ESSENTIALS OF TABLET COMPUTING FOR MANAGERS AND EDUCATORS

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ABSTRACT

In the area of technology, one of the most popular subjects is tablet computing. Tablet computers are now used in business, government, education, and the personal lives of practically everyone – at least, it seems that way. The success of tablets is enormous and has severely cut into the sales of personal computers. The reason is simple: the tasks performed with tablets are precisely the tasks that people would like to perform with personal computers, but they find it cumbersome to lug around a computer to do them. Tablets are mobile, because they are small and light weight. Tablets are adaptable, because the owner can download applications (called apps) that are useful to them and ignore the rest. Tablets are likeable, because they have a bright screen, a touch interface, and are inexpensive. There are news apps, weather apps, music apps, video apps, photo apps, document apps, email apps, presentation apps, calculation apps, electronic book apps, map apps, teaching apps, learning apps, game apps, Internet apps, and the list goes on-and-on. So a user can select exactly what to do with a tablet, when they want to do it. This paper covers a brief history of tablet computers, the tablet hardware, tablet operating systems, app development, and a comparison of the various categories of tablet computers. A collection of tablet computers will be demonstrated. The presentation will be particularly useful for people who do not have the time to look into the subject but would like to tap into the power of tablet computing.

INTRODUCTION

We are inundated with information in modern society, and most of us have become used to having it at our fingertips. Actually, we depend on it to support everyday activities, ranging from business and educational reports, news, entertainment, opinions, social activities, how-to-do-it information, and access to professional and personal record keeping. In fact, we are so dependent upon instant communications and up-to-date information, that we expect information to be available at a moment's notice. Two technologies underlie our information-rich society: computers and the Internet. There is one additional characteristic. We are mobile, and what this means is that we expect to take our computing power with us. Except, perhaps, in organizational settings, most computer systems in general use are transportable, for instance notebook computers and laptops. However, there is another important consideration. What do people actually do with their transportable computers? And the answer is that they do things, for the most part, that can be done when they are away from their office setting – for example email and messaging, note taking, schedule and address book functions, video watching, music listening, photo viewing, reading books, and Internet access. Also, they take advantage of organizational networks to retrieve information from databases and to do e-commerce. What people don't do are traditional office functions that require that a person sit in one place for a long period of time, such as entering a document. So it follows that modern society was ripe for a light and easily transportable device, designed to do the mobile operations mentioned. In April 2010, Apple Computer delivered the first iPad tablet, and the world of information and Internet access has been forever changed. Briefly stated, the sales of tablet computers are up, the sales of personal computers are down, and more people are doing what they want to do when they want to do it. Tablet computers aren't exactly new to the world of technology, but the power and scope of the modern tablet is a game-changing phenomenon.

A BRIEF LOOK AT A GENERIC TABLET COMPUTER

A generic tablet computer is a flat-panel computing device with a touch-screen on the upper layer and the electronics below. It is a one-piece device, which means you can do most applications with just the tablet. The screen is touch sensitive in the sense that if you want to run an application, you just touch an icon that represents the application (hereafter called just an *app*) and the tablet operating system calls that program into action. Where does that app come from? Either it is pre-loaded into the tablet or the user can download it from an app store. Take the weather app as an example. Ordinarily, you would download a small program, typically less than 200 megabytes, into the static storage unit of the underlying computer. Normally, it stays there. When its icon is tapped, the app is read into the tablet computer's memory, and it then reads the local weather, using the GPS device to identify the location from the app's web site, and then displays it on the screen. When an app needs temporary memory to operate, it requests a nominal amount from the operating system. When an app needs to store information for a long time, relatively speaking, static storage space is requested and obtained from the operating system, Most apps are less than 500 megabytes in size, so a lot of apps can fit into the storage unit of a small tablet, which can hold at least 16 gigabytes. The upper limit on storage space is nominally 64 gigabytes. Some of the apps that are preloaded are a browser, mail, photos, notes, and music. A large number of essential apps are free, such as news, electronic books, dictionary, maps, calculator, and so forth. Video and music app programs are typically free, but it is necessary to pay for the downloaded content. Office functions, such as document processing, presentation graphics, and spreadsheet apps are typically not-for-free and occupy slightly more storage. Built-in functions such as contacts, calendars, messages, and social features are commonly included with a tablet, but not for certain.

In most pure tablets, the underlying computer processor is selected to conserve electricity, because there is a lot of "looking time" by users with tablets, and the computing power of the processor is not a high priority. Many apps use a location feature, so GPS hardware is normally included, as well as an accelerometer so the tablet can sense its orientation.

A tablet nominally contains an on/off switch, a sound-volume switch, a rotation lock switch, a microphone connection, front and rear-facing cameras, an optional keyboard connection, and a connection for external devices. Since a tablet is commonly used as an "Internet connection" device, a Wi-Fi connection is always available, and some systems have cellular facilities. Since Wi-Fi connections are practically everywhere, the cellular hardware appears to be of lesser value to the user than originally expected. A Bluetooth connection for an external keyboard and a headset is common, but not necessary.

A typical screen will hold about twelve icons, and it is easy to run up considerably more than two or three screens worth. One would use a swipe of their fingers to move from one screen to another and use an up-or-down swipe to scroll through a document.

Some tablet apps involve the entry of information into a page. When a user taps the input bar, a virtual keyboard appears to facilitate the data entry. Physical keyboards are frequently available as optional additions for use when entering or editing documents. In this instance, either the tablet fits into a keyboard unit or the keyboard snaps onto the tablet.

There is an old saying that 80% of the people use about 20% of the features available with a computer. Tablet computers are commercial products, and features sell products. The competition is strong and there are many innovative software possibilities found in the product marketplace.

Another important characteristic of a tablet is its size. The prototypical tablet is notebook size with a screen measuring roughly 7.5 by 9.5 inches with a diagonal screen measurement of 9.5 inches. The

diagonal measurement seems low, but the screen normally has a border that accounts for the diagonal measurement. A couple of other screen measurements are 4.5 by 7.5 with a screen of 7.0 and 10.75 by 6.75 with a screen of 10.5.

The screen of a 7.5 by 9.5 unit is usually addressed in the portrait mode, as are the 7-inch screens. It is normally the case to be able to rotate the screen by 180 degrees with the contents being adjusted accordingly. Screen rotation is convenient for games and data entry through a physical keyboard. The portrait mode is convenient for reading – commonly taken to be documents and web pages – but convenience is in the mind of the beholder. Holding a 9.5 inch unit that weighs roughly 1½ pounds gets tedious after awhile, so a stand is frequently available, except when reading in a resting position. A 7-inch unit is convenient in that regard, if it is possible to adjust the type size as with eBook readers. A compromise size between 7 and 9½ screens is particularly useful as a size for convenience and flexibility.

A landscape mode tablet, such as the 10.75 by 6.75 unit mentioned above, is a useful compromise, since it is convenient to hold, and a left-right swiping modality is surprisingly efficient. By definition, a tablet incorporates a virtual keyboard, and a physical keyboard, if available, as an added feature. Most tablets are used for Internet access, music and videos, and a variety of personal operations, such as address-book, calendar, photo management, and variety of other tasks, so that a physical keyboard is not needed.

FEATURES

The key function of a modern tablet is to execute apps and to handle housekeeping tasks for the user, and as such, it is in a distinct category from desk and laptop computers that provide an open-ended capability. Two sets of elements are of particular interest: hardware and software. From the hardware, you would expect a high definition screen with sufficient fidelity and anti-glare features to enable the tablet to be used in a variety of operational environments. Wi-Fi capability is required for Internet access, since most tablets are used for Internet access. Mobile broadband is a convenient feature, but it normally has a price attached to it. GPS navigation allows the tablet to sense its location to assist the apps that need it. The accelerometer, mentioned above, provides orientation for screen rotation and other tasks. The processor, covered later, should supply fast start-up and shutdown times and support a long battery life. The weight should be manageable for the intended tasks. Photographic features should support photos and video in various forms. External connections, such as USB, video, and Bluetooth are currently expected with a well-defined tablet. The unit should have a substantial case, usually aluminum or magnesium, since a high level of hand juggling is often experienced. A good tablet should be able to withstand a minimal amount of rough treatment – such as a short drop. Some “tough tablets” have surfaced for extreme conditions, but their widespread use is minimal.

The tablet operating system should be designed for a tablet and not another device with similar characteristics. The touch-response system should be accurate and have sufficient fidelity so the user will not have to touch more than once to initiate the execution of an app or return to a previous operation. The processor’s memory allocation capability should permit several apps to reside in memory so that unnecessary reloads are not needed, when switching between apps. There is no overwhelming need to have two or more apps run at once, but allowing multiple apps to reside in memory is a modern necessity. Software facilities should be available for downloading, experiencing, and storing the following types of information: e-books, PDF documents, songs, videos, and other publications. You should not have to download a special app, for example, in order to read a document in a common file format. Typical built-in software features should include: a web browser, email, social media, messaging, speaker and headset functions, photo management, and contact and scheduling functions.

SETTINGS

One set of features is often overlooked, until it is needed. That is the general subject of "settings." Here are some examples of questions that a user should ask from time to time. Do you know what apps are loaded on your table, and how much static storage apace do they occupy? How do you turn on Bluetooth? How do you turn on or off the sharing of usage data with a news agency? What is the name of your Wi-Fi network connection? How do you turn off the capability of storing cookies on your tablet? How do you delete your browsing history? How many photos or videos or apps or songs are stored on your tablet? What is the ID that you used when you registered your tablet with the manufacturer? How do you change the brightness or the wallpaper on the screen? How do you disable screen rotation? How do you change your email setup specifications? How do you turn on or off the location services? How is the processor time being used? Usually, there is a settings icon on the screen to invoke the information feature of the operating system. The reason this is important is that the tablet operating system uses the settings to govern the operation of the tablet.

PROCESSOR

The processor in most tablets is known as the ARM that stands for Advanced RISC Machine, a low-cost 32-bit processor that uses fewer transistors, is smaller in size, generates less heat, and uses less power than traditional processors found in most personal computers. An ARM processor is widely used in mobile battery-powered devices, such as smart phones and tablet computers. When the computer is waiting for input in conventional devices, the processor cycles in a wait mode until it is interrupted by an input event. The wait cycle uses electrical power and is the main reason that laptops and notebook computers have a short life between re-charges. With an ARM processor, the processor "effectively" turns off, conserving battery power. The special processor coupled with a static storage device, in lieu of disc storage, enables a tablet to have a relatively fast start-up and shutdown time.

Some hybrid tablets designed to span the gap between a tablet and a personal computer use a conventional processor. The future of hybrid tablets is uncertain at this time. This subject is covered in the operating system section.

SCREEN INTERFACE

Touch is the basic operational mode that underlies modern tablet computing. A simple touch invokes an app that does something for the user. Navigation between screens and within documents is achieved through left-right and up-down swiping. The notion of "multi touch" is realized by swiping two or more fingers together to perform more complicated gestures that result in functions, such as exiting the current app and returning the user to the home screen. The screen itself is of interest. A touchscreen is essentially the main feature that gives a tablet computer its personality, since it contributes to its lightweight and operational convenience. To get something done, all a user need do is touch its icon and the app is read into memory and executed. The app may access the outside world to do what it does, but the touch interface gives a tablet its charm.

There are two kinds of technology used to implement a touch screen: the kind where you have to press the screen to get action and the kind where you just have to touch the screen. The pressure sensitive screen is known as a *resistive touchscreen* that responds to any sort of pressure, such as a finger, fingernail, or stylus. This type of screen, used with older PDA devices, normally requires a stylus, but possesses a high degree of accuracy. A *capacitive touchscreen*, used with modern tablets is less accurate and requires the conduction of electricity, such as with a fingertip. Modern tablets primarily employ capacitive screens

and are in widespread use. Touching, swiping, and pinching are the major operations, so that the use of a capacitive technology is a prudent design decision.

Some tablet computers permit handwriting and voice for supplying textual input and also audio output in some instances. The direct storage of handwriting, as well as other graphics, and audio input would appear to be the most useful form of non-keyboard input.

APPLICATIONS

There are so many apps available for modern tablet computers that it is impossible to note all of them or categorize them in a useful fashion. Because screen space for app icons is limited, it is possible in most tablets to group the app icons into categories and assign the various categories a name, so that the user can tap on a category and get a sub-display of included icons. Here are some useful taxonomies for grouping apps:

- Productivity (Presentation graphics, Spreadsheet calculations, Word processing, Notes, Calculator, Tablet users manual, Books and documents)
- Communication (Messages, Calendar, Contacts, People, Reminders, Downloads)
- News and Weather (News apps, Weather apps, Periodicals, Newspapers)
- Entertainment (Videos, YouTube, Game center, Movies, Music, Sports, Travel)
- Social (Photos, Maps, Earth views, Visual media, Message media, Camera and photo studio)
- Operational (Browser, Mail, Settings, App store, Book store)
- Reference (Medical, Dictionary, Encyclopedia, Finance)
- Collections of Web references

There are, of course, other categories, since thousands of apps exist on the Internet.

TABLET OPERATING SYSTEMS

Without the slightest doubt, the most important component of a tablet is the event driven operating system that controls the total system operation. The touch form of operation in modern tablets evolved from the smartphone that has similar characteristics. The application domain is expanded somewhat with tablets, because of extended functionality and end user expectations. The key point, however, is that a tablet is not a conventional computer, such as a desktop or a laptop. For example, extensive document processing and storage is not expected with a tablet; on the other hand, the ability to support expanded music and video offerings is a practical necessity.

Here's a snapshot of what a tablet operating system can do. When you touch or otherwise invoke an icon representing an app, the tablet operating system brings that app from storage into the computer's memory and executes it. The operations that can be performed are severely restricted, although they commonly interact with devices that contact resources external to the tablet. The exact nature of the devices that can be referenced by an app is clearly defined beforehand. For the most part, each app is unique, self-contained, and unable to interact with other apps. At the end user level, there is no file system structure that enables files, associated with an app, to be cataloged and shared with other apps. A device driver, such as for a special printer, cannot be installed, as with a conventional computer, unless it is part of an app. In a sense, the tablet environment is determined by the apps that the owner installs. Some people refer to a tablet as an "Internet appliance," and in a real sense that is absolutely correct.

HYBRID TABLETS

One of the salient properties of a modern tablet is the distinct lack of a file system, useful for managing information. Heretofore, apps are designed to manage their own files. This doesn't mean that information can't be stored – only that files from diverse apps cannot, for the most part, be combined into a common folder. With a hybrid tablet, the underlying operating system does make a file system visible, but primarily for office documents managed on the tablet. In general, the tablet operating system manages internal and external storage dynamically, which is suitable for the application domain of a tablet computer.

A BRIEF TABLET HISTORY

While the modern tablet is relatively new – circa 2010 – the general concept of a tablet computer has been around for some time. In 2001, a tablet PC operating system was developed that permitted certain touch features but reversing the screen in a laptop computer and interacting with a specially designed stylus. Personal digital assistants, known as PDAs, are also available for routine record keeping and communications.

The tablet with the most interesting history is the Apple Newton produced by Apple Computer from 1993-1997, and named the MessagePad. The Newton, as it is commonly known, was an amazing predictor of today's tablets in that it was a mobile handheld slate device without a physical keyboard; the user was expected to enter commands and information with a stylus. The computing power was an ARM 610 RISC processor that was mated with a special operating system called the Newton OS. The ARM processor, still used today, was selected to lower battery consumption. The Newton included screen rotation, handwriting recognition, a virtual keyboard, sketching and artistic features, connectivity via fax, various calendar and address-book functions, and personal note taking facilities.

Applications denoted by icons were the primary interaction mechanism together with sound response. Many features were built into the operating system via a large ROM to reduce the requisite amount of required RAM memory. In addition to the features mentioned, such as screen rotation and icons, the Newton OS provided facilities for printing and handling documents, a menu system, and email – features that are relevant today. Available software included programs for graphics and word processing, lists and notes, calendar and contacts, calculations and numerical conversion of various kinds, a clock,, and an e-book reader. Graphic, hand printed text, and cursive handwritten text recognition. Text recognition included learning facilities that improved with use. The Internet was not in widespread use at that time and that is possibly the reason that the Newton was not an extraordinary success.

SUMMARY

This paper should have been entitled "The Ubiquitous Metaphysics of Tablet Computing," because the objective is to describe what lies behind the outwardly visible electronic devices popularly presented by the media and tablet manufacturers. The concepts that transcend the limits of ordinary common sense and experience are precisely that which differentiates a run-of-the-mill Internet connection device and a truly useful mobile companion. In so doing, the fundamental concepts of tablet computing are covered, along with elements of reality, existence, and causality.

REFERENCES

[1] *Amazon Kindle User's Guide*, Amazon.com, 2004-2011.

[2] Ballew, J., *How to Do Everything: iPad*, New York: McGraw-Hill Book Company, 2010.

[3] Biersdorfer, J. and D. Pogue, *iPad: The Missing Manual*, Sebastopol, CA: O'Reilly Media, Inc., 2010.

[4] Cheshire, J., *My Surface*, Indianapolis, IN: Que Publishing, Inc., 2013.

[5] *Nexus 7 Guidebook*, Mountain View, CA: Google, Inc., 2012.

[6] Rosenzweig, G., *My iPad Mini*, Indianapolis: Que Publishing, 2013.

[7] Wikipedia, *ARM Architecture*, http://en.wikipedia.org/wiki/ARM, downloaded 5/2013.

[8] Wikipedia, *Tablet Computer*, http://en.wikipedia.org/wiki/Tablet_computer, downloaded 6/2013.

[9] Wikipedia, *Newton OS*, http://en.wikipedia.org/wiki/Newton_OS, downloaded 6/2013.

[10] Wikipedia, *Newton Platform*, http://en.wikipedia.org/wiki/Newton_(platform), downloaded 6/2013.