When to Use an NK.bin
Application Note 296

Logic Product Development
Published: October 2005
Last revised: November 2007

Abstract

It is possible to demonstrate and evaluate a wide range of Windows® CE features with a binary Windows CE Operating System (OS) image, referred to as an NK.bin. Demonstration and evaluation scenarios include performance, user interface, development tools, hardware peripherals, communications, and overall system functionality. Actual product development is one of the only scenarios in which Board Support Package (BSP) software is required to build a customized Windows CE OS image.

REVISION HISTORY

REV	EDITOR	DESCRIPTION	APPROVAL	DATE
A	Hans Rempel	Release	HAR	11/10/05
B	Jed Anderson	Removed "Source Code BSP" from Appendix A	JCA	11/16/07

1   Introduction

This document explains what types of Windows® CE system evaluation scenarios can be accomplished by using a binary Windows CE OS image. A binary Windows CE OS image is also referred to as an "NK.bin," which is the file name that the Windows CE development tools use for the OS image.

The purpose of this document is to educate customers and partners that most, if not all, Windows CE system evaluation needs for specific development can be accomplished without having to compile a custom Windows CE OS image. In most cases, a pre-compiled NK.bin can be used for everything from system demonstration to device driver development without requiring Board Support Package (BSP) software.

This document is not meant to provide instructions on how to use the Windows CE binary OS images, it is only meant to provide an overview of what can be achieved with an NK.bin.

2   NK.bin Usage Overview

Development kit hardware running binary OS images can provide a platform sufficient to perform most demonstration and evaluation activities on a system. For a complete list of the different Windows CE offerings Logic Product Development can provide, please reference Appendix A.

2.1   Role of the NK.bin

The main role of a pre-compiled NK.bin is to provide an environment for demonstrating and evaluating Windows CE on the target hardware with minimal investment.

There are typically three stages in Windows CE product design: 1) Demonstration, 2) Evaluation, and 3) Product Development. A generic, binary OS image can fulfill the needs of the first two stages, but may not be sufficient for the final Product Development stage.

An NK.bin is by far the fastest and cheapest way to accomplish stage 1 and 2 goals. It does not require specialized software tools or expert domain knowledge, yet it allows for quick evaluation of custom software, drivers, and settings on the hardware platform of choice. Utilizing BSP software from these beginning stages will almost surely incur additional time and money just to reach the evaluation stage for the system.

2.2   Logic's NK.bin Files

Logic Product Development provides two different types of NK.bins for each supported platform: a Show Image and a Dev Image. The main difference between the two images is that the Show Image is structured to demonstrate the "built-in" Windows CE applications, whereas the Dev Image is without certain high-level applications, but includes a variety of development libraries that the Show Image does not contain. Therefore, use the Dev Image for application or ".dll" development, and use the Show Image to demonstrate Windows CE functionality.

The rationale for providing two unique OS images is to keep the overall size of the image less than 16MB. Please note that in order for any of the OS images to function correctly, a properly formatted CompactFlash® card must be inserted into the memory-mapped CompactFlash slot on the Zoom™ Development Kit because the system's registry is stored on the CompactFlash card.

3   NK.bin Usage in Design Phases

The following sections contain bulleted lists describing the capabilities of an NK.bin in the different phases of product design. Please bear in mind that the features available in an OS image are typically constrained by the hardware peripherals available on the development platform.

3.1 Demonstration and Evaluation Phases

The following items can be demonstrated and evaluated with an NK.bin on Logic's Zoom Development Kits.

3.1.1 Display

Demonstrating and evaluating different display technology is key to showing overall system functionality and for increasing confidence in the display technology. Supported display interfaces for demonstration and evaluation with the NK.bin include:

- Logic's LCD Zoom Display Kits
  - □ Different resolutions and settings are controlled via a single parameter "disp_num" on the bootloader command line.

- Custom LCD Panels
  - □ An application can be created that modifies the registry settings for the display driver after the initial boot. Alternatively, ActiveSync™ can be used to manually modify the settings. Successive power-ons will then use the correct settings for the customer LCD panels.

- Other
  - □ A CRT interface can also be demonstrated, but requires an external Digital-to-Analog Converter IC to translate the LCD signals into the necessary signaling for the CRT. Logic typically uses a 640x480 or 800x600 registry setting for CRT signaling.

3.1.2 Connectivity

Demonstrating and evaluating different data transports and user interface peripherals gives the user the ability to do something "useful" with the system. These connectivity interfaces can be applied to demonstrate or evaluate interfaces that will be used on the final product. Supported connectivity interfaces for demonstration and evaluation with the NK.bin include:

- Ethernet
  - □ Default behavior is to use DHCP to obtain an IP address. If proper network connectivity is provided, the device can browse the web and use other Windows CE networking utilities.

- USB Host
  - □ Devices such as USB key fobs, USB mice, and USB keyboards can be demonstrated. Please note that due to the embedded nature of Microsoft's USB host stack, not all variations of devices are supported.

- USB Function / ActiveSync
  - □ ActiveSync will automatically connect upon cable-connect as long as the PC it is being connected to has the correct driver available (downloadable from the Logic website).

- Kernel Independent Transport Layer (KITL)
  - □ It is possible to connect to Windows CE Platform Builder via KITL (over Ethernet) by sending the appropriate bootloader command line to the OS image.

- Other
  - □ SPI, I2C, local bus, and other "bus" type interfaces can be demonstrated by writing application- or driver-level software to interface with the bus and connected peripherals.

3.1.3 Development Tools

Demonstrating and evaluating the development tools are essential for establishing developer confidence in their ability to exercise their intellectual property via application or device driver code. The ability to use the tools is sometimes also a requirement to deploy other benchmarking

or functionality exercises on the system. Supported development tools for demonstration and evaluation with the NK.bin include:

■ eMbedded Visual C++®
  □ Native application and/or device driver development can be performed by using the freely-downloadable eMbedded Visual C++ application development tool from Microsoft®. Connectivity to eMbedded Visual C++ is via "Platform Manager," which uses ActiveSync, TCP/IP, or KITL as its communications medium.

■ Visual Studio® .NET
  □ Managed application development can be performed using Visual Studio .NET 2003 with the .NET Compact Framework. Both managed and native application development can be accomplished with Visual Studio 2005. The primary connection used for active cross-development is ActiveSync.

■ Windows CE Platform Builder
  □ Windows CE Platform Builder can be used to develop application or dynamic link libraries, and connect to the binary OS image via KITL.

■ Other
  □ Other development tools and interfaces, such as status LED indicators and debug UART functionality, are part of the NK.bin and can be controlled via the bootloader command line, or application and driver functionality. A JTAG emulator can also be used at lower-levels of development with the system, but this is typically below the OS layer.

3.1.4 Applications

Demonstrating and evaluating different applications is often needed to gather information on the "look and feel" of the final system or to provide a quick way to comparatively evaluate performance on a number of systems. Supported applications for demonstration and evaluation with the NK.bin include:

■ Auto-Launch Application
  □ If an application called "boot_app.exe" is placed on a CompactFlash card in the memory-mapped CompactFlash slot, it will run automatically at system boot.

■ Application Development
  □ All types of application or device driver cross-development can be accomplished by using either an ActiveSync or a KITL connection as the communications transport between the development kit and a PC running an application development tool.

■ Windows Media® Player
  □ Windows Media Player is a good application to use for demonstrating and evaluating system A/V performance.

■ Other
  □ A variety of other applications are provided in the OS images, everything from WordPad™ to performance testing applications such as iltiming.exe.

3.1.5 Storage

Demonstrating and evaluating different storage technology is key to understanding the capabilities of non-volatile storage (e.g., density, speed, and general functionality). Supported storage for demonstration and evaluation with the NK.bin include:

- CompactFlash
  - Memory CompactFlash cards of all sizes can be supported. The CompactFlash card interface is provided via a root-level folder on the system's filesystem. It is also available via the filesystem Application Program Interfaces (API) to an application.

- USB Memory Sticks
  - A variety of USB memory sticks are supported and exposed as a root-level folder on the system's filesystem. Please note that due to the embedded nature of Microsoft's USB host stack for mass storage devices, there are some USB memory sticks that may not function without modification of the USB host stack source code.

- Other
  - Other volatile and non-volatile memory can be exposed via application or driver software accessing the hardware directly. Please note that, although a flash-file system driver is not included in the binary OS images, Logic does provide one as part of the downloadable BSP components.

3.1.6 User Interface

Demonstrating and evaluating different user interfaces is essential for understanding how the final product may look, sound, and feel. The ability to control user interfaces in a manner similar to the final product is also useful for creating a mock-up product for show-and-tell exercises. Supported user interfaces for demonstration and evaluation with the NK.bin include:

- Touch Screen
  - Almost any four-wire resistive touch screen can be demonstrated and evaluated with the system. If the panel is not calibrated, the calibration sequence can be manually activated or launched via an application API call.

- Audio
  - Both audio-in and -out can be demonstrated. Audio-out is most often demonstrated via the standard shell sounds or Windows Media Player, while a custom application can be used to record and play audio to demonstrate audio-in functionality.

- Display
  - Graphical APIs can be called via application or driver code to draw custom screens.

3.1.7 Performance

Demonstrating or evaluating different system performance traits is essential for understanding whether the underlying hardware will support the real-time and user interface needs of the final product.

Supported performance traits for demonstration and evaluation with the NK.bin include:

- Interrupt Response
  - Applications such as iltiming.exe can be used as an out-of-the-box method to evaluate relative system performance. Custom code can also be written to act as an interrupt service routine or interrupt service thread to evaluate a specific hardware interrupt response time.

- Multimedia
  - Windows Media Player can be used to get an idea of the frame rate at which a specific video file can be played back. A custom application could also measure bit times for custom drawing requirements.

- Processor Speed
  - Software can be run on the system to benchmark the processor with a specific benchmark program.

- Other
  - Scenarios can be developed to measure several performance features as one value. For instance, the performance of the system could be evaluated in transferring files over ActiveSync while simultaneously playing back an mpeg video file.

3.2 Product Development Phase

There are some activities, typically associated with the product development phase, that cannot be achieved with an NK.bin. In these cases, a BSP in conjunction with the Windows CE Platform Builder image-creation tool should be used to create a customized OS image. Some items that require the binary or source-code BSP to create a custom OS image include:

- Built-in device driver development
  - Developing with drivers that load as part of the OS at boot time.

- OS Image size or location modification
  - Changing the physical size of the NK.bin, and where it should run from or be programmed at (e.g., run from flash vs. SDRAM).

- Default system registry modifications
  - Changing the default behavior of how the system loads and what parameters are used by the built-in OS components.

- OS component selection
  - Changing which OS components are included in the NK.bin (e.g., removing the TCP/IP stack, adding a built-in device driver, adding wireless networking support).

- Modifying OS components
  - Modifying source code for items like the explorer shell, communication stacks, built-in device drivers, etc.

- Shell replacement
  - Replacing the explorer shell with a custom shell or application.

- System boot time optimization
  - Configuring the different built-in OS features to optimize the time it takes the system to go from power-on to fully functional.

4 Summary

Although there are some activities during product development that cannot be accomplished without using Board Support Package (BSP) software, the majority of demonstration and evaluation activities can be accomplished by using a stock binary Windows CE OS image. These images are downloadable for free from Logic Product Development's website for any individual that has purchased a development kit from Logic. Documentation and supporting tools are also provided to walk the user through NK.bin usage, and enable development and connectivity on the development kit.

Appendix A: Logic's Windows CE Offerings

This appendix exists as an overview of the different Windows CE-related offerings Logic provides to help determine the most effective use of pre-compiled binary OS images during product development. These offerings are available for multiple hardware platforms (Logic's development kit and module products) and include the following items:

- Pre-Compiled Binary OS Image
  - □ Use to quickly demonstrate and evaluate features of the hardware system and the Windows CE OS.
  - □ The downloadable is available for free from website for any development kit user.

- Binary Board Support Package (BSP) Components
  - □ Use to create custom Windows CE images (e.g., customize size, location, and feature-list of the Windows CE OS image).
  - □ The downloadable is available from website if authorized per the terms detailed in the *BSP Software License Agreement*.

- eMbedded Visual C++ Software Development Kit
  - □ Used with eMbedded Visual C++ to perform Windows CE native application development on Logic's development kit or SOM products.
  - □ The downloadable is available for free from website for any development kit user.

- Sample Source Code
  - □ Used as reference source code for Windows CE application or device driver development.
  - □ The downloadable is available for free from website for any development kit user.

- Evaluation Guide
  - □ Use as a guide to get Windows CE binary OS images running on development kit hardware quickly.
  - □ The downloadable is available for free from website for any development kit user.

- BSP QuickStart Guide
  - □ Use as a guide to gain a minimal level of experience in building a custom Windows CE OS image with a Board Support Package.
  - □ The downloadable is available for free from website for any development kit user.

- BSP User's Guide
  - □ Use as a reference for how to interact with Board Support Packages.
  - □ The downloadable is available for free from website for any development kit user.

- Driver Description
  - □ Use to understand how to configure and interact with device drivers.
  - □ The downloadable is available for free from website for any development kit user.

- PC Workstation USB Driver
  - □ Use to connect a development kit to a development workstation via ActiveSync.
  - □ The downloadable is available for free from website for any development kit user.