

Booting XP Embedded from USB Flash

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1 The Issues with USB

Compact Flash (CF) has understandably been the most talked about boot device for Windows XP Embedded. Flash life issues, EWF setup, and removable versus fixed have been discussed and re-discussed and written about over the past few years. Being small, inexpensive, and readily available, it is understandable why flash is so popular. As technology evolves, new products begin to take shape. USB flash disks have virtually taken over for the floppy drive as a simple removable drive.

Like CF, USB flash disks are small, inexpensive, readily available, and almost everyone who has a computer has a USB port. With USB 1.x, booting is slow and boot-time is long for a system as big as XP Embedded, but with USB 2.0, the possibilities for a faster flash boot solution is feasible. The past couple years have seen a growing interest in booting XP Embedded from a USB flash disk. The problem is that XP and XP Embedded do not have direct support to boot from a USB device. IDE and to a lesser extent SCSI drives were the standard when Windows XP was introduced. Booting from a USB device wasn't imaged when Windows XP was being developed.

The problem is that the NT Hardware Detect doesn't look for a USB device and the USB driver is loaded well after the kernel has switched the system from real-mode to protected mode. There have been attempts to boot from USB. As anyone who has tried booting XP Embedded from a USB disk knows, the result is always the infamous blue screen.

There have been 3rd party custom solutions and lengthy instructions to get XP Embedded to boot from USB, but the consensus in the XP Embedded community has been to have direct support built into Windows XP Embedded.

2 USB 2.0 Boot

2.1 A New Embedded Enabling Feature

By popular demand and with community feedback, Windows XP Embedded Service Pack 2 Feature Pack 2007 introduces a new embedded enabling feature (EEF) called USB Boot 2.0, thus it is now possible to boot XP Embedded from USB flash disks. Most importantly, the new EEF solution is intended to support any USB 2.0 flash disk and not just custom USB flash disk solutions. Best of all, booting from USB 2.0 is fast. USB 2.0 has a bandwidth of 480Mbps (it won't transfer that fast), which is much faster than standard CF with Port I/O mode of 12Mbps.

There are two new components and a prep utility that make up the USB Boot 2.0 solution:

- **USB Boot 2.0** - supports booting from USB flash devices. Given the wide availability of external USB ports on PC boards and the rapidly falling cost of USB devices, USB boot media are a cost-effective alternative to compact flash.
- **USB NT Hardware Detect** – a special version of NTDETECT.COM to look for the USB boot device.
- **UFDPrep.EXE** – new USB flash format utility. Lays down the NT Boot section on the flash disk.

Even though the support is available in XP Embedded, this is only part of the solution. The target hardware, specifically the BIOS, plays a big role whether you can boot from USB 2.0. There are some system considerations that need to be addressed:

1. System must support USB 2.0 and the ability to boot USB 2.0 devices. Some systems support USB 2.0, but the BIOS doesn't flip the bits to switch USB 1.1 to USB 2.0.

2. USB HDD emulation support - In some cases, the BIOS needs to emulate the USB flash drive as a hard drive.

USB has been around for awhile now, but many older systems don't have the correct support in the BIOS. The newer systems may have support; but many still do not, so you have to contact your hardware vendor for more information.

2.2 Implementing the USB Boot 2.0

Now let's walk through some steps to implement USB Boot 2.0.

1. Run TAP.EXE under Windows XP Pro on your target hardware.
2. Import the resulting PMQ file into Component Designer and create a platform macro component. You may have to create device driver components for any missing items; especially USB chipset drivers.
3. Import the component(s) into the database using Component Database Manager.
4. Open Target Designer and create a new configuration.
5. Add the newly created platform macro component.
6. Add the USB Boot 2.0 component.
7. Add the Runtime Quick Start Helper Macro component.
8. Make sure "Auto-resolve dependencies" is checked in the Tools->Options->Dependency Check. Run Check Dependencies. USB NT Hardware Detect will automatically be brought into the configuration.
9. Build the image.
10. Save the configuration.

The next step is to prepare the flash disk using the new UFDprep.exe utility.

11. Insert the flash disk in to the development PC.
12. Open a command window
13. run the UFDprep.exe utility:

```
c:\>ufdprep <drive>, where <drive> is the drive letter for the USB flash disk you want to format
```

14. Once the format has completed, copy the XPe image to the USB flash disk.
15. Undock the USB flash disk.
16. Insert the USB flash disk into the target.
17. Set the BIOS in the target to boot USB 2.0, and let the system boot from the flash disk.

The system will run through FBA and the XPe build will boot. This is only a basic test. USB flash disks have the same flash life issues as CF devices. You will want to implement the Enhanced Write Filter or the File Based Write Filter to protect the flash from constant writes.

3 New Possibilities and a New Deployment Solution

The ability to boot from USB flash disk opens new possibilities for development deployment and field upgrade. First is the ability to service systems in the field. Field support staff can boot to a USB flash disk and copy down log files, troubleshoot hardware, or upgrade whole images or just a few files.

The next possibility is a new XP Embedded image deployment solution. The current offering in XP Embedded is to use a WinPE/SDI combination to transfer the image over a network from the development machine to the target. WinPE has its limitation because it might not have all the

support needed for the target's hardware, and the combination with SDI creates too many steps where something could go wrong. Another limitation is that WinPE is bootable from a CD, and some systems don't support a CD-ROM drive.

Now, using the new USB Boot 2.0 solution, a USB 2.0 Flash disk could hold an image that supports TCP/IP file sharing. The developer can boot to the USB flash disk, prepare and share the local hard drive on the network, and then drag and drop a new XPe image from the development machine. This would save a whole lot of time compared to the WinPE/SDI solution. You could add support for a bunch of network cards so you could have a single USB flash disk that would support different Ethernet cards.

To create this deployment disk for the above configuration, all you have to do is the following:

1. Open the configuration in Target Designer.
2. Add the following components if they are not already in the configuration:
 - a. TCP/IP Networking with File Sharing and Client For MS Networks
 - b. Disk Management MMC Snap-In
 - c. System Control Panel
 - d. Administration Support Tools
 - e. Control Panel Command Line Support
 - f. NTFS
 - g. FAT
 - h. NTFS Format
 - i. FAT Format

The above components add network sharing capability so you can share a drive on the network. The other components add support to partition and format the target hard drive.

3. Add any network cards to the configuration.
4. Check dependencies.
5. Build the image.
6. Save the configuration.
7. Run the image on the target. Once the image has completed FBA you can use the image to prepare and share the local hard drive, and then copy an XP Embedded image to the shared drive.

The above solution would be limited to the target hardware. The USB disk couldn't be used with a different chipset. The alternative would be to remove any ACPI components and replace them with the Standard PC component. You may have to keep or add chipset drivers for some chipsets.

4 Summary

Booting from a USB disk has long been sought by the XP Embedded community, and it is now a new out-of-the box boot feature in XP Embedded. The ability to boot from small, inexpensive, and readily available flash disks opens up new possibilities to boot XP Embedded faster, deploy images more simply, and provide new, simple means to support systems in the field.