

## **Y2K Microcomputer Hardware Compliance Issues**

### **Scope:**

Of the estimated 12,000 microcomputers within the State's installed base, it is believed that approximately 30% - 45% may not be year 2000 hardware compliant. This is due to the fact that the majority of microcomputers manufactured and purchased by agencies before mid-1996 exhibit the Year 2000 hardware problem, "costing the enterprise an average of \$36 per PC to test and correct" (Gartner Research, Note TU-820-1340, Oct. 29, 1996). If Gartner is correct on their numbers then the cost to the State of Maine to achieve Y2K hardware compliance on Intel based Microcomputers may run from \$100,000.00 to \$200,000.00+.

### **Y2K Hardware Problem/Design Flaw:**

Beginning with the IBM AT and compatible microcomputers a battery backed-up hardware timer, called a Real Time Clock (RTC), is used to keep track of the current date and time. Due to storage limitations and design oversights, the standard RTC can only store (address 9) the last two digits of a four-digit year. To overcome this limitation, a byte in the Complementary Metal-Oxide Semiconductor (CMOS) memory was allocated (address 50d) to track the two-digit century information of the date.

When the PC is booted, the ROM (Read Only Memory) BIOS (Basic Input/Output System) combines the century information (contained in CMOS) with the last two digits of the year (contained in the RTC) to create a four digit year. The ROM BIOS then initializes the system with the complete date and time and makes the date and time available to the operating system and any application that asks for them. Most applications obtain the date and time from the operating system; however, some applications may read the date and time directly from the CMOS RTC memory or the BIOS.

In AT-compatible PCs, the inability of the CMOS byte to update itself leads to an incorrect interpretation of the date in year 2000. The RTC will update itself from "99" to "00" but the CMOS remains constant, at "19", in theory causing 2000 to become 1900. In reality, based on the version of the ROM BIOS chip installed and the operating system in use, the system date will likely be interpreted as "1980" or "1984" instead of "2000".

The Year 2000 problem will manifest itself by the failure to update the CMOS century information when the RTC rolls over from 11:59PM 12/31/99 to 12:00AM 01/01/00. Since most operating systems (i.e., Windows, NT, OS/2) use the system clock as the time reference, any date/time based calculations or stampings will be incorrect for software applications. Although generally capable of handling dates after 1999, operating systems will only boot into the year 2000 if the system BIOS is compliant -- exceptions to this are Windows 98, Windows NT v3.51

(with Service Pack 5), Windows NT v4, and OS/2 Warp v4, which will reinterpret incorrect BIOS dates of 1900 as correctly being 2000.

Since lack of support for the Year 2000 is a basic AT architectural design flaw, it is a known fact that *most PCs released and/or purchased before mid-1996 exhibit the year 2000 "date" problem. Having a motherboard produced after mid-1996 is no guarantee that the system is year 2000 compliant, as the BIOS chip may have been produced earlier.* While not fully confirmed for "every" new PC delivered, it is believed that all microcomputers made available from the existing statewide desktop, server, and notebook contracts (awarded between 4Q97 and 1Q98) are year 2000 compliant, these microcomputers most likely contain year-2000-compliant BIOSs. PC hardware year 2000 compliance means that the CMOS RTC hardware year - as provided via the BIOS - increments from 1999 to 2000, and that a valid 2000+ BIOS date will remain correct after rebooting. Therefore, no software, hardware, or user intervention is required for computers containing year-2000-compliant BIOSs. Unfortunately, this is not the case for the majority of microcomputers purchased from prior purchases. For these systems other solutions are required to establish Y2K compliance.

### **Y2K Hardware Compliance Solutions Advantages & Disadvantages**

Several potential hardware compliance solutions exist for correcting the Y2K hardware problem exhibited by the majority of AT-compatible microcomputers manufactured and purchased before mid-1996. These hardware solutions bring about various pros, cons and associated risks. It is impossible to recommend a single solution for all situations due to the estimated 12,000 + microcomputers within the State's installed base, their location, and use. **The manual set/date fix is the optimal solution.** With the exception of mission critical high-risk systems and applications, other recommended solutions include the **Server Date Push** and **Software Date Fix/TSR** solution for establishing Y2K hardware compliance for most desktop and notebook microcomputers. For mission critical high-risk systems/applications, agency consideration should be given to the other solutions on a case by case basis.

#### **Manual Set Date/FIX:** *Recommended Solution*

The only **nearly guaranteed** approach of updating PCs with non-compliant BIOSs. The manual set/date may either be delegated to users where viable or managed by a dedicated SWAT team before work resumes after January 1, 2000. The DOS DATE command and equivalents set both the CMOS RTC and the DOS dates correctly if used on or after January 1, 2000. All four digits of the year must be entered if the two-digit year is less than "80".

#### **Advantages:**

- Guaranteed approach (if performed correctly) for updating PCs with non-compliant BIOSs.
- A no-cost solution, with exception of people resources.

## **Disadvantages:**

- *Fix cannot be applied in advance.*
- It is error prone; the date may not be entered correctly (i.e. typo) or forgotten about.
- Programs may get launched/executed (for example in autoexec.bat) before the date command or equivalent can be manually entered.
- It is not suitable for PCs which are left running continuously or which may be left on (for whatever reason) overnight on December 31, 1999.
- Some machines will auto-revert back to 1980 when they are powered-off. This is because in some computers the CMOS RTCs and BIOSs are incapable of storing dates equal to or greater than 2000. Estimated number of PCs with these problems are minimal.
- There may also be problems with leap year calculations being incorrect, but this is not likely.

## **Server Date Push (passing date/time stamp to clients):**

### *Recommended Solution*

This option provides an effective safety layer and is being adopted by BIS for all Novell Netware and Microsoft NT servers. The need of occasionally connected users (i.e., mobile users) is of concern. ***This should be view as a secondary, not a primary, solution to establishing Y2K hardware compliance.*** However, it can yield the same results as the manual set date/fix but without the possibility of human error/resources.

## **Software Date Fix/TSR:**

### *Recommended Solution*

Software-based compliance tools are applications loaded on a system to ensure the proper rollover of a system's complementary metal-oxide semiconductor (CMOS) century byte in year 2000. Software fixes are usually terminate-and-stay-resident (TSR) programs.

## **Advantages:**

- Economical vendor supplied solution.
- Corrects the majority of IBM AT-compatible systems (286 to Pentium processor models) offered by the various microcomputer manufacturers.
- ***A common solution that can be tested and applied organizationally and in advance to a large number and variety of PCs.***
- Eliminates the need to research and make available specific BIOS upgrades which may or may not be available (see BIOS Updates/Upgrades below).

## **Disadvantages:**

- May not work for all BIOS versions such as some AWARD v4.5x-series and Windows NT can't load TSRs (Note: NT v4.0 with Service Pack 3 detects and fixes the Y2K problem automatically).
- Unsuspecting individuals, not knowing what the patch/TSR software is, could easily remove the patch/TSR software from the config.sys or autoexec.bat files or modify its position/location.
- Personnel overhead cost (resources needed to apply and test fix/patch/TSR)

### **Operating-System Date Correction:**

Although not a true Y2K hardware fix/solution, Windows 98, Windows NT v4, and OS/2 Warp v4 all provide an additional safety layer to BIOS compliance. They all apply a layer of logic to reinterpret incorrect dates to be correct 21st-century date/year 2000. However, this solution should be treated as a secondary (safety net) approach, as BIOS and CMOS layers beneath may remain invalid or non-compliant.

#### **Disadvantages:**

Any system that has the minimum hardware resources to run these Operating Systems most likely have no Y2K issues. (Most recent purchases.)

### **BIOS Updates/Upgrades:**

Some BIOS chips allow for "flash" revisions/upgrades. A flash upgrade is a program that runs from a floppy or hard disk drive. It updates the system BIOS by overwriting or "patching" the information in the Read-only Memory (ROM) segment of the chip. PC suppliers like COMPAQ, DELL and IBM are making flash BIOS upgrades available for some of their existing systems via a diskette or on their web sites.

#### **Advantages:**

- RTC is corrected automatically via the BIOS update.
- Fix is invisible to the user.
- Cannot be accidentally eradicated (i.e. erased/removed) by the users.
- Only correct dates are passed to the OS and other software.
- A warranty (explicit or implied) is given by the supplier.

#### **Disadvantages:**

- Installation and management is resource intensive.
- Maybe overkill for such a simple problem.
- Some upgraded BIOSs only check (and if necessary correct) the date at boot time. This is inadequate for PCs which run continuously or are left on overnight on December 31, 1999 (i.e. servers).
- Not all BIOSs can be software / flash upgraded; the solution is not suitable for all PCs (especially older models).

- *Flash BIOS upgrading is not for the novice; the original BIOS is erased. When the wrong BIOS upgrade is obtained and/or performed improperly, it may render the motherboard useless; requiring, at minimum, a return to the manufacturer or distributor for repair.*
- PC manufacturers sometimes add their own changes to BIOSs originally created for them by BIOS manufacturers such as Award. If one goes back to Award to obtain what is believed to be the correct BIOS upgrade, one could easily erase modifications made by the motherboard manufacturer.
- BIOS upgrades can affect the successful operation of existing devices (i.e. peripherals).

### **BIOS Cards/Boards:**

Hardware-based cards (usually Industry Standard Architecture or ISA based) are used to detect and properly rollover a system to year 2000. Just like a video card, it works at the lowest level to create a BIOS extension that corrects both the BIOS and the hardware clocks and dates, permanently. An example of such a card is the Millennium BIOS Board by Fernlink 2000, LTD.

#### **Advantages:**

- Limited risk of user modification.
- Single solution for most PCs regardless of the operating system (i.e., DOS, Windows, NT, OS/2, UNIX).
- Most effective for mission-critical systems/applications environment.

#### **Disadvantages:**

- Most expensive solution (\$75.99 MSRP, plus labor).
- Installing and configuring an ISA card is no simple task, especially when it must be retrofitted into an existing configuration (i.e., I/O memory address assignment). Memory address conflicts are highly possible for existing SCSI devices as well as memory managers (i.e., Quarterdeck QEMM, Microsoft MemMaker).
- *Most difficult alternative to implement and should be avoided in almost all situations.*
- May not work for all BIOS versions (i.e., Phoenix 4.50g).
- Cannot be installed in systems containing only MCA card slots (i.e. IBM PS/2s)

### **CMOS RTC Device Replacement:**

Dallas Semiconductor manufactures the DS12C887, a hardware year 2000 compliant, drop-in, PC compatible CMOS RTC replacement device. Motherboards that feature a DS12-series Clock/CMOS RTC onboard socket will accept this device and achieve Y2K

hardware compliance.

**Advantages:**

- Limited risk of user modification.
- Most effective for mission-critical systems/applications environment.

**Disadvantages:**

- Cost of device and implementation may be prohibitive ( \$24.95 MSRP, plus labor) for large quantities of microcomputers.
- Only compatible in microcomputers that contain existing pluggable DS12-series Clock/CMOS RAM devices manufactured by Dallas Semiconductor as well as those made by Odin, BenchMarq, and Twinhead.
- Device cannot be implemented in the majority of PCs purchased from prior/current statewide microcomputer contracts; they contain no such onboard compatible socket.
- Examination of every PC motherboard is required for compatibility.
- Not compatible with all system BIOSs (i.e., Award 4.5 series).
- Not user installable; requires skill/trained technician.

**Y2K Software Date Fix/TSR:** - Software-based compliance tools are applications loaded on a system to ensure the proper rollover of a system's complementary metal-oxide semiconductor (CMOS) byte in year 2000. Software fixes are terminate-and-stay-resident programs (TSRs). As with most Y2K hardware compliance solutions, there are some risks associated with these solutions. TSR programs can easily be removed or modified from the batch files that load them and they usually need to be loaded into the 640K memory range. This can be a problem in older DOS and Windows 3.1 systems because this is an extremely critical, low-availability area that is subject to change. Nonetheless, this is still the best possible and economical solution for IBM AT-compatible systems (286 through Pentium processor models) purchased from prior/current statewide contracts as well as those obtained from other sources. For mission critical high-risk systems and applications, the other Y2K hardware compliance solutions may be more appropriate.

Several Y2K hardware remedies are suggested by various hardware manufacturers, Gartner Group, IT groups of other State Governments, Federal Systems Integration and Management (FEDSIM) center, US Nuclear Regulatory Commission as well as vendors claiming Y2K hardware compliance solutions. The Bureau of Information Services does not recommended any single vendor as a source for a Software Date/Fix TSR but recognizes that the State of Tennessee has performed extensive testing on Y2KPCPro from RightTime Corp and has found it to perform as advertised

**Free for Home Use:** Although Year2000.com is available "free" for evaluation purposes as well as home/non-business use via the [www.righttime.com](http://www.righttime.com) web site, Y2KPCPro (the licensed version of Year2000.com) is required for corporate/business implementation. Y2KPCPro includes all the functions of Year2000.com but it is strictly designed for use by businesses. It includes 4 levels of virus protection not found in the Year2000.com program which prevents potential program distortion and/or destruction.

Y2KPCPro is a small resident/TSR program for DOS (v3 or later), Windows 3.1, Windows 95, OS/2, and Netware (2.x, 3.1x, 4.1x) that cures the year 1999 to 2000 date change flaw of the CMOS RTC in IBM AT-class PCs, PS/2s, and their clones (including 286 through Pentium processor models). RightTime states that Y2KPCPro has better than a 95% fix rating for the majority of IBM AT-compatible PCs.

(Government pricing of \$4 per  
license guaranteed with a  
minimum order of 7,500 licenses)

Utilities available "free of charge" from the RightTime company are Test2000.exe and ViewCMOS.exe. Test2000.exe is a PC hardware year 2000 diagnostic. It performs two tests: a real-time BIOS 1999-2000 transition test, and a BIOS date retention after reboot test. If a machine passes these two tests, it is year 2000 hardware compliant. Testing for leap year is not necessary. According to RightTime, "no PC hardware leap year failures have ever been demonstrated, and there is no reason to suspect that PC hardware leap year errors exist.

Additionally, Test2000.exe can perform a timing test that reveals the differences between true hardware compliance and software fixes, whether applied by the BIOS, BIOS extensions or by utility software. Test2000.exe has been downloaded from Internet repositories more than one million times, and has been adopted by many large organizations including General Motors Corporation.

The ViewCMOS utility provides verification of Y2K hardware compliance/correction. It displays the date and time maintained in the CMOS RTC, BIOS, and DOS/operating system. ViewCMOS also displays at address 9 the last two digits of the year and at address 50d, the century

In addition to companies such as General Motors and Northwest Airlines, the following companies are included in the 750,000+ Y2KPCPro licenses sold:

- City of New York
- State of Florida, Orange County Data & Applications Department
- State of Maryland, Motor Vehicle Administration
- State of New Jersey, Judiciary Administrative Office
- U.S. Army Materiel Command
- U.S. Department of Veterans Affairs
- U.S. Library of Congress

- U.S. National Security Agency
- U.S. Postal Service