



## EMBEDDED OS

### - a comparison of Windows XP Embedded and Windows CE

When choosing your embedded computer, an equally important consideration is whether to use an embedded OS. Typically, the embedded operating systems (OSs) that control industrial devices are relatively simple and are there for life - they may never get upgraded, and could be used for up to 10 years or more.

The following guide introduces and compares Microsoft's two offerings - Windows XP Embedded and Windows CE.

#### Similarities and key differences

On initial inspection, Windows CE and Windows XP Embedded may seem to be similar, since both are componentized operating systems - Windows CE has around 500 components; Windows XP Embedded has around 12,000 components. (About 9,000 components are device drivers, the rest of the components are operating system technologies). Both expose similar programming interfaces (Win32, MFC, ATL, and support for .NET applications), and both expose similar operating system technologies, which include support for networking, internet browsers and media players etc

However, Windows CE has been designed to be a small footprint, componentized, real-time operating system that runs on multiple processor architectures. Windows

XP Embedded, on the other hand, can be considered to be a componentized version of Windows XP Professional Service Pack 2 with additional embedded-enabling features.

This means there are a number of core differences between Windows CE and Windows XP Embedded. First, Windows CE is a full 32-bit, Unicode operating system that doesn't support MS-DOS or Windows 3.x applications. At a minimum, desktop applications would need to be recompiled to run on a Windows CE device, not only because of the architectural differences, but also because the Windows CE device is potentially running on a non-x86 processor.

#### License Fees

Technical considerations aside, each OS has its own associated cost benefits. Windows CE has a "Core" license that covers most of the operating system for a few pounds or about £15 for a "Professional" license. Windows XP Embedded licenses are approximately £60 per device.

#### XP Embedded

Windows XP Embedded is the embedded operating system that delivers the power of Windows in componentized form to allow developers to rapidly build reliable and advanced embedded devices. Based on the

same binaries as Windows XP Professional, Windows XP Embedded contains over 10,000 individual feature components so developers can choose and achieve optimum functionality while managing or reducing footprint in a customized device image. A typical example may be omitting components like Windows Media Player, DCOM, RPC, Microsoft Internet Explorer from an industrial application. Other popular device categories for building operating systems using Windows XP Embedded include retail point-of-sale terminals, thin clients and advanced set-top boxes.

### **Image Size**

The Windows XP Embedded minimum build size is approximately 5 MB. This is a kernel-only build, not much use in itself but it does boot and run. An average image size for Windows XP Embedded would be around 150MB or above, a lot smaller than a typical install of Windows XP Professional on the desktop. It's therefore quite possible to build custom images small enough to run a 512MB Flash memory card instead of a hard drive. This solid state capability in a fanless industrial computer can deliver an extremely reliable solution.

### **Development**

One of the advantages of using Windows XP Embedded in an embedded system is the speed of development. Windows XP Embedded-based systems run on an x86 processor and PC Architecture hardware, both of which are very well understood. This means that any existing Windows 2000 or Windows XP device driver or application can run on Windows XP Embedded without modification.

The typical development cycle for a Windows XP Embedded device is to first snapshot the underlying hardware using a tool called Target Analyzer, which generates an XML file that defines all of the hardware components found on your target device. The XML file can then be imported into the Component Designer tool and saved as a custom component that defines the hardware of your device. Once components are defined, they can be checked into the Windows XP Embedded component database and then used in an embedded design. The next step is to use the Target Designer tool. This tool exposes all of the Windows XP operating system technologies and drivers allowing the system developer to simply select the components he needs and add them to a project workspace.

Blue Chip Technology will build a custom image on their client's behalf and maintain and deploy this image in production. Customers simply discuss their application with our sales team and capture their requirements using our XP Embedded Custom Image Requirement Form.

## **Windows CE**

### **Advantages and applications**

You may think that Windows CE is limited to running only on handheld, battery powered devices such as Windows Mobile devices. While it's true that this is perhaps the most visible device shipping based on Windows CE, and that Windows CE does have a great power management story, you can also find Windows CE running on industrial control systems, medical monitoring devices, robots, retail point-of-sale devices, and many other categories of embedded systems.

The componentized features in Windows CE are optimized for next-generation devices that require rich networking and communications standards, a hard real-time kernel, rich multimedia and Web browsing capabilities and smaller footprints. You typically find Windows CE running on custom hardware where the designer is looking to reduce the bill of materials by reducing the size of the operating system image, the power of the processor, and the supported peripherals, but at the same time include support for the latest operating system technologies.

### **Image Size**

The Windows CE minimum build size is approximately 200 KB. A residential gateway image would be about 4 MB in size. Support for wired and wireless networking, remote administration UI (web server), and a PDA-like image which includes the Windows-like shell, networking, RDP, Internet browser, Windows Media Player, COM/DCOM, etc., would require around 18 MB. Blue Chip Technology can combine a RISC engine with a custom CE image, to offer a fanless low power system operating with display operating on 3 Watts or less.

### **Realtime support**

Windows CE has been designed to be a hard-real-time embedded operating system supporting interrupt latencies in the sub-ten-microsecond range. This is more than adequate for many real-time embedded designs. Real-time is not available as a standard part of XP Embedded, but the OS design is such that a real-time extension can be added from a third party if this is required. One of the best known is Venturcom's Real Time Extensions (RTX), is a legitimate amendment to the hardware abstraction layer (HAL) of the operating system that introduces hard real-time features.

### **Development**

Windows CE ships with a suite of tools that can be used to configure, build, and debug an embedded operating system image. The Platform Builder tool is in many ways similar

to the Windows XP Embedded Target Designer tool. A developer has the ability to use a Platform Wizard (similar to the Windows XP Embedded design templates) to configure the initial operating system configuration, and he can then add or remove features from the operating system design. Platform Builder also contains support for operating system feature dependencies. For example, adding the .NET Compact Framework to a design will also add support for the required operating system technologies.

### Summary Decision Criteria – CE or XP Embedded?

#### 1. CPU Architecture Are you using an x86 or non-x86 CPU?

If you are using an X86 CPU, you can use either Windows CE .NET or Windows XP Embedded. If you are using a non-X86 CPU, then you must use Windows CE .NET, which supports both ARM and MIPS. Additionally, heat dissipation concerns will affect both CPU selection and operating system. If heat dissipation is a concern, and you select a non-X86 processor as a result, then Windows CE .NET is an option.

#### 2. Real-Time Support. Does your device require real-time support?

Windows CE .NET is inherently a hard real-time operating system. Windows XP Embedded would need third party add ons to support real-time performance.

#### 3. Win32-based Applications. Does your device design take advantage of Win32-based applications?

If your device will make use of existing Win32-based applications and drivers without modification, use Windows XP Embedded. Win32 applications and drivers must be modified to run on Windows CE .NET.

#### 4. Operating System RAM Configuration. How much RAM will your device include, and what is the corresponding device image footprint requirement?

Both Windows CE .NET and Windows XP Embedded are componentized to enable you to create small or managed footprint designs. The minimum footprint for Windows CE .NET is less than 350 KB, while the minimum footprint for Windows XP Embedded is approximately 8 MB. Footprint requirements are an important factor when choosing between Windows CE .NET and Windows XP Embedded