DOS to Windows CE Migration: How—and Why—to Develop Enterprise Mobility Applications for the Windows CE Environment

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The Enterprise Mobility Company™

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This white paper provides a general overview of developing enterprise mobility applications for your Symbol devices using the Microsoft Windows CE operating system. It also describes how Symbol can help you migrate your existing DOS applications with our Symbol Mobile Developer Kits (SMDKs).

DOS to Windows CE: A Short History

Despite advances in operating-system technologies and the increasing adoption of wireless technologies throughout the global business environment, many enterprises using mobile technology have continued to make investments in DOS-based applications. Although this approach has worked successfully for many customers, continuing to develop to legacy technologies will prevent DOS-based enterprises from evolving into agile businesses capable of capturing, moving and managing data efficiently. This is why Symbol has chosen Microsoft Windows CE as our development platform moving forward, and why we will help you to do the same with our SMDKs.

Unlike contemporary operating systems, DOS was designed to perform a single task at a time. A program was loaded from storage to memory, executed to perform a task, and then exited. The total memory supported was limited to 640KB. The user interface was character-based; mass storage was limited; and mobile technology wasn't available yet. And since multimedia was in its infancy, no one imagined that Web browsing, video display or audio output would be possible, let alone widespread, on mobile devices.

With the advent of the Microsoft Windows operating system, the world of mobile computing changed for the better. Graphical user interfaces (GUIs) made applications easier to use. Increased memory and storage space in Windows devices led to more functionality being available on mobile devices, which in turn resulted in increases in end-user productivity. Windows provided the ability to add new technologies to mobile devices without having to rewrite applications.

Most recently, Microsoft Windows CE has been introduced into the mobile-computing scene. Windows CE is a componentized operating system that can be used to rapidly build applications for small-footprint smart devices such as handhelds, smart phones, set-top boxes, retail point-of-sale devices and displays. It belongs to the Microsoft family of embedded operating systems. Built on its own code base, which is different from that used on the desktop, Windows CE offers rich configuration and application options for a broad range of embedded devices. Device manufacturers have the ability to use Windows CE to build both a customized operating system and applications for a variety of devices that require a small footprint.

Designed from the ground up for the embedded marketplace, Windows CE combines an advanced, real-time embedded operating system with powerful tools for rapidly creating the next generation of smart, connected, small-footprint devices. With a complete operating system feature set and comprehensive development tools, Windows CE contains the features you need to build, debug and deploy customized mobile devices, including:

- Support for secure and scalable networking
- Support for basic building blocks of .NET, including Hypertext Transfer Protocol (HTTP), Extensible Markup Language (XML), Simple Object Access Protocol (SOAP) and Universal Description, Discovery and Integration (UDDI)
- Enhanced real-time processing
- Faster performance than DOS
- Rich multimedia and Web browsing capabilities
- Interoperability with personal computers, servers, Web services and devices
- Customizable, real-time and targeted at embedded devices

The table below summarizes some of the key differences between DOS and Windows CE.

Today, networked devices communicating with host-based systems are commonplace. The cost of designing, implementing and maintaining these systems is dropping rapidly as a result of a number of factors, including an operating system that performs much of the work. An older operating system, such as DOS, requires custom components that are not reusable, scalable or portable across platforms. The future of operating systems is clear—Windows CE provides you with the greatest flexibility to address your needs today and as they evolve. That's why we've chosen Windows CE for our next generation of enterprise mobility devices.

	DOS	Windows CE
Memory	• 640KB	• 64MB
CPU support	• Extremely limited • No modern CPU architectures supported	• 4 CPU architectures, modern CPUs including the ARM line (which includes ARM720T, ARM920T, ARM1020T, StrongARM and XScale)
Multimedia	• Requires custom tools • No standard products available	• Direct X, Media Player and others
LAN, WAN, PAN	• Requires custom drivers • No further development being done • Little or no support	• Full support in the operating system for LAN, WAN and PAN, including Bluetooth and IRDA, 802.11 with security, VPN, PPP and RAS
Web browsing	• Requires custom browser	• Internet Explorer and Pocket IE
Software development	• BASIC • C/C++ • Some 4 GL/RAD tools	• Modern tools such as Visual Studio.NET • Java • Many 4GL/RAD Tools

Microsoft .NET Framework

The Microsoft .NET Framework is a component for building and running Microsoft .NET software applications and Web services. The Microsoft .NET Framework supports over 20 different programming languages and manages much of the plumbing involved when you develop applications. This makes application development easier and results in more robust, higher-performing applications.

The Microsoft .NET Framework consists of the Common Language Runtime (CLR) and a unified set of class libraries, including ASP.NET for Web applications and Web services; Windows Forms for smart client applications; and ADO.NET for loosely coupled data access. The Microsoft .NET Framework gives you:

- Shared code
- Robust code
- Secure execution
- Encryption support
- Automatic deployment
- Rapid application development for faster time-to-market
- Ability to call Win32 dynamic link libraries (DLLs) without having to rewrite them
- Debugging and development for use by Microsoft Visual Studio .NET 2003
- Code that is not prone to failure resulting from uninitialized variables
- Just-in-time compilation that is not interpreted
- "Garbage" collection, which greatly minimizes memory leaks by cleaning up objects no longer in use

Microsoft .NET Compact Framework

The Microsoft .NET Compact Framework is a smart-device development framework that brings the world of managed code and XML Web services to devices. The Microsoft .NET Compact Framework is a rich subset of the Microsoft .NET Framework. It is useful specifically for resource-constrained devices, such as handheld mobile computers. The Microsoft .NET Compact Framework greatly simplifies the process of creating and deploying applications to mobile devices while also allowing you to take full advantage of the capabilities of the device. In addition to the benefits of the Microsoft .NET Framework, Microsoft .NET Compact Framework features include:

- Single binary deployment that runs on various CPUs on the same platform without recompilation
- Controls, applications and services that can be easily moved from one device to another
- Portable subset of the Microsoft .NET Framework
- Same naming conventions as in the Microsoft .NET Framework
- SOAP—a lightweight and simple XML-based protocol that is designed to exchange information on the Web

Making it Easy to Develop Applications for Windows CE

When you develop applications for mobile devices running Windows CE, you have access to a rich selection of tools from Microsoft, Java and other rapid application development third-party vendors.

Microsoft Tools

eMbedded Visual C++ 4.0

The first of two Microsoft tools available for mobile device development is eMbedded Visual C++. You can use C or C++ to write native applications. When you write an application in C or C++ you must compile it from source code to executable code. When you write an application for one device it cannot be copied to another device. Instead, you must generate the specific program for the target device. Although not difficult, it is an additional task.

Because managed code is not suitable for all situations, such as integration with custom hardware, native code development is required. Microsoft offers you eMbedded Visual C++ 4.0 for this reason. Native code, being compiled directly for the specific device, offers the highest performance. However, it is also the most difficult to develop in, since it offers none of the benefits of the CLR such as memory management, secure execution and portability between devices.

Microsoft Visual Studio .NET

The second Microsoft development tool for Windows CE is Microsoft Visual Studio .NET 2003. This tool lets you create managed code. Useful for much more than just device development, Visual Studio .NET enables you to select from traditional Web and client models to properly architect complete systems, including mobile applications.

Visual Studio .NET doesn't restrict you to mobile device, Web services or Windows programming—it does all three. This enables you to rapidly build a broad range of applications so you can:

- Reduce IT operating costs
- Integrate more easily and quickly with the latest applications, systems and devices

Java Tools

Java, the original write-once-run-anywhere programming language from Sun Microsystems, Inc., is also supported by Symbol Technologies for mobile device programming. Java uses the concept of a Java Virtual Machine (JVM) to provide portability across platforms. The Java application is written in a standard language. The JVM interprets the Java line of code, translates it into machine code and the machine code is executed.

Crème Plus, JVM from NSICom, is available for Java development on Symbol mobile computers. The Crème Plus JVM can run any Java program, and includes support for all Symbol-specific hardware, such as the bar-code scanner, wireless LAN, magnetic stripe reader and more. Crème Plus is available for all Windows Mobile 2003 devices, as well as the PPT8800 and MC9000 CE .NET devices. IBM also has a JVM, called J9, that is suitable for the CE environment.

Rapid Application Development Programs from Third-Party Vendors

While full-featured programming environments from Microsoft and Sun are powerful, they can also be complicated and may require professional programmers to take advantage of all of the features. Some third-party vendors provide simpler application development environments, for when speed-to-market, ease-of-use and developer productivity are of primary importance. These Rapid Application Development (RAD) tools for Symbol devices come from Odyssey Software, Wavelink, MCL and Symbol Technologies.

Odyssey

Odyssey Software delivers mobile and wireless application infrastructure and application development tools for fast and effective mobile enterprise application development and deployment. You can implement powerful distributed enterprise applications with true interoperability among a wide range of mobile, desktop and server-class platforms. The Odyssey products available include CFCom, for adding COM support to CE; ViaXML, for Web services; and CEFusion, for rapidly building and deploying rich mobile enterprise applications.

The MCL Collection

The MCL Collection is a set of software tools that enables non-programmers to quickly create and deploy batch or real-time data collection applications. MCL Technologies, a Division of Zetes SA, is the provider of graphical software development tools for automatic identification applications. The MCL Collection enables you to dynamically collect and update databases like Oracle, Access, FoxPro and Excel.

The MCL Collection provides software to help you design your application. This collection includes MCL-Designer, for terminals; MCL-Link, to help you design communication for batch terminals; MCL-NetS24, for RF terminals; and MCL-Code Interpreter, to run your application on the terminal.

Wavelink

Wavelink offers tools for wireless mobility development. Wavelink Studio COM is a powerful collection of development libraries, server-side software and client applications for mobile devices. The clients run on the mobile device and are the bridge between the server-side application and the end user. The client is specific to a particular mobile device, but supports Wavelink Studio COM development libraries.

The Wavelink libraries reduce the time it takes you to create a wireless application by allowing you to separate the business functions from the presentation of the applications. Note that Wavelink is not the development environment for the business logic; instead, Wavelink libraries can be used with C/C++ and Java.

Symbol Pocket Browser

The Symbol Pocket Browser integrates the core components of Pocket Internet Explorer (pIE) with Symbol's unique features such as bar-code scanning. The Symbol Pocket Browser blocks the end user from the operating system, exposes the full real estate of the Pocket PC's screen to the Web application designer and harnesses Symbol's unique features, so you can add more value to the terminal, while preserving the ease-of-use of the Web services programming model.

How Symbol Helps to Simplify the Development of Enterprise Mobility Applications

Symbol devices contain many specific hardware components, such as bar-code scanners, magnetic stripe readers, wireless LAN adapters and more. It can be challenging and time-consuming to develop applications for all of these components. The key to merging specific device capabilities with standard tools is the Symbol Mobility Developer Kit (SMDK). Our SMDK works across a range of devices to help you make a successful transition from DOS to Windows CE, guaranteeing true program portability.

Our SMDKs support a number of programming languages and environments:

- SMDK for Microsoft .NET supports applications created in managed code, such as C# or VB.NET
- SMDK for eVC4 supports native applications created in C or C++
- SMDK for Java supports applications created in Java

To use any one of the SMDKs, you will need the following:

- Microsoft Windows 2000 or Microsoft Windows XP
- Microsoft Visual Studio .NET 2003
- Microsoft Visual Studio .NET 2003 Add-on Pack
- Microsoft ActiveSync 3.7

SMDK for Microsoft .NET

The SMDK for Microsoft .NET provides all of the tools necessary for you to develop C# and VB.NET managed applications for Symbol mobile devices. These tools include class libraries, sample applications and the associated documentation. SMDK for Microsoft .NET allows Microsoft .NET Compact Framework developers to programmatically access the Symbol value-add features of the mobile devices.

The supported assemblies include Audio, Barcode, BarcodeForms, Display, Imaging, Keyboard, MagStripe, Printing, ResourceCoordinator, WirelessLAN, Notification and StandardForms.

The SMDK for Microsoft .NET is available from the Symbol Developer Zone (http://devzone.symbol.com).

SMDK for eVC4

The SMDK for eMbedded Visual C++ 4.0 provides all of the tools necessary to create custom applications that target Symbol Value-Add "C" libraries, such as scanning and printing.

Prior to installing SMDK for eVC4, you must install the following software packages, which are available as downloads from Microsoft:

- Microsoft eMbedded Visual C++ 4.0 with Service Pack 2
- Microsoft Windows Mobile 2003 SDK (formerly known as the Pocket PC 2003 SDK)

SMDK for Java

The SMDK for Java provides a set of tools for you to develop Java applications for Symbol mobile devices. These tools include class libraries, sample applications and the associated documentation. SMDK for Java allows J2ME developers to programmatically access the Symbol value-add features of their mobile devices.

The first released version of the SMDK for Java includes support for the following classes and sample applications:

- Scan - J_ScanSample1
- MSR - J_MSRSample1
- WLAN - J_WLANSample1
- Display - J_DisplaySample1
- Audio - J_AudioSample1
- Keyboard - J_KeyboardSample1
- Notification - J_NotifySample1
- ResourceCoord - J_xxxSample1
- Printing - J_PrintSample1
- Power - J_PowerSample1

Conclusion

Today, there is an ever-increasing demand for technology-rich customer applications. This demand is driving the requirements of Symbol's current generation of mobile devices to include advanced operating systems and development environments that deliver the following to your mobile enterprise:

- Increased available memory for users to load applications and store data
- Reliability and security to ensure accurate data
- Advanced multimedia and Web-browsing capabilities

Windows CE provides you with the features and functions necessary for today's fast-paced, connected programs as well as the capability to easily grow and adapt as your needs evolve. There is a rich selection of tools available for Windows CE, with support from Microsoft, Sun and others. With help from our SMDK toolkits, you will be on your way to entering the rich and scalable world of Windows CE for the devices and networks that support your true enterprise mobility.

About Symbol Technologies

Symbol Technologies, Inc., The Enterprise Mobility Company™, manufactures and services enterprise mobility systems, delivering products and solutions that capture, move and manage information in real time to and from the point of business activity. Symbol enterprise mobility solutions integrate advanced data capture products, radio frequency identification technology, mobile computing platforms, wireless infrastructure, mobility software and services programs under the Symbol Enterprise Mobility Services brand. Symbol enterprise mobility products and solutions are designed to increase workforce productivity, reduce operating costs, drive operational efficiencies and realize competitive advantages for the world's leading companies.

For system, product or services availability and specific information within your country, please contact your local Symbol Technologies office or Business Partner.

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