

13. Handheld Computers and Windows CE

There are many types of handheld computers and versions of Windows CE available. This section will give you more information about handheld computers and Windows CE. Before you get started in the details about the features and capabilities of these devices, you may need to look at 13.1 - Glossary explains some of the new terms used to describe them.

13.1 Glossary of Terms

Wireless Ethernet - A wireless local area network protocol which allows high speed access to network resources. It operates at 11, 5.5, 2 and 1 megabits per second depending on distance. It uses the 2.4 ghz spectrum using direct sequence spectrum (DSS).

ActiveSync - The desktop software that the Handheld PC, Palm-size PC and Pocket PC use to synchronize with. The latest version is ActiveSync 3.7.

Cable Modem - Provides high speed access to the internet at receive rates from 1,544k or faster. The upload rate is much slower usually 256 or 512k. Each cable company uses different standards for their cable modem.

CHAP - A security (authentication) protocol used with PPP. It sends an encrypted hash of the password to the client for comparison to the password entered. It does not send the password over the PPP connection. Windows CE and the Pocket PC do not support encrypted CHAP password authentication.

CF, CompactFlash - A non-volatile secondary storage card which is compatible with the Pocket PC and Windows CE originally designed by Sandisk. CompactFlash uses flash memory so it does not require very much power to work. With an adapter it is compatible with a PC Card slot.

DHCP - Dynamic Host Configuration Protocol - Automatically configures the PC Companion with an IP address, subnet and gateway. DHCP is supported with Ethernet and wireless LANs.

DNS - Domain Name Server - The server where host names are translated to their IP address. This server is used on the internet and some private networks.

Domain - This is the Windows NT/2000/XP domain name for Netbios/WINS. You should not use this unless directed to do so by your ISP. This is not the Internet domain name. It is commonly used when dialing corporate networks.

FTP - File Transfer Protocol - A common way that users download or upload files to the internet. Can be used to update a website as well.

H/PC, HPC - Handheld PC, a Windows CE PDA with a 640 x 240 or larger display and a built in keyboard. For more information read the [PC Companion Feature Comparison](#).

H/PC Pro - Handheld PC, Professional Edition, the 3rd generation of H/PC.

H/PC 2000 - Handheld PC 2000, the 4th generation of the H/PC.

Partnership - The connection made with ActiveSync to your desktop. The Partnership is stored on both the desktop and PC Companion.

PC Companion - A term used to describe the Handheld PC, Palm-size PC and Pocket PC as a group.

PDA - Personal Digital Assistant - A term used to describe computers small enough to fit in the palm of your hand.

POP3 - Post Office Protocol 3 - The address for receiving e-mail from your ISP. You will need to know your username and password to access this. In some cases the username and password are NOT the same as the log on username and password.

Pocket PC - A computer that fits in the palm of your hand that runs the latest Windows CE Operating System 3.0. Includes Pocket Word, Pocket Excel, Calendar, Contacts and Tasks as well as other applications.

P/PC, PPC - Palm-size PC - The first and second generation keyboard less PDA. Normally not used to describe a Pocket PC.

TCP/IP - Transport Communications Protocol/Internet Protocol - The communications protocol that the Windows CE uses to communicate to the internet and synchronization.

USB - Universal Serial Bus - An 11 megabits per second bus for peripherals. Requires one host controller and supports multiple slaves.

13.2 Choosing Handheld Computers/PDA

When choosing a PDA to purchase, you should consider the following characteristics and uses prior to purchase. I recommend that users make a list of the uses for their PDA and consider the following characteristics:

Size/Weight - Does the PDA fit in your pocket? Is it portable enough? Is it light enough that you will carry it with you when you need it? Is the system too large to carry with you?

Input Methods - Does the PDA have a keyboard? Do you want to use handwriting recognition for input? Does the PDA have a touch screen, glidepad or a trackpoint for mouse functions? Does the PDA support an external mouse?

Features - Do you need a CompactFlash, PC Card or SD slot? Do you need a modem - if you do then what speed? Do you need a camera card? Do you want to have a keyboard? Will an external keyboard meet your needs? Is the keyboard large enough for you to touch type? Is the unit fast enough to meet your needs? Do you have enough ram for running programs and storage? Will a flash card suffice for additional storage or is the PC Card slot occupied? What kind of connectivity do you need - Ethernet, IrDA, RAS, wireless LAN, wireless nationwide? How long do you need to run on batteries?

Uses - Will you be entering in lots of data? If so, is a keyboard important? How important is a large screen? How many colors does the screen need to support - 256 colors, 65536 colors? Are you going to be editing pictures? Is printing important?

Applications - Do you need Pocket Word, Pocket Excel, Pocket Access or Pocket PowerPoint? If so then consider the H/PC Pros since the P/PCs do not offer these capabilities. Do you need to run a special application? If you are looking for specific capabilities, I suggest you review my [PC Companion Feature Comparison](#) for a list of the capabilities of the Windows CE devices.

Table 1. Comparisons of Windows CEs.

Version/ Device	Handheld PC, Handheld PC Pro, Handheld PC 2000	Palm-size PC	Pocket PC 2002, Pocket PC
Windows CE 3.0	Handheld PC 2000 http://www.cewindows.net/wce/30/HPC2000Comparison.htm	not applicable	Pocket PC 2002 Pocket PC
Windows CE 2.11	Handheld PC Pro http://www.cewindows.net/wce/21/HPCProComparison.htm	Palm-size PC English/Japanese Palm-size PC Chinese	not applicable
Windows CE 2.0	Handheld PC http://www.cewindows.net/wce/20/wcetech.htm	Palm-size PC English	not applicable
Windows CE 1.0	Handheld PC http://www.cewindows.net/wce/wcetech.htm	not applicable	not applicable

Screen shots of HPC 2000 and HPC Pro are presented in Figure 1 and 2.



Figure 1. Desktop of HPC 2000.

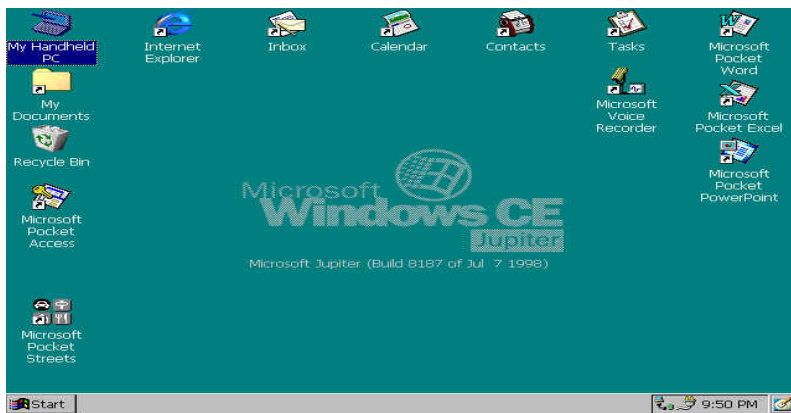


Figure 2. Desktop of HPC Pro.

13.3 Windows CE PC Companion Feature Comparison

There are many different Windows CE products available. Table 2 lists the potential applications included with the Pocket PC 2002, Pocket PC, Handheld PC 2000, Palm-size PC, Handheld PC Professional Edition and Auto PC. They are commonly known as the PC Companions that are available for consumers and corporate users to purchase.

Table 2. PC Companion Application/Function.

Application / Function	Pocket PC 2002	Pocket PC	Palm-size PC	Auto PC	Handheld PC 2000	HPC, Professional Edition
Pocket Outlook (Calendar, Contacts, Tasks)	Yes	Yes	Yes	Contacts	Yes	Yes
Pocket Applications (Excel, Word, PowerPoint, Access)	Excel, Word, Money (download), Reader, Media Player 8	Excel, Word, Money, Reader, Media Player	No	No	Excel, Word, PowerPoint, Access, Media Player	Excel, Word, PowerPoint, Access
Notetaker/Inkwriter	Yes, Notes	Yes, Notes	Yes, Notetaker	No	Yes, Inkwriter	Yes, Inkwriter
Pocket Internet Explorer (Web Browser)	Yes, AvantGo	Yes, Mobile Channels, AvantGo	No, Mobile Channels	No	Yes, Internet Explorer 4.0	Yes
WAP (Wireless Access Protocol)	Yes	No	No	No	No	No
Inbox (E-Mail)	Yes, HTML, Folders	Yes, HTML	Yes	No	Yes	Yes
Accessories (Calculator, Voice Recorder, World Clock)	Yes	Yes	Yes	Voice Recorder	Yes	Yes
Communications (PPP, Terminal Emulator, Ethernet , Wireless , Network Client)	PPP, Ethernet, Cellular Wireless	PPP, Ethernet, Cellular Wireless	PPP, Ethernet	PPP	Yes	Yes
Terminal Server/Citrix Client	Terminal Server, Citrix	Citrix	Citrix	No	Terminal Server, Citrix	Terminal Server, Citrix
Printing	No - 3rd Party	No - 3rd Party	No -3rd Party	No	Yes, including Internet Explorer	Yes
Games (Solitaire)	Yes	Yes	Yes	No	Yes	Yes
Microsoft Reader	Yes	Yes	No	No	No	No
Radio/CD Audio	No	No	No	Yes	No	No
MP3/WMA Audio	Yes	Yes	No - 3rd Party	No	Yes	No - 3rd Party
Maps & GPS	Yes, Pocket Streets, 3rd Party	Yes, Pocket Streets, 3rd Party	Yes - Pocket Streets, 3rd Party	Yes - GPS, voice directions	Yes - Pocket Streets, 3rd Party	Yes - Pocket Streets, 3rd Party
Voice Commands	Yes, 3rd party	No	No	Yes	No	No

As you can see each of these different hardware systems includes different applications that are included with each system. For some systems, 3rd parties have added capabilities that exist for other platforms.

13.4 Versions of Windows CE

Windows CE is composed of a variety of components. Each component provides specific functionality and capabilities. Here is a list of the different versions of the various components:

Table 3. Versions of Windows CE.

Product Name	Code Name	Windows CE Operating System	Applications and Shell	Desktop Synchronization Software
<u>Handheld PC 1.0 (Released Fall, 1996)</u>	Pegasus	1.0 Build 126-457 to 737-737	1.0	H/PC Explorer 1.0, 1.1
<u>Embedded Toolkit 1.0 (Developers Only)</u>	Alder	1.0	n/a	n/a
<u>Embedded Toolkit (Developers Only) Released Fall, 1997</u>	Birch	2.0	n/a	n/a
<u>Handheld PC 2.0 (Released Fall, 1997)</u>	Mercury	2.0 Build 7258-7260	2.0	Windows CE Services 2.0, 2.1
<u>Palm-size PC 2.0 (Released Spring, 1998)</u>	Gryphon	2.01 Build 8037-8040	1.0	Windows CE Services 2.1
<u>Embedded Toolkit (Developers Only) Released Fall, 1998</u>	Birch SP1	2.1	n/a	n/a
<u>Palm-size PC 2.11 Chinese Version (Released Fall, 1998)</u>	Orion	2.11	1.1	Windows CE Services 2.2
<u>Handheld PC, Professional Edition (Released Fall, 1998)</u>	Jupiter	2.11 Build 8262	3.0	Windows CE Services 2.2
<u>Palm-size PC 2.11 US, Japanese Version (Released Winter 1999)</u>	Wyvern	2.11 Build 9015	1.2	Windows CE Services 2.2
<u>Video-Internet-Computers (VIC) TV</u>	Venus		n/a	n/a

Settop Box - China (Previewed Spring 1999)				
Web-Enabled Telephone (Previewed CeBIT 1999)	Hermes	2.11	n/a	n/a
Embedded Toolkit (Developers Only) Released Spring 1999	Birch SP2	2.12	n/a	n/a
Microsoft TV Announced 6/99		2.12 w/Direct X	n/a	n/a
Embedded Toolkit (Developers Only) (Preview Release from Windows CE Developer's Conference, Released June 2000)	Cedar	3.0	n/a	n/a
Pocket PC, (Previewed at CES 2000, Announced 4/19/2000)	Rapier	Original 3.0.9348 Build 9351 Latest iPAQ Rom 3.0.9348 build 9616	3.0	<u>ActiveSync 3.1</u>
Handheld PC 2000, (Announced 9/8/2000)	Galileo	3.0 Build 9546-126	3.0	<u>ActiveSync 3.1</u>
Embedded Toolkit - (Announced 2/6/2001) Windows CE.NET (10/24/01)	Talisker	4.0	skinnable UI	
Pocket PC 2002 (Announced 9/6/2001, Shipped 10/4/01)	Merlin	3.0.11171 Build 11178	3.0	<u>ActiveSync 3.5</u>
Pocket PC 2002 Phone Edition, (Announced 2/19/02, Shipped 3/13/02)		3.0	3.0	<u>ActiveSync 3.5</u>
Notes	Internal Microsoft Code Name	Core Operating System.	The included applications and the GUI Shell	Synchronization software that runs on the desktop.

I hope this clarifies the different versions of Windows CE. You can read about the capabilities on <http://www.microsoft.com/mobile/>.

13.5 Initial Configuration Recommendations

When you first get a Pocket PC or Pocket PC 2002 there's a few things you will want to do to make it easier to use. There are many options to customizing your Pocket PC. This discussion focuses on the initial configuration you will want to do right after you take it out of the box.

Settings - Another Name for the Control Panel

First you will notice that there is no Control Panel in the Pocket PC (HPC has it). Microsoft uses the name Settings to refer to the functions that you would find in the Control Panel on the desktop. You can get to these settings by clicking on Start -Settings.

I recommend the following changes in the Settings - Personal:

- (1) **Owner Information** - Make sure you enter your name and address in here or in the notes. That way if you lose your Pocket PC and someone finds it they can contact you. I recommend adding a reward if you want to further ensure that you get your Pocket PC back.
- (2) **Sounds & Reminders** - Don't you find it annoying that the Pocket PC makes all kinds of noise right out of the box? Picture taking it to a meeting this way! Well I turn off certain sounds to make it silent except when there's a problem or an alarm. I start with unchecking the Screen Taps and Hardware buttons. Then under Sounds, I remove the sounds for Menu Popup and Menu Selection so it won't make sounds whenever I navigate.
- (3) **Password** - You can always set a power-on password as well. If you do this you must remember it! If you do not remember it, there is no function that Microsoft or an OEM can do to save your data off your Pocket PC. The workaround is a full reset where you will lose everything!
- (4) **Buttons** - Most Pocket PCs have the top left button programmed for the Notes - Voice Recorder application to make voice notes. While initially this sounds cool, I ran into problems with certain Pocket PCs like the iPAQ where if the button gets pressed inadvertently then the iPAQ turns on and starts recording! So if you put it in a purse or a briefcase, you can run your battery down without even knowing it! I suggest unmapping that button to prevent this from occurring.
- (5) **Menus** - I suggest that you go through and add applications you use a lot and remove the ones you do not use. If you add more than 9 applications, you will see arrows at the top and bottom of the menu. These are used to scroll up and down on the main menu. If you add more than 8 items, the menu will pop up to the right rather than under the Start button.

I recommend the following changes in the Settings - System

- (1) **Brightness** - Make sure you set the brightness to the lowest setting you feel comfortable with. This will extend your battery life compared to using the highest brightness level. The difference can be as much as double the battery life!
- (2) **Power** - You can check the amount of power you have left here. It's a simple bar graph on the remaining power and the condition of the backup battery. The backup battery is critical so on units with replaceable backup batteries, if it's low it's time to replace it! If you do not and you let your main battery run low, you may lose all your data! You can also set the amount of time before the Pocket PC turns off when it is not in use. The default of 3 minutes seems good for me however you may want to choose another option.

Clicking

You probably noticed that there is a new way to get to functions on the Pocket PC when you went through the setup. It is called Click and Hold. There are many applications that use Click and Hold for functions on items. So if you don't see an option on the menu for something you want to do, try Click and Hold. If the item supports this then you will see a drop down menu that you can select from. Basically Click and Hold is used in a similar way to the right mouse button on the desktop. In the Pocket PC 2002, you will notice that there's a red ring of dots indicating that you are using Click and Hold. Just hold the stylus until the circle is complete.

13.6 Managing Your Menus

So you've got your Pocket PC or Pocket PC 2002 and you have added a few applications to it. Well one of the first things you will notice is that almost every application wants to install to the Start menu. This leads to some changes in the way the menu works that makes navigating on the Pocket PC cumbersome since you have to scroll up/down one at a time through the items to select them.

(1) Where do I change the Menus?

First click on Start - Settings - Menus. There you will find a list of applications that are selected for the Start menu when you click on the start button. This list only allows you to decide what applications are stored in the Start menu. By default all the rest of the applications are placed in the Programs folder. If you enter more than 9 items into the main menu, you will see up/down arrows displayed to allow you to scroll up/down the menu. In the Pocket PC 2002, you can not enable more than 9 items in the main menu. Microsoft did this to attempt to eliminate the up/down arrows from being shown. When the up/down arrows are shown, they use white background instead of the themes.

(2) Setting up Another Folder in the Menus

You can add an additional folder and move the shortcuts to the applications to this new folder. By doing this, you will be able to click on applications faster and organize them to better meet your needs. This procedure is not supported by the OEMs or Microsoft so be careful! For example, I have 3 versions of Media Player installed on my Pocket PC. I want to create a folder called Media and place the shortcuts to all the Media Player applications in it. To do that, I need to use File Explorer. Click on Start - Programs - File Explorer to launch it. Then Click on the My Documents at the top and select My Device. Then click on the Windows folder. Then you will see the list of folders. Click on the Start Menu folder. There you will see all the applications that you have selected in the Main Menu. To add a folder, click and hold on a blank portion of the screen. A drop down menu will appear. On the drop down menu, select New Folder. Then type in Media and press enter. Now there's a new folder called Media listed in the Start menu.

(3) Moving Shortcuts to the Folder

After you have created the Media folder, you can move applications into it. Simply click and hold on the icon to display the drop down menu. From there select Cut. Then click on the Media folder to open it. Then click on the Edit option in the menu and select Paste. This moves the icon to the Media folder. You can also use the Copy option to create multiple shortcuts in the menus for your applications. This procedure also works for the Programs folder as well so you can organize all your applications to best meet your needs. The only caveat with placing the new folder under the Start menu folder is that you can no longer manage it from the Menu applet. So the only way to manage this folder is to use File Explorer. I suggest placing the new folder into the `\Windows\Start Menu\Programs` folder if you want to use the Menu applet to manage the contents.

(4) See More Recently Run Applications

If you rename an item (actually a shortcut) in the menu to be longer than the menu width, you can see more recently run applications at the top of the menu than the default 6. The menu automatically adjusts to the width of the widest named option. If you make a larger name for an item, you can see up to 8 recently run applications. To rename an option you need to use File Explorer. Click on Start - Programs - File Explorer to launch it. Then Click on the My Documents at the top and select My Device. Then click on the Windows folder. Then you will see the list of folders. Click on the Start Menu folder. There you will see all the applications that you have selected in the Main Menu. Then click and hold on the item you want to rename and a drop down menu will appear. Once the menu appears, you can select Rename to rename the shortcut. For example, adding 2000 to the shortcut for Internet Explorer expands the menu to the fullest.

(5) Deleting Applications Left Over After You Uninstall

To do that, I need to use File Explorer. Click on Start - Programs - File Explorer to launch it. Then Click on the My Documents at the top and select My Device. Then click on the Windows folder. Then you will see the list of folders. Click on the Start Menu folder. There you will see all the applications that you have selected in the Main Menu. Then just click and hold on the item you want to delete and select Delete from the drop down menu. The shortcut for that item will be removed from the menu. *Note: There is no easy way to get these shortcuts back if you delete existing applications so be careful!*

13.7 Installing and Removing Software

Installing and removing Windows CE applications is different than installing applications on the desktop. The applications come in a variety of formats including .exe, .cab and .zip. Some are installed on the desktop first and then transferred to the PC Companion using ActiveSync while others require you to copy the files to your device directly. This FAQ covers the common formats for distributing programs and how to install and remove them. Don't forget to read the directions whenever they are provided with the application.

(1) Checking Available Ram

Prior to installing the application, you should check the amount of ram you have allocated for storage is large enough to store the application. Ram for Storage can be checked under Start - Settings (Control Panel for H/PCs) - System - Memory. Just adjust the slider to increase storage as needed. In Windows CE 2.11 and earlier, you are limited to using 16 MB of ram for storage.

(2) Installing .EXE Files

.EXE files are used to distribute applications that either run directly on the PC Companion or are installed on the desktop. If you run a program designed to run on your PC Companion, you will see a message indicating that the program is not compatible. See the messages below:

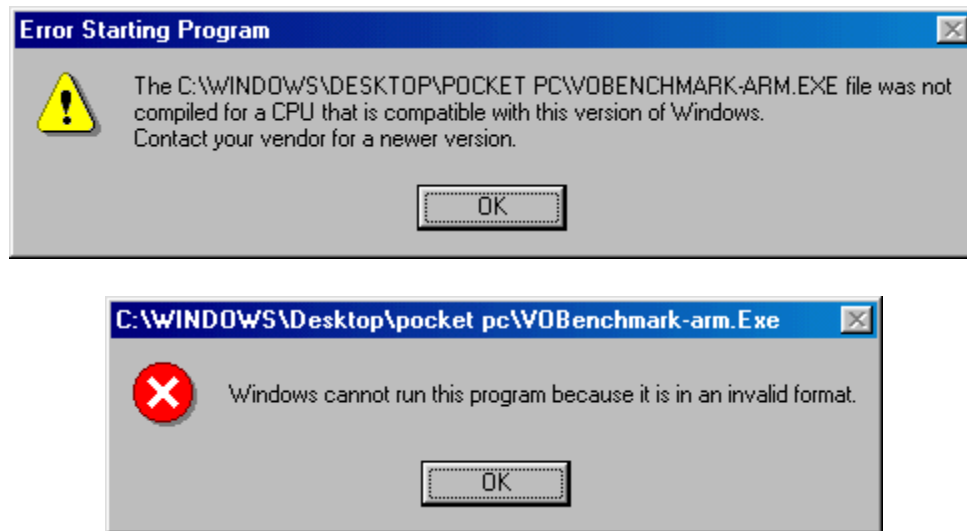


Figure 3. Setup .exe files.

If you receive these messages, all you have to do is make sure that you have the right version of the application for your CPU type. Then just use ActiveSync to copy the program to your PC Companion. It is ready to run right on the device.

If the program is designed to be installed on the desktop first, it will automatically install the copies of the program in a subdirectory of \Program Files, \Program Files\ActiveSync or \Programs Files\Windows CE Service\. Most of the time, these programs are called Setup or the name of the application if it is a self extracting installation. Once you have completed the installation of the program, you will need to synchronize using ActiveSync to complete the installation. Using the installation program via ActiveSync allows you to select a different directory other than the default directory to install the application to. This includes the ability to install applications to flash cards.

(3) Installing .CAB Files

Installing .CAB files is different than other files. You need to copy the right .CAB file to your device via ActiveSync. Then use File Explorer to click on the .CAB file to complete the installation. Most installation programs create .CAB files that are installed via ActiveSync. You can install these .CAB files directly on your device as discussed previously. Also, .CAB files can be installed from a website. All you need to do is click on the .CAB file and it will be installed on your device. Be careful when attempting this because you can not stop the installation. When using .CAB files for installation, you do not get the option to choose what directory the application is installed to.

(4) Installing .ZIP Files

.ZIP files are compressed to minimize the time it takes to download files to your desktop via the internet. You will need a program to uncompress the files such as Winzip. Once the files are uncompressed, you will see either a setup program or just the program to run on the device. Just follow the recommendations I listed above for .EXE files to complete the installation.

(5) Removing Applications

If you installed the software using ActiveSync then you can remove it by clicking on Start - Settings (Control Panel H/PC only) - System and select the Remove Programs icon. The application should be listed there and you can remove it this way. You can also use the Add/Remove Programs option from the Tools menu in ActiveSync while you are synchronizing to remove applications as well. If you copied the program to your PC Companion, then you can just delete the files you installed.

In some cases with drivers, you will not be able to delete the files. This is caused when the drivers are in use after you reboot your PC Companion. The workaround for this is to perform a full system backup and restore.

13.8 Storage FAQ

So you've got a Pocket PC, Handheld PC or Palm-size PC and you want to know more about storing information on it. This FAQ covers common issues and solutions for using internal and external storage.

(1) Where Can I Store Stuff?

When you first got your device, you probably noticed that you can store information on it right away. Well this information is stored in internal ram. You can add a CompactFlash or PC Card flash card to store data and programs as well. The CompactFlash or PC Cards appear as Storage Card in the device. In the Pocket PC 2002, some models allow for internal storage to the extra flash that is not used by the Flash ROM.

(2) Internal Ram

The internal ram is used to store both programs and data. It is compressed real time using 2 different methods to maximize the amount of information you can store. One method is to compress the whole file as it is received. This is good for programs and some data that is in ASCII format. The other method of compression is to split every other byte of data into 2 separate streams. Then the resulting streams of data are

compressed. The second method of compression is very good for Unicode (2 byte) representation of data. Certain types of data like the registry and the internal databases must be stored in internal ram. If you develop applications, the internal ram for storage is called the Object Store by Microsoft.

There are some limitations to using internal ram for storage. Prior to Windows CE 3.0, the internal ram for storage was limited to 16 MB. In Windows CE 3.0, this limit has been increase to 256 MB. In Windows CE 1.0 and 2.0, the largest file was limited to 4 MB in size. In Windows CE 2.1 and later, the largest file is limited to 16 Mb. So if you need to use really large files, you should consider using external storage.

(3) Flash ROM

In the Pocket PC 2002 some of the devices like the HP Jornada 560 series, Casio E-200 and the iPAQ 3700/3800 series allow for internal storage of files in the extra flash that is not used by the ROM. The iPAQ and Jornada use an application from Intel called Persistent Storage. Persistent Storage is a new way to format and write to flash in sections. I've found that writing to flash is very slow - like about 1/2 hour to write a 3.3 MB file. So be patient if you choose to store things here. The good news is that if you run your batteries out, the information stored here will be retained.

(4) External PC Card, CompactFlash Card or MultiMedia/Secure Digital Card

The PC Card, CompactFlash card or MultiMedia or Secure Digital Card is a separate area to store both programs and data. The programs and data are not compressed before being stored. You can store much larger files on the external storage. There is 2 types of storage available, flash and hard disk. Flash storage is fairly fast from about 250k/second to over 1 MB/second and it is much lower power at about 50 mA to read and write to it. Most users do not notice a significant reduction in the battery life of their device when using a flash card. The hard disk storage is very large and economical. You can get hard drives up to 2 GB in size for PC Cards and 1 GB for CompactFlash Cards. Hard disks require much more power than flash. The lowest power hard disk from IBM requires approximately 250 ma so your battery life will be diminished greatly. Both flash and hard disks use the FAT file format and are compatible with notebook PCs and card readers for the desktop so you can transfer files faster than using ActiveSync. I have a list of compatible [PC Cards](#) and [CompactFlash Cards](#) that you may find helpful in deciding which type of card to purchase. The [MultiMedia Card or Secure Digital Card](#) are much slower than CompactFlash or PC Cards since the data is written in a serial fashion to the card. The big advantage that they offer is the small size of the media.

(5) Using External Storage

Please note that external storage does not expand the amount of ram you have available to run programs. You can use external storage to install applications if you choose Storage Card when you install them using ActiveSync's Add/Remove Programs. If you want to move programs from internal ram to external storage, you should uninstall

them and then reinstall them while selecting Storage Card as the destination. For all external storage, you should create a directory called My Documents in the root of the disk. This directory is merged with the My Documents in ram when you view the My Documents directory on the device. Some programs do not search directories other than My Documents so this may be crucial to your ability to maximize the external storage. Also, there is no utility to format or check (scandisk) your external storage which is included with your device. You can purchase a program called Flash Format from CNetX or Format Flash Card from PDA Resources.

(6) Where does the Program Execute?

The internal ram and external PC Card or CompactFlash card are used to store programs only. When you choose to run a program stored in either place, the program is copied into ram (the execution space, not the storage space) to execute. This means that there is 2 copies of a program if it is being executed.

13.9 RAM FAQ

(1) What is RAM?

RAM is Random Access Memory. In the case of a Handheld PC, Palm-size PC or Pocket PC, it is used differently than it is on a desktop PC. The RAM on your device is battery backed up. This means that as long as the unit still has power, your data and programs that are running are kept exactly where you left them. So if the battery is completely depleted (like when you go on vacation and forget to leave your device in the charger) all your data will probably be lost. I suggest you perform regular backups of your device to allow you to restore your data.

(2) What is RAM Used For?

The RAM is used for multiple areas in the device. First, RAM is divided into 2 sections. One is for data storage and the other is for program execution. I have covered the data storage aspects of the ram in the Storage FAQ. The program execution is where the program is loaded after you have selected it from the menu and told the system to run it. The Handheld PC and Palm-size PC require the user to manually adjust the amount of ram for storing data and running programs. I suggest you use approximately 8 Mb for running applications and the rest for storage whenever possible. On older systems with less ram, try splitting the ram evenly between storage and execution. The ram settings are adjusted in Control Panel - Memory by sliding the slider according to what you want. Ram is automatically managed on the Pocket PC so if you adjust it, the system will re-adjust it depending on what you are running or storing at any given time.

(3) Executing a Program

Each program on the Pocket PC is loaded into its own ram slot. There are 33 RAM slots in the Windows CE memory architecture. Each of these slots can be up to 32 MB in size for a total of approximately 1 GB. So the largest program for Windows CE is approximately 32 MB. The first slot (slot 0) is where the currently running program is at any given time. These 33 slots are all composed of virtual memory. Virtual memory in the Windows CE operating system means that memory is allocated for programs that are running on a page (usually 4k in size) by page basis. The system reclaims pages that are no longer being used so that they can be used by other programs. Pages that have data that has been written to them do not get reclaimed since there is no swap file to write the data to temporarily. This concept is radically different than the desktop. Also, the Windows CE operating system can close applications that are no longer being used in the foreground to release ram as well. For example the Pocket PC never has more than 10 applications running at any given time even though the operation system can support more.

(4) Looking for Program Memory Leaks

So you see the ram fluctuate radically between loading and running programs. Since ram is allocated in pages and the initial loading of the program requires the most ram, the amount of free ram will vary dramatically. This is not a memory leak. Basically if you close all the programs you will free up all the ram. There is one exception for loading DLLs that are used by the system. These are only completely unloaded in the event of a soft reset. So if you need all your ram as available as possible, consider a soft reset.

References

This section was edited based on the publications at <http://www.cewindows.net/wce/gettingstarted.htm>.