HP Notebook Hard Drives & Solid State Drives

Identifying, Preventing, Diagnosing and Recovering from Drive Failures

Care and Maintenance Measures

Technical White Paper

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Identifying, Preventing, Diagnosing, and Recovering from Drive Failures

Introduction

This white paper explains how companies and users can reduce the risk of hard drive failures. These measures include enhanced hard drive diagnostics, Intel Storage Matrix Technology, HP 3D drive guard, firmware updates, and more. The following sections explain how to identify and possibly prevent hard drive (HDD) and Solid State Drive (SSD) failures.

Symptoms of Hard Drive Issues

The symptoms of hard drive issues can be traced to connector issues, shock events, software issues, and more. The following sections summarize some of these.

Connector issues

It is important to check the physical connector that extends from the hard drive to the system board. A hard drive that is not detected by the BIOS or operating system may need adjustment.

Note: The following information is not applicable to Solid State Drives. In the event of an issue with an SSD, the HP Diagnostics should be run. Symptoms may include the following:

- The SSD drive is no longer recognized by the notebook.
- You receive an error message during Power On Self-Test (POST) that says "Imminent drive failure."
- Your notebook spontaneously restarts when the Windows OS is running.

Shock events

With each new generation of hard drives, manufacturers make improvements to the drive's susceptibility to shock events. However, hard drives are fragile, and if they are exposed to shock events beyond their specifications, they can fail.

Shock events can cause read/write head misalignment, or contact between the read/write heads and the media, resulting in symptoms such as a clicking noise, the failure to complete servo, and/or an inaccessible boot device message.

Typically, these symptoms result from a significant bump or drop, due to the following factors:

- Non-operational shock (when the notebook is turned off)

–or–

- Operational shock (when the unit is turned on and the hard drive is reading or writing data)

Shock events may cause different error messages to be displayed such as "Non-system disk" or "No boot device".

Software issues

Some hard drive performance problems appear to mimic hard drive failure, but may actually be caused by software issues. These software issues include (but are not limited to):

- File corruption
- File fragmentation
- Read errors

File Corruption

One of the most difficult software problems to trace is file corruption, because corruption occurs very easily during routine computer handling. For example, powering off the notebook before the OS has completed the shutdown process can create corrupted boot files that ultimately result in blue screens and/or continuous reboots.

Issues such as blue screens, application lockups, and other occurrences are caused by write splices. A write splice is an incomplete write to a sector of the HDD. Upon the next read of that sector, the OS encounters incomplete data, and marks this area as a bad sector. The OS remaps a reserved sector in its place.

If write splices continue to occur with increasing frequency, errors such as blue screens, application lockups, and other occurrences will result, because the HDD has reached the Self-Monitoring, Analysis, and Reporting Technology (S.M.A.R.T.) attribute threshold. S.M.A.R.T. technology was developed by a number of major hard drive manufacturers to increase reliability of drives. For more information on S.M.A.R.T attribute checking, refer to the "Client Management Software" section in this white paper.

File Fragmentation

Hard drive performance is also degraded when file fragmentation is not reduced by regular software maintenance. Over time, the hard drive file structure becomes fragmented due to continuous creating, editing, copying, and deleting of files. New data is written to the hard drive on a "first available space" basis. Fragmentation occurs when an entire file or application is not stored contiguously on the hard drive. Once fragmentation occurs, the hard drive throughput performance is impacted, because it must seek the data from multiple locations across the hard drive.

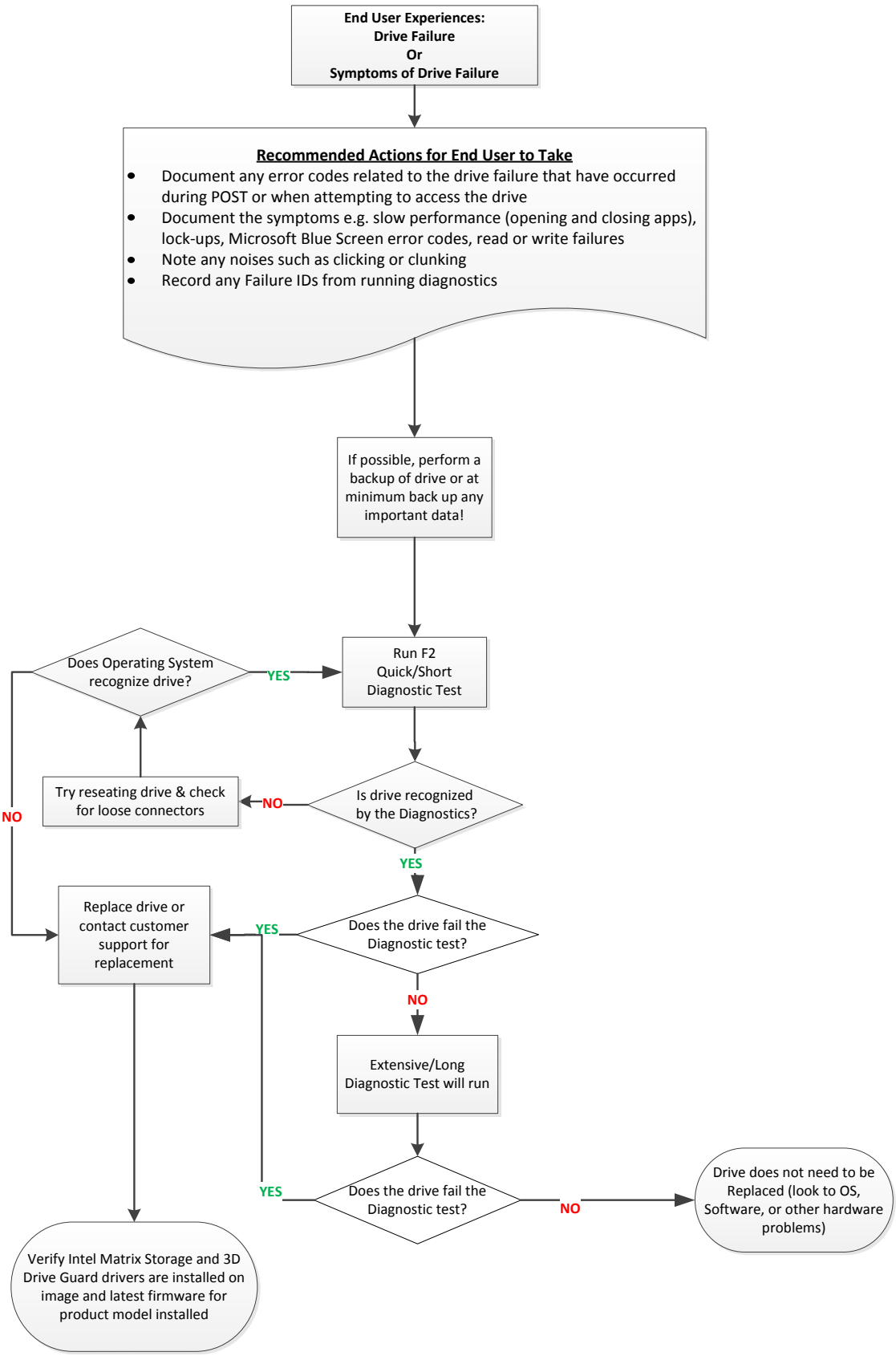
Read Errors

HDDs can experience issues due to read errors. In this situation, a low-level format of the drive can be performed. Refer to your HDD manufacturer for low-level format utilities or download the HP File Sanitizer for HP ProtectTools, located at the following website:

http://h20000.www2.hp.com/bizsupport/TechSupport/SoftwareDescription.jsp?lang=en&cc=us&prodTypeId=321957&prodSeriesId=4138624&prodNameId=4138625&swEnvOID=4054&swLang=13&mode=2&taskId=135&swItem=ob-86982-1

Other software issues may include viruses, application, and operating system (OS) bugs. To address these issues, refer to your software Help for more information.

Hard Drive / Solid State Drive Troubleshooting Flowchart



Hard Drive (HDD) & Solid State Drive (SSD) Diagnostics

HP Diagnostics

In the event you experience hard or solid state drive issues, the first step is to select the f2 function key when booting up the system. This diagnostic routine detects any faults and issues that can cause the drive to fail.

Note: The short/Basic and long/Full versions have been combined into one.

When initiated, the diagnostics perform the following steps:

- Runs the short/basic test. If no errors occur, the long/full test automatically runs.
- If no errors occur, S.M.A.R.T. attribute checking automatically runs.
- If a fault is detected in either of the tests, the process halts and a Failure ID or Code is displayed.

Note: The diagnostics may be aborted at any time by pressing the Esc key.

Note: The f2 Self-Test is available through the commercial notebook system BIOS. Please visit the HP Web site at http://welcome.hp.com/country/us/en/support.html to download the latest BIOS for your product. See the UEFI section below to install the more advanced diagnostics.

Advanced Diagnostics – Unified Extensible Firmware Interface (UEFI)

The HP System Diagnostics UEFI or HP UEFI Support Environment downloads provide more advanced diagnostic tests, which can be installed to a USB key. Go to your product Software & Drivers download page to obtain:
http://welcome.hp.com/country/us/en/support.html

To launch the UEFI diagnostics, select the f2 function key when booting up the system.

Note: The diagnostics may be aborted at any time by pressing the Esc key.

Additional information can be found at the following URL:
http://h20000.www2.hp.com/bizsupport/TechSupport/Document.jsp?lang=en&cc=us&objectID=c01443317&jumpid=reg_R1002_USEN

HP 3D Drive Guard

The opportunity for operational shock is greatest when the notebook is being moved. If the notebook is accidentally dropped or is abruptly impacted by another object, the HP 3D Drive Guard driver receives notifications from the integrated accelerometer, and protects the hard drive (HDD) by automatically "parking the heads" to reduce the risk of damage.

Download the latest HP 3D Drive Guard driver under the Solutions section from the “Download Drivers & Software” website for your product and OS:

http://www8.hp.com/us/en/support-drivers.html

Note: The 3D Drive Guard is not needed for SSD drives, but it does not harm or in any way damage an SSD if installed.

Firmware & Product Updates

It is important to check for updates for your product. There are new firmware updates for certain OEM drives and/or special product updates. Download and install any newer HDD firmware updates or other HDD related product drivers for your product and OS:

http://www8.hp.com/us/en/support-drivers.html

Intel Matrix Storage Technology driver

HP offers the Intel Matrix Storage Manager driver for notebook PC models that are configured with Intel Matrix Storage Manager Technology. The Intel Matrix Storage Technology solution technology provides improved performance and reliability, as well as support for lower power consumption on computer systems equipped with Serial ATA hard disk drives. Updates to the Intel Matrix Storage Manager driver are released to address known issues. The latest device driver versions address multiple known issues that could affect hard disk drive performance and reliability.

To download the latest version of the Intel Matrix Storage Technology driver:

http://www8.hp.com/us/en/support-drivers.html

Installing SATA drivers

SATA Native Mode is a storage interface technology that provides up to 150MB/sec transfer rate for disk traffic, and provides link power management with Intel® Application Accelerator drivers. Intel Matrix Storage Manager Driver provides support for the SATA Advanced Host Controller (AHCI) Interface.

Procedures for adding SATA drivers to RIS (Remote Installation Service) installation points include:

- Adding SATA drivers to installation CDs, building an image, and switching to SATA AHCI mode
- Using Sysprep with SATA in AHCI or NATIVE mode

Adding SATA drivers using WinPE can be located at the following URL:
http://bizsupport2.austin.hp.com/bc/docs/support/SupportManual/c01600726/c01600726.pdf.

Care and Maintenance Measures

Preparing Advanced Format HDDs for Microsoft Windows installations

Historically, hard disk drives (HDDs) have used 512-byte sectors; however, this sector size is now limiting HDD capacity. To address this limitation, the industry is moving Advanced Format drives with 4096-byte (4-KB) sectors – eight times larger than current drive technology. With 4-KB sectors, less space is wasted on the physical media, making the drive easier to manufacture and able to support higher capacities.

First-generation Advanced Format drives retain backwards-compatibility by using external SATA communications based on a 512-byte sector; however, these drives – also known as 512e drives – operate internally at 4 KB. Thus, any business notebook with a SATA interface can use an Advanced Format drive. Depending on the installed OS, extra steps may be required to optimize performance.

If an OS that is not Advanced Format-aware is being used, you may need to take steps to align logical sectors (OS) with physical sectors (disk media). For information about using Advanced Format drives to optimize the performance of your HP Business Notebook, refer to the following URL:

http://bizsupport2.austin.hp.com/bc/docs/support/SupportManual/c02691731/c02691731.pdf.

Hard Drive Mounting Bracket

Be sure the hard drive is secured in the mounting bracket correctly. For more information, refer to the Maintenance and Service guide for your computer.

HP CMI – Client Management Interface

HP has integrated SMART health monitoring into our management console portfolio. This support is included in all editions of HP Client Automation and HP Client Manager 7.0 from Symantec. More information can be found at the following URL:

www.hp.com/go/clientautomation

Additional HP Recommendations for Optimizing Performance on Products with Older Operating Systems

- It is important to have the latest BIOS, firmware, and driver enhancements for your computer. Check www.hp.com for the latest releases.
- Install and maintain a virus protection program to prevent failures due to viruses.
- Whenever possible, adjust the power management settings (power schemes) in the Control Panel to permit the hard drive to turn off when it is unused for an extended period of time. For example, adjust the power management settings if you work with applications that execute primarily from electronic memory (such as word processors) that do not have to access the hard drive very often.
- Perform the Defrag operation periodically to optimize the reading and writing of data to the hard drive. During this process, data is moved to contiguous space. As a result, movement of the hard drive reading/writing heads is decreased. Please refer to the following Microsoft Knowledge Base articles for information on how to defragment your hard drive:

Windows XP

http://support.microsoft.com/default.aspx?scid=kb;EN-US;314848

Windows XP command line:

http://support.microsoft.com/default.aspx?scid=kb;EN-US;283080

Windows 2000:

http://support.microsoft.com/default.aspx?scid=kb;EN-US;227463

- Use the Microsoft Recovery Console periodically to run the chkdsk /p /r commands in order to check your hard drive for any errors, bad sectors, and/or recovery of readable information. Please refer to the following Microsoft Knowledge Base articles for information:

Windows XP

http://support.microsoft.com/default.aspx?scid=kb;en-us;314058&Product=winxp

Windows 2000:

http://support.microsoft.com/default.aspx?scid=kb;EN-US;229716

For more information

Contact HP Technical Support:

http://welcome.hp.com/country/us/en/wwcontact_us.html

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