively large display for user output. These mobile devices are usually manufactured in a clamshell-like package with a rich set of connectors [6]. The main difference between PDAs and handheld computers is that the handhelds are usually equipped with a miniature keyboard, unlike PDAs' dual purpose (keyboard and display) touch-screen interfaces. Handhelds are used to achieve a variety of tasks for increasing efficiency that include digital recording, storing notes and documents, sending and

receiving invoices, information management, and scanning barcodes.

4. CONNECTION SCHEMES

Personal Area Networking Bluetooth

Bluetooth provides a way to connect and exchange information between devices such as mobile phones, PDAs, PC/Notebooks, printers, digital cameras, and video game consoles over an unlicensed short-range radio frequency. The key features of Bluetooth wireless technology are robustness, low power usage, and low cost. Bluetooth offers services that enable the connection of devices and the exchange of a variety of data between these devices with the help of Bluetooth technology, many cables that connect one device to another can be replaced with one universal short-range radio link.

For example, a mobile phone equipped with Bluetooth radio technology and a notebook would replace the burdensome cables used before to connect a mobile phone to a notebook computer. PDAs, desktop computers, keyboards, headsets, and almost any other digital device can be a part of Bluetooth network system [7]. Bluetooth enables a mechanism to construct small private ad hoc groupings of mobile devices away from fixed network infrastructures. It is very resilient to noise which makes it easy to operate in a noisy radio frequency environment such as a home or an office. The Bluetooth radio system runs on a frequency-hopping scheme and uses a fast acknowledgement design to make the connection quality robust.

Bluetooth can reach a maximum data capacity of 1 Mbps, which is equivalent of only 780 Kbps when the protocol overhead is taken into account. Most of the new mobile phones are manufactured to provide Bluetooth connection; some other mobile devices such as PDAs and notebooks can have either integrated Bluetooth radio modules or optional add-on devices which support the Bluetooth radio system. Bluetooth can be used on mobile phones in several ways. It provides cable-free remote networking with another mobile phone, PDA or a notebook computer. It enables mobile phone personal information synchronization with trusted mobile devices. And, it provides wireless hands-free operation using a Bluetooth headset. Of course there might be other usage models which are not discussed here.

Infrared

Infrared data connection is generally called with the name IrDA (Infrared Data Association). IrDA actually defines a standard for an interoperable universal two way cordless infrared light transmission data port for uses such as personal area networks (PANs). IrDA is utilized for high speed short range, line of sight, point-to-point cordless data transfer -

suitable for mobile phones, digital cameras, handheld data collection devices, etc. [8].

The data standard of IrDA had found a place in millions of notebook computers, mobile phones, PDAs, and other devices until Bluetooth connection interface has become very popular. The market coverage of infrared interface soared swiftly because infrared transmissions are inherently localized and governments do not regulate the infrared portion of the light spectrum. It helps, too, that the components of an infrared transceiver have been perfected and their costs reduced through their successful use in so many remote control applications.

The first IrDA standard paved the way for asynchronous data communications at rates up to 115.2Kbps and synchronous communications at 1.152Mbps and a synchronous 4Mbps option was added to the standard later. IrDA transceivers communicate via infrared pulses in a cone that extends a minimum of 15 degrees half angle off center. The position and location of devices have critical importance during infrared connection. The IrDA physical specifications require that a minimum irradiance be maintained so that a signal is visible up to three feet away.

Likewise, the specifications necessitate that a maximum distance not be exceeded so that a receiver is not overwhelmed with brightness when a device comes close. It is obvious that in order to use infrared connection there must be a line-of-sight visibility between device infrared ports. It has been argued that Bluetooth has been created as a substitute for infrared. However this is not quite true:

Bluetooth has been invented as an enhancement to Infrared, especially in terms of low cost, small volume, low power, and the presence of infrared's limitations, such as its unidirectional connections, its short connectivity range of only a few feet and its limitation to point-to-point connections. Although Bluetooth has actually coped with these constraints with a connectivity range of up to 30 feet, or its capability for point-to-multipoint connections the two technologies are quite complementary. While

Bluetooth is very applicative for mobile networking, infrared is more appropriate for the direct connections, e.g. for exchanging small files [9]. Recent notebook computers and mobile phones do not have an infrared port mostly because of in favor of Bluetooth. Many experts claim that infrared connection technology on mobile devices has come to an end. In his article [9], Brooks wrote "Many are calling IRDA the most popular failure in mobile technology—nearly every mobile computer or device carries an IR port, and yet those ports are severely underused."

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