Boot Process

Section Four

Troubleshooting Bootup Problems

Introduction

GENERAL

What happens in the bootup process is extremely important to both the performance and reliability of the operating system. Errors recorded during the bootup process can affect applications and hardware functionality. By stepping through the bootup process we can map out when and why something fails later on.

The Microsoft Windows XP Professional Boot Process:

- The Pre-Boot Sequence
- The Boot Sequence
  Initial Boot Loader Phase
  Operating System Selection Phase
  Hardware Detection Phase
  Configuration Selection Phase
- Kernel Load Sequence
- Kernel Initiation Sequence
  Hardware Key Is Created
  Clone Control Set Is Created
  Device Drivers Are Loaded and Initialized
  Services Are Started
- Logon Sequence

The Pre-Boot Sequence

POST

The *power on self test* is part of all Intel/AMD based personal computer bootup process. POST insures that basic hardware work together and is initially configured to work with each other. It does not insure that all hardware configuration possibilities are, in fact, working at a premium. POST can complete with errors (displayed or not).

When power is turned on, POST (Power-On Self-Test) is the diagnostic testing sequence that a computer's basic input/output system (or “starting program”) runs to determine if the computer keyboard, random access memory, disk drives, and other hardware are working correctly.

If the necessary hardware is detected and found to be operating properly, the computer begins to boot. If the hardware is not detected or is found not to be operating properly, the BIOS issues an error message which may be text on the display screen and/or a series of coded beeps, depending on the nature of the problem. Since POST runs before the computer's video card is activated, it may not be possible to progress to the display screen. The pattern of beeps may be a variable numbers of short beeps or a mixture of long and short beeps, depending on what type of BIOS is installed.

The patterns of beeps contain messages about the nature of the problem detected. For example, if the keyboard is not detected, a particular pattern of beeps will inform you of that fact. An error found in the POST is usually fatal (that is, it causes current program to stop running) and will halt the boot process, since the hardware checked is absolutely essential for the computer's functions.

BEEP CODES

American Megatrends' AMI BIOS.

TABLE 1.

Beeps	Description
1	The memory refresh circuitry has failed
2	Parity errors have been detected in the first 64 KB of memory
3	A failure has occurred within the first 64 KB or memory
4	System Timer failure: Timer 1 on the mainboard does not work properly
5	The CPU has generated an undetectable error
6	8042 Gate-A20 failure: BIOS cannot switch the CPU into protected mode
7	The CPU has generated an exception error
8	The video adapter is missing, or the memory on the adapter has generated a failure
9	The ROM checksum value does not match the value in BIOS
10	The shutdown register for CMOS interrupt channel 2 has failed POST; the system board cannot retrieve CMOS contents during POST
11	Level-2 cache memory has failed the tests, and has been disabled
2 short	POST has failed, caused by a failure of one of the hardware tests

TABLE 1.

Beeps	Description
1 long / 2 short	Failure in video system: a checksum error was encountered in video BIOS ROM, or a horizontal retrace failure has been encountered
1 long / 3 short	Failure in video system: the video DAC, the monitor detection procedure or the video RAM has failed
1 long	POST procedures have passed

AST Research BIOS.

TABLE 2.

Long	Short	Description
0	1	Low level processor verification test failed (POST 1)
0	2	Clearing keyboard controller buffers failed (POST 2)
0	3	Keyboard controller reset failed (POST 3)
0	4	Low level keyboard controller interface test (POST 4)
0	5	Reading data from keyboard controller failed (POST 5)
0	6	System board support chip initialization failed (POST 6)
0	7	Processor register read/write verify test failed (POST 7)
0	8	CMOS timer initialization failed (POST 8)
0	9	ROM BIOS checksum test failed (POST 9)
0	10	Initialize primary video (POST 10)
0	11	8254 timer channel 0 test failed (POST 11)
0	12	8254 timer channel 1 test failed (POST 12)
0	13	8254 timer channel 2 test failed (POST 13)
0	14	CMOS power-on and time test failed (POST 14)
0	15	CMOS shutdown byte test failed (POST 15)
1	0	DMA channel 0 test failed (POST 16)
1	1	DMA channel 1 test failed (POST 17)
1	2	DMA page register test failed (POST 18)
1	3	Keyboard controller interface test failed (POST 19)
1	4	Memory refresh toggle test failed (POST 20)
1	5	First 64 KB memory test failed (POST 21)
1	6	Setup interrupt vector table failed (POST 22)
1	7	Video initialization failed (POST 23)
1	8	Video memory test failed (POST 24)

Phoenix BIOS

TABLE 3.

Beeps	Description
1-1-3	CMOS read/write failure
1-1-4	ROM BIOS checksum failure
1-2-1	Programmable interval timer failure
1-2-2	DMA initialization failure
1-2-3	DMA page register read/write failure
1-3-1	RAM refresh verification failure
1-3-2	First 64 KB RAM chip or data or data line failure
1-3-3	First 64 KB RAM odd/even logic failure
1-3-4	First 64 KB RAM address line failure
1-4-1	First 64 KB RAM failure bit 0
1-4-2	First 64 KB RAM failure bit 1
2-1-1	First 64 KB RAM failure bit 2
2-1-3	First 64 KB RAM failure bit 3
2-1-4	First 64 KB RAM failure bit 4
2-2-1	First 64 KB RAM failure bit 5
2-2-2	First 64 KB RAM failure bit 6
2-2-3	First 64 KB RAM failure bit 7
2-2-4	First 64 KB RAM failure bit 8
2-3-1	First 64 KB RAM failure bit 9
2-3-2	First 64 KB RAM failure bit A
2-3-3	First 64 KB RAM failure bit B
2-3-4	First 64 KB RAM failure bit C
2-4-1	First 64 KB RAM failure bit D
2-4-2	First 64 KB RAM failure bit E
2-4-3	First 64 KB RAM failure bit F
2-4-4	Slave DMA register failure
3-1-1	Master DMA register failure
3-1-2	Slave interrupt mask register failure
3-1-3	Slave interrupt mask failure
3-1-4	Keyboard controller test failure
3-2-4	Screen memory test failure
3-3-4	Screen initialization failure
3-4-1	Screen retrace test failure
3-4-2	Failure searching for video ROM
3-4-3	No timer tick
4-2-1	Unexpected interrupt in protected mode

There are several more beep code tables but these are most common.

The boot sequence

BOOTUP FILES

The following files are used during the boot process:

TABLE 4.

File Name	Location	Boot Sequence Used
NTLDR.EXE	C:\	Preboot and boot
BOOT.INI	C:\	Boot
BOOTSECT.DOS	C:\	Boot (optional)
NTDETECT.COM	C:\	Boot
NTOSKRNL.EXE	C:\Windows\System32	Kernel load
NTBOOTDD.SYS	C:\	Preboot (used only when using a small computer system interface (SCSI) controller)
HAL.DLL	C:\Windows\System32	Kernel boot
SYSTEM	C:\Windows\System32\Config	Kernel init
Device drivers (*.sys)	C:\Windows\System32\Drivers	Kernel init

CONTROL SETS

FIGURE 1. Registry Control Sets

The *CurrentControlSet* is the governing control set for your system configuration. It is generated every time you boot your computer. It gets its configuration from the boot up process. Once you login it is copied to the *ControlSet001* (as a cloned control set). If you run into problems prior to logging in you can always reboot your system and load the ControlSet001 and recover from any problems. This is known as the *last known good* option that can be accessed during the bootup process using the F8 key.

The problem is that people login prior to the boot process completing. As you boot up and log in, you'll notice that your hard drive is still accessing files even though Microsoft has given you access to the login prompt. It is a very good idea to let the hard drive finish loading files prior to logging on. When you login, your last known good option is replaced by the CurrentControlSet and all of its problems -- removing your chance to recover easily.

BOOT.INI

There are two sections of the boot.ini file:

1. The “boot loader” section, which contains time-out settings and path to the default operating system.
2. The “operating system” section which contains paths to each operating system installed.

SAFE MODE

There are three “safe modes” available during startup:

1. **Safe Mode** (basic drivers and files needed to run the computer)
2. **Safe Mode with Networking** (same as 1 with networking options)
3. **Safe Mode Command Prompt** (same as 1 without GUI)

ADVANCED BOOT OPTIONS

TABLE 5.

Option	Function	Purpose
Enable Boot Logging	Logs all drivers and services that are loaded at startup	Helps you to determine the cause of system problems.
Enable VGA Mode	Loads basic VGA	Used to debug new video settings
LastKnownGood	Loads ControlSet001	Allows you to backout from a bad system configuration change prior to logging on.
Debugging Mode	Sends debugging information across a serial cable to another computer	Gather information about a badly crippled computer using another computer to link to.
Boot Normally	Exits advanced boot options menu	Continue the boot process
Reboot	Restarts the boot process	Ditto
Return to OS Choices	Returns you to the operating system choices	Lets you reselect the OS

INSTALLING THE RECOVERY CONSOLE AS A STARTUP OPTION

With the Windows XP CD-ROM in your CD ROM drive:

1. Click **Start**, then **run** and type **cmd**.
2. Switch to your CD ROM drive.
3. Type **\i386\winnt32.exe /cmdcons** (if you are using a 32 bit computer)
4. Type **\ia64\winnt32.exe /cmdcons** (if you are using a 64 bit computer)
5. Click yes to install the recovery console, follow defaults.

RUNNING THE RECOVERY CONSOLE FROM THE CD

With the Windows XP CD-ROM in your CD ROM drive:

1. **Press any key to boot from your CD** (this option must be selected in your computer BIOS to work).
2. Allow the CD to boot.
3. On the Welcome to setup screen type **r** for recovery.
4. Select an installation to repair, then type the password to the administrator.

Additional Boot Fixes

CREATING RESTORE POINTS

This option allows to the ability to build restore points prior to adding new applications or modifying your system configuration. If the new applications cause problems with your system then you can just return to the previous set of application or system configuration without major work being required.

To create restore points:

1. Click **Start**, point to **All Programs**, point to **accessories**, point to **System Tools**, and then click on **System Restore**.
2. Select **Create a restore point** and then click **next**.
3. Type a name for your restore point (such as: *before installing Office XP*).
4. Click **create** and then **close**.

REVERTING TO RESTORE POINTS

To revert to a restore point:

1. Click **Start**, point to **All Programs**, point to **accessories**, point to **System Tools**, and then click on **System Restore.**
2. Select **Restore my computer to an earlier time,** then click **next**.
3. On the calendar, **select the day** that contains the restore point to wish to revert to. **select the specific restore point** then click **next** twice.

SUMMARY

As you can see, Windows XP offers many ways to, not only manage the boot process, but also recover from bad upgrades or system modifications. While there are numerous other options that can be applied to this section, section four covers most of the information you should be familiar with.

The key to recovery is:

1. Do not panic
2. Take your time fixing what is broken.
3. Make recovery points as often as you modify your system.
4. Do not login until the hard drive stops reading files.