KillDisk

USER MANUAL

ver. 25

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Contents

Introduction

As a relatively new technology an overwhelming majority of people, businesses and organizations do not understand the importance of security in digital data storage. The average hard drive stores thousands of files written on it and many of them contain sensitive information. Over the course of a hard drives lifetime the likelihood for recoverable remnants of sensitive information left on a hard drive at its end of life is very high. To see this just try out **KillDisk**'s File Browser on your system drive. You'll be surprised to see what you find!

The modern storage environment is rapidly evolving. Data may pass through multiple organizations, systems, and storage media in its lifetime. The pervasive nature of data propagation is only increasing as the Internet and data storage systems move towards a distributed cloud-based architecture. As a result, more parties than ever are responsible for effectively sanitizing media and the potential is substantial for sensitive data to be collected and retained on the media. This responsibility is not limited to those organizations that are the originators or final resting places of sensitive data, but also intermediaries who transiently store or process the information along the way. The efficient and effective management of information from inception through disposition is the responsibility of all those who have handled the data.

The application of sophisticated access controls and encryption help reduce the likelihood that an attacker can gain direct access to sensitive information. As a result, parties attempting to obtain sensitive information may seek to focus their efforts on alternative access means such as retrieving residual data on media that has left an organization without sufficient sanitization effort having been applied. Consequently, the application of effective sanitization techniques and tracking of storage media are critical aspects of ensuring that sensitive data is effectively protected by an organization against unauthorized disclosure. Protection of information is paramount. That information may be on paper, optical, electronic or magnetic media.

An organization may choose to dispose of media by charitable donation, internal or external transfer, or by recycling it in accordance with applicable laws and regulations if the media is obsolete or no longer usable. Even internal transfers require increased scrutiny, as legal and ethical obligations make it more important than ever to protect data such as Personally Identifiable Information (PII). No matter what the final intended destination of the media is, it is important that the organization ensure that no easily recoverable residual representation of the data is stored on the media after it has left the control of the organization or is no longer going to be protected at the confidentiality categorization of the data stored on the media.

Sanitization refers to a process that renders access to target data on the media infeasible for a given level of effort.

Note:

Additionally, try formatting a USB drive with files on it and browse it with **KillDisk**'s File Browser as well. Data leakages are not limited to hard drives!

Sanitization Types

Sanitization Types

NIST 800-88 international security standard (Guidelines for Media Sanitization) defines different types of sanitization.

Regarding sanitization, the principal concern is ensuring that data is not unintentionally released. Data is stored on media, which is connected to a system. Simply data sanitization applied to a representation of the data as stored on a specific media type.

When media is re-purposed or reaches end of life, the organization executes the system life cycle sanitization decision for the information on the media. For example, a mass-produced commercial software

program contained on a DVD in an unopened package is unlikely to contain confidential data. Therefore, the decision may be made to simply dispose of the media without applying any sanitization technique. Alternatively, an organization is substantially more likely to decide that a hard drive from a system that processed Personally Identifiable Information (PII) needs sanitization prior to Disposal.

Disposal without sanitization should be considered only if information disclosure would have no impact on organizational mission, would not result in damage to organizational assets, and would not result in financial loss or harm to any individuals. The security categorization of the information, along with internal environmental factors, should drive the decisions on how to deal with the media. The key is to first think in terms of information confidentiality, then apply considerations based on media type. In organizations, information exists that is not associated with any categorized system. Sanitization is a process to render access to target data (the data subject to the sanitization technique) on the media infeasible for a given level of recovery effort. The level of effort applied when attempting to retrieve data may range widely. NIST SP 800-88 Rev. 1 Guidelines for Media Sanitization Clear, Purge, and Destroy are actions that can be taken to sanitize media. The categories of sanitization are defined as follows:

Clear

Clear applies logical techniques to sanitize data in all user-addressable storage locations for protection against simple non-invasive data recovery techniques; typically applied through the standard Read and Write commands to the storage device, such as by rewriting with a new value or using a menu option to reset the device to the factory state (where rewriting is not supported).
For HDD/SSD/SCSI/USB media this means overwrite media by using organizationally approved and validated overwriting technologies/methods/tools. The Clear pattern should be at least a single write pass with a fixed data value, such as all zeros. Multiple write passes or more complex values may optionally be used.

KillDisk supports Clear sanitization type through the **Disk Erase** command for all R/W magnetic types of media, more than 20 international sanitation methods including custom patterns implemented and can be used.

Purge

Purge applies physical or logical techniques that render Target Data recovery infeasible using state of the art laboratory techniques.
For HDD/SSD/SCSI/USB media this means ATA SECURE ERASE UNIT, ATA CRYPTO SCRAMBLE EXT, ATA EXT OVERWRITE, ATA/SCSI SANITIZE and other low-level direct controller commands.

KillDisk supports Purge sanitization type through the **Secure Erase** command only for media types supporting ATA extensions.

Destroy

Destroy renders Target Data recovery infeasible using state of the art laboratory techniques and results in the subsequent inability to use the media for storage of data due to physical damages.
For HDD/SSD/SCSI media this means Shred, Disintegrate, Pulverize, or Incinerate by burning the device in a licensed incinerator.

It is suggested that the user categorize the information, assess the nature of the medium on which it is recorded, assess the risk to confidentiality, and determine the future plans for the media. Then, the organization can choose the appropriate type(s) of sanitization. The selected type(s) should be assessed as to cost, environmental impact, etc., and a decision should be made that best mitigates the risk to confidentiality and best satisfies other constraints imposed on the process.

International Standards in Data Destruction

KillDisk works with dozens of international sanitizing standards for clearing and sanitizing data including the US DoD 5220.22-M and NIST 800-88 standards. You can be sure that once you erase a disk with **KillDisk** all the sensitive information is destroyed forever.

KillDisk is a professional security application that destroys data permanently from any computer that can be started using a boot USB or CD/DVD. Access to the drive's data is made on the physical level via the BIOS (Basic Input-Output Subsystem) bypassing the operating system's logical drive structure organization. Regardless of the operating system, file systems or machine types, this utility can destroy all data on all

storage devices. It does not matter which operating systems or file systems are located on the machine which disks being sanitized.

Supported Sanitizing Standards:

- US DoD 5220.22-M
- US DoE M205.1-2
- Canadian CSEC ITSG-06
- Canadian OPS-II
- British HMG IS5 Baseline
- British HMG IS5 Enhanced
- Russian GOST p50739-95
- US Army AR380-19
- US Air Force 5020
- NAVSO P-5329-26 RL
- NCSC-TG-025
- NSA 130-2
- NIST 800-88
- NIST 800-88 rev.1
- German VSITR
- Bruce Schneier
- Peter Gutmann
- Australian ISM-6.2.93
- IEEE Std 2883-2022

User Defined Erase Method

KillDisk offers User Defined erase method where user indicates the number of times the write head passes over each sector. Each overwriting pass is performed with a buffer containing user-defined or random characters. User Defined method allows to define any kind of new erase algorithms based on user requirements.

Secure Erase for SSD

KillDisk offers low-level ATA Secure Erase method for Solid State Drives (SSD). According to National Institute of Standards and Technology (NIST) Special Publication 800-88: Guidelines for Media Sanitation, *Secure Erase* is "*An overwrite technology using firmware based process to overwrite a hard drive. Is a drive command defined in the ANSI ATA and SCSI disk drive interface specifications, which runs inside drive hardware. It completes in about 1/8 the time of 5220 block erasure.*" The guidelines also state that "*degaussing and executing the firmware Secure Erase command (for ATA drives only) are acceptable methods for purging.*" ATA Secure Erase (SE) is designed for SSD controllers. The SSD controller resets all memory cells making them empty. In fact, this method restores the SSD to the factory state, not only deleting data but also returning the original performance. When implemented correctly, this standard processes all memory, including service areas and protected sectors.

Related information

Erase Methods on page 97

Erase Confidential Data

Modern methods of data encryption are deterring network attackers from extracting sensitive data from stored database files.

Attackers (who want to retrieve confidential data) become more resourceful and look for places where data might be stored temporarily. For example, the Windows **DELETE** command merely changes the files attributes and location so that the operating system will not look for the file located on FAT/exFAT volumes. The situation with NTFS file system is similar.

One avenue of attack is the recovery of data from residual data on a discarded hard drive. When deleting confidential data from hard drives, removable disks or USB devices, it is important to extract all traces of the data so that recovery is not possible.

Most official guidelines regarding the disposal of confidential magnetic data do not take into account the depth of today's recording densities nor the methods used by the OS when removing data.

Removal of confidential personal information or company trade secrets in the past might have been performed using the **FORMAT** command or the **FDISK** command. Using these procedures gives users a sense of confidence that the data has been completely removed.

When using the **FORMAT** command Windows displays a message like this: `Formatting a disk removes all information from the disk.`

Actually the **FORMAT** utility creates new empty directories at the root area, leaving all previous data on the disk untouched. Moreover, an image of the replaced FAT tables is stored so that the **UNFORMAT** command can be used to restore them.

FDISK merely cleans the Partition Table (located in the drive's first sector) and does not touch anything else.

Moreover, most of hard disks contain hidden zones (disk areas that cannot be accessed and addressed on a logical access level). **KillDisk** is able to detect and reset these zones, cleaning up the information inside.

Related information

Disk Erase on page 63
Erase Disk Concepts on page 88
Disk Hidden Zones on page 114

Wipe Confidential Data

You may have some confidential data on your hard drive in spaces where the data is stored temporarily. You may also have deleted files by using the Windows **Recycle Bin** and then emptying it. While you are still using your local hard drive there may be confidential information available in these unoccupied spaces.

Wiping the logical drive's deleted data does not delete existing files and folders. It processes all unoccupied drive space so that recovery of previously deleted files becomes impossible. Installed applications and existing data are not touched by this process.

When you wipe unoccupied drive space on the system disk, the process must be run under operating system booted from CD/DVD/USB disk. As a result the wipe or erase process uses an operating system that is outside the local hard drive and is not impeded by Windows system caching. This means that deleted Windows system records can be wiped clean.

KillDisk wipes unused data residue from file slack space, unused sectors and unused space in system records or directory records.

Wiping drive space can take a long time, so do this when the system is not being actively used. For example, this can be done overnight.

Related tasks

Disk Wipe on page 27

Related information

Wipe Disk Concepts on page 92

Data Recovery

Advances in data recovery have been made such that data can be reclaimed in many cases from hard drives that have been wiped and disassembled. Security agencies use advanced applications to find cybercrime related evidence. Also there are established industrial spy agencies using sophisticated channel coding techniques such as PRML (Partial Response Maximum Likelihood), a technique used to reconstruct the data on magnetic disks. Other methods include the use of magnetic force microscopy and recovery of data based on patterns in erase bands.

Although there are very sophisticated data recovery systems available at a high price. Almost all the data can also be easily restored with an off-the-shelf data recovery utility like Active@ File Recovery, making your erased confidential data quite accessible.

Using **KillDisk** all data on your hard drive or removable device can be destroyed without the possibility of future recovery. After using **KillDisk** the process of disposal, recycling, selling or donating your storage device can be done with peace of mind.

Related information

Getting Started on page 16
Usage Scenarios on page 22
Erase Disk Concepts on page 88

Overview

Active@ KillDisk

Active@ KillDisk is a powerful and portable software that allows you to destroy all data on Hard Disks, Solid State Disks (SSD) & USB drives, excluding any possibility of deleted files and folders data recovery. KillDisk advanced features include:

- Enhanced visualization of physical disks and erase processes
- Improved handling of disks with controller malfunctions
- Stable handling of hot-swappable and dynamic disks
- Sound notifications for completed erase jobs with different results
- Auto hibernate or shutdown the system after all jobs are completed
- Enhanced certificates and reports for disk erase and wipe
- Advanced Disk Viewer with flexible Search for low-level disk inspection
- Customizable file names for certificates & XML reports
- Unique Computer ID can be displayed in certificates/reports
- Disk health - SMART information can be displayed and monitored
- Customizable look & feel: four different application styles included
- ATA Secure Erase option for SSD (Linux and Console packages only)

New features for version 24 include:

- Added Barcodes and QR codes to labels and certificates
- Export erase results to CSV log
- Minor bug fixes and functionality improvements
- Latest kernel version 14.1.17 including many improvements

New features for version 23 include:

- Improved output to certificates and application log
- Improved submitting online requests
- Improved work with NTFS volumes formatted with large cluster size

- Latest kernel including bug fixes and improvements

New features for version 15 include:

- Dark application style by default
- Configurable dynamic disks (LDM\LVM) reconstruction
- Device view filtering improved
- Bug fixes and performance improvements
- Latest kernel including bug fixes and improvements

New features for version 14 include:

- Added context help
- Dialogs adopted for low-resolution monitors (800x600)
- Secure e-mail notifications provided (added SSL & TLS support for SMTP)
- Improved Console functionality to support the latest hardware
- Latest kernel including bug fixes and improvements

New features for version 13 include:

- Resume Disk erase action to continue interrupted disk erase due to disk malfunction or errors
- Digitally signed PDF certificate with optional encryption and visual signature presentation
- Secure Erase (ATA command) implementation for Solid State Drives (SSD)
- Enhanced faulty disks detection and handling
- Bug fixes and major performance improvements

New features for version 12 include:

- Customizable Printable Labels
- Customizable Sound Notifications
- Redesigned and improved printable Certificates and Reports
- Disk Serial Number can be properly detected for most scenarios, including disks connected via USB
- Many other enhancements and stability improvements while working with unstable disks

This release is available as an executable to run in your desktop environment, or in a bootable environment with the help of the **Active@ Boot Disk Creator** - the bootable disk creation tool included in the installation package.

Related information

Erase Methods on page 97

System Requirements

KillDisk runs on Microsoft Windows, Linux and Apple macOS/OS X operating systems with the following minimum requirements:

Workstation:

- PC: x64 (64-bit) or x86 (32-bit)
- CPU: Intel or AMD
- RAM: 512 Mb (Windows), 1 Gb (Linux), 1GB (macOS)
- Disk: 100Mb of disk space

Video:

- VGA (1024x768) or better resolution

Operating System:

- Windows XP to Windows 11, Windows Servers 2003 to 2022
- Linux Kernel 2.x or later (all Linux family: Ubuntu, Debian...)
- Apple macOS / OS X 10.12 or later

Drive Storage:

- CD/DVD/Blu-Ray optical drive (for applicable boot disk features)
- USB 1.0 / 2.0 / 3.0 / 3.1 / 3.2 storage device (for applicable boot disk features)
- Disk types supported:
- HDD via IDE, ATA, SATA I, SATA II, SATA III, SAS
- SSD via SATA I, SATA II, SATA III, SAS
- External eSATA & USB disks
- SCSI & iSCSI devices
- Onboard NVMe M.2 (SATA & PCI-E types)
- Removable media (USB drive, MemoryStick, SD card, Compact Flash, Floppy Disk, Zip Drive)

KillDisk supports all drives visible by the OS with read/write access, additional drivers can be loaded onto the boot disk for drivers not included by default in the bootable environment.

Related information

Installation on page 17

Software Licensing

KillDisk is licensed **per concurrent use of the software** and **for each concurrent disk being erased or wiped** outlined in the EULA. The maximum number of disks erased in parallel corresponds to the number of purchased licenses.

One corporate license grants you an ability to run the software on one machine and erase one disk at any given time. To run on several machines in an office (or to erase multiple drives in parallel on one machine) you require the corresponding number of licenses.

Site and Enterprise licenses grant the license holder use of the software in one geographical location and worldwide respectively.

This licensing is maintained through software registration and activation. Once the commercial version of **KillDisk** is purchased the license holder will receive an email with their **Registered Name** and **Registration Key**. Every machine that needs to use the fully-functional version of the software needs to be activated with this key.

Activations are limited to the number of licenses held. To transfer from one machine to another they must be deactivated from decommissioned hardware first.

For boot disks containing **KillDisk** the **Active@ Boot Disk Creator** must be registered with a registration key.

Register Online

For this task you require an active internet connection for the PC you wish to register the product on.

After installation **Active@ KillDisk** still starts as a FREE (unregistered) version having limited functionality. You need to register it first to have all professional features activated. To register the software:

1. Start registration wizard

   On application first start Registration & Licensing dialog launched by default. If freeware software has already been registered, the dialog does not appear at start. In this case click **Registration** menu item from **Help** menu.

2. Select register option

   Select the **Register or Upgrade Software** radio button. Read the License agreement and activate the check box to agree to the Terms and Conditions of the license. Click **Next** to proceed with the registration.

Figure 1: Registration Dialog

3. Type registration info

   Type your name into **Registration Name** field, then copy & paste your 30-digit registration key obtained after software purchase into the **Registration Key** field. Registration and network activation should be completed automatically. You should receive a response that the software has been registered. The registration is now complete. You may click **Next** to go to the final confirmation and click **Finish** to close registration wizard.

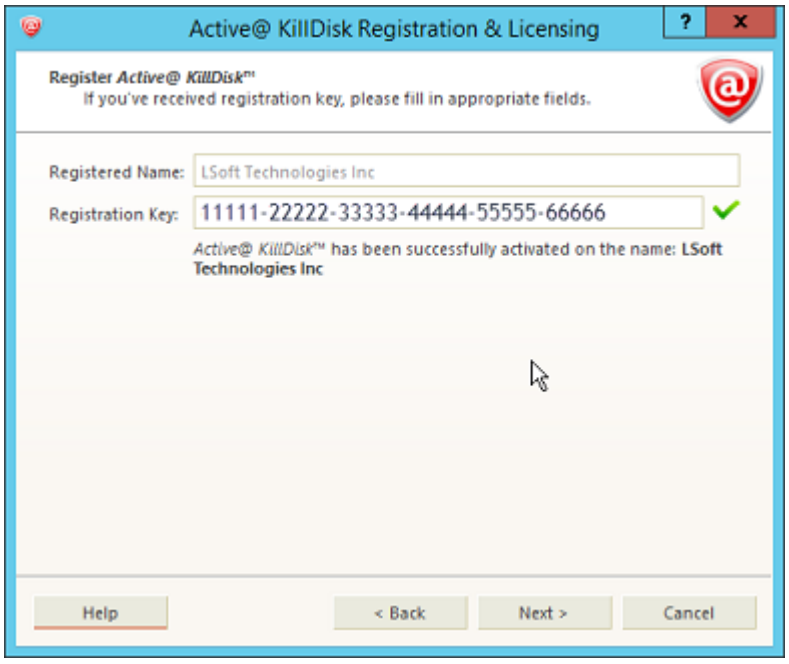


Figure 2: Registration Complete

Now you have access to all professional features of the application.

Note: If your registration key is too long you are using the key for an earlier version. Ensure you update to the latest version by making sure your support and updates are active and use the key to this latest version. This can be done through your client profile.

Register Offline

For this method of activation, you need another PC with a web browser and active Internet connection and a USB flash disk for transferring activation data.

Note: Use this method only if the computer you are activating does not have Internet access.

In some cases such as security reasons or corporate firewalls you may not have access to an Internet connection on the machine you wish to install the software on.

For product registration and activation offline:

1. Start registration wizard

   On application first start Registration & Licensing dialog launched by default. If freeware software has already been registered, the dialog does not appear at start. In this case click **Registration** menu item from **Help** menu.

2. Select register option

   Select the **Register or Upgrade Software** radio button. Read the License agreement and activate the check box to agree to the Terms and Conditions of the license. Click **Next** to proceed with the registration.

Figure 3: Registration Dialog

3. Type registration info

   Type your name into **Registration Name** field, then copy & paste your 30-digit registration key obtained after software purchase into the **Registration Key** field. The Activation Request and Activation Response boxes will appear:

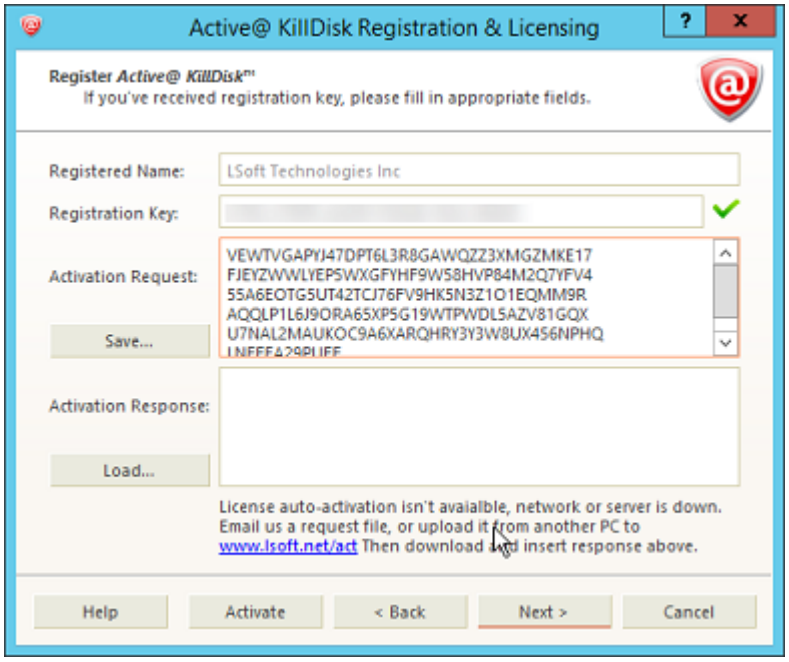


Figure 4: Offline Activation Request

Click **Save...** to store registration request to a file. Copy this file to a USB drive.

4. Activate via internet

   Bring the USB drive to a computer with an active Internet connection.

   Open Web browser and navigate to https://www.lsoft.net/act/

   Import the request file using the **Choose File** button and click **Load**

   Click **Process!** to generate the Activation Response

   Save the response to your USB drive by clicking **Save to *.licenseActivated**

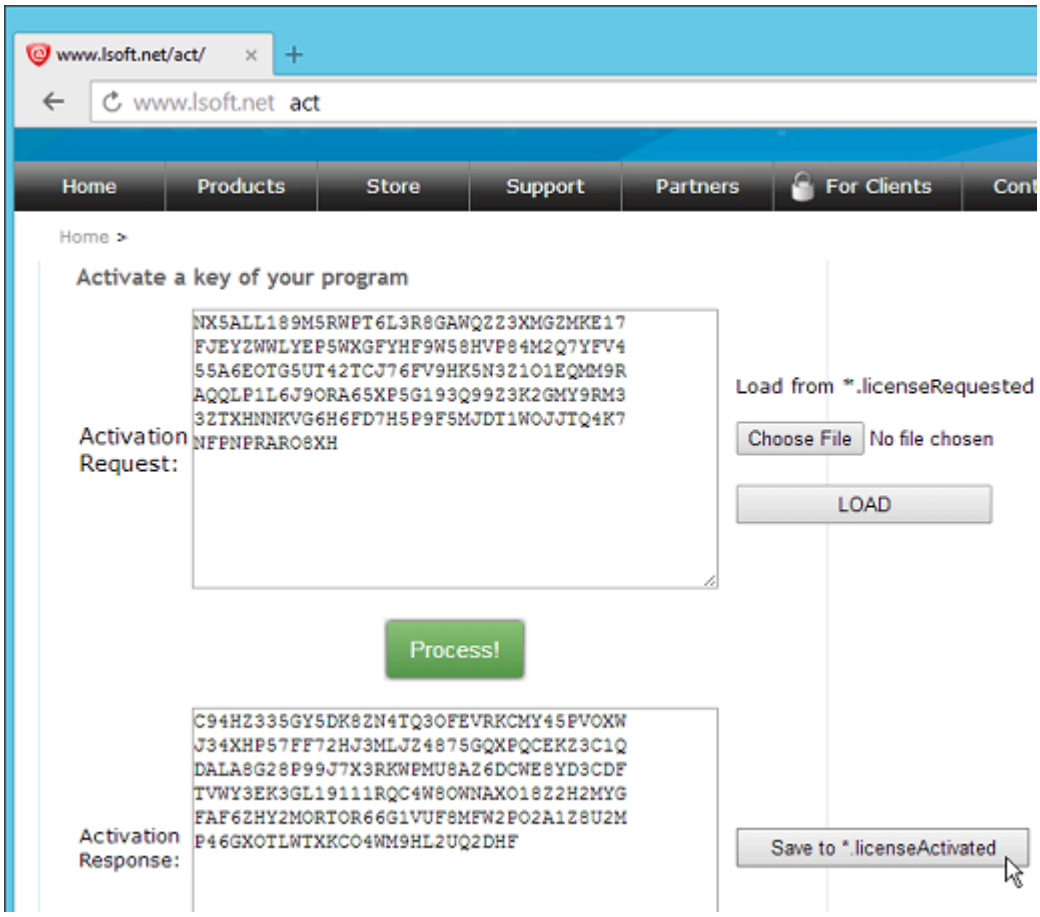


Figure 5: Activate in Browser

5. Complete activation

   Bring the USB drive to the PC with **KillDisk** installed and where activation request for offline activation was created.

   Click **Load...** button to import activation response from **.licenseActivated** file to the registration window and click **Activate** button to complete and store offline activation.

   Click **Next** and **Finish** buttons to confirm and close registration wizard.

You have now activated the software on your machine than does not have active internet connection.

Deactivate License

To transfer licenses from one machine to another you need to free up (remove) your activation on the licensed machine. You may do this by deactivating the registration from within the **KillDisk** application:

1. Start registration wizard

   Click **Registration** menu item from **Help** menu.

2. Select deactivate option

   Select the **Deactivate Registration** radio button. Click **Next** to proceed with the registration.

Figure 6: Registration Dialog

3. Deactivate registration

   Click **Deactivate Registration** button to complete online license deactivation.

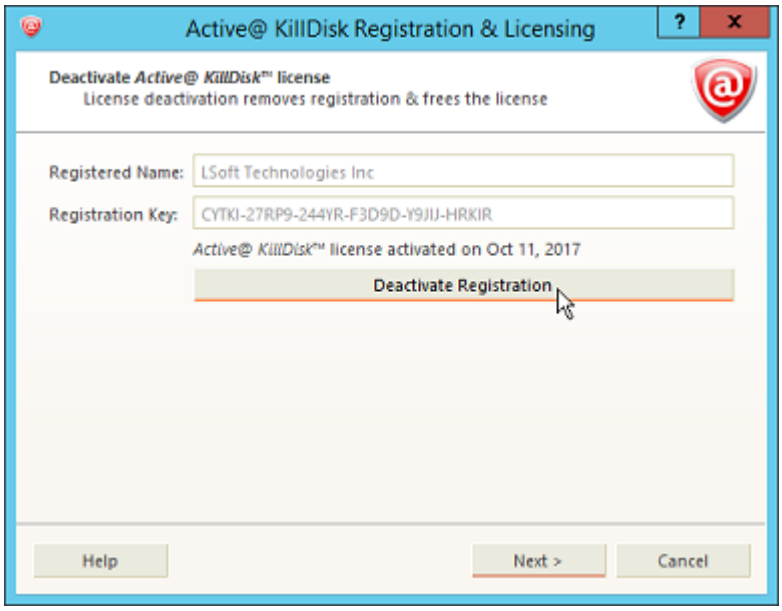


Figure 7: Deactivating Registration

   Click **Next** and **Finish** buttons to confirm and close registration wizard.

Your active license is now revoked from your PC and may be used to activate a different computer.

Note: Uninstalling the application from the computer using the uninstaller will also deactivate your license.

Software Updates

KillDisk has a built-in update feature to ensure you always have an access to the latest version of the application. To check for updates, use the file menu bar to navigate to **Help** > **Check for Updates**

Figure 8: Check for Updates

Update dialog contains history of previously installed versions and updates.

If a new version or update is detected it can be downloaded and installed on the next wizard steps.

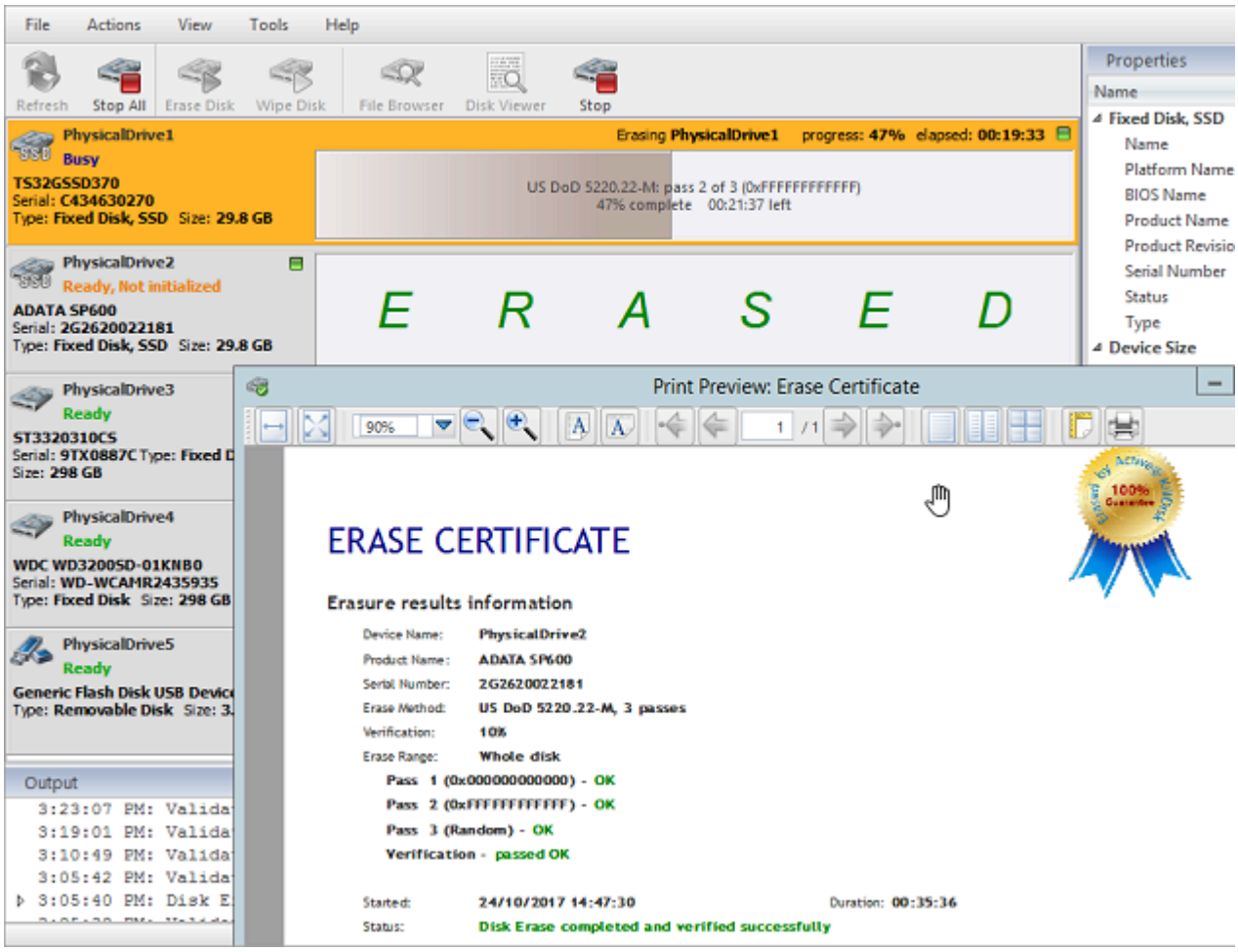
Click **Next** button to proceed with an update, if exists. Software download and installation will start automatically.

Note:

KillDisk stores your previously installed versions so you may roll back to any of your older versions at any time. To rollback to previous version, just select target version, mark **Rollback to previously installed version** check box and click **Next** button.

Getting Started

This section describes key features of **KillDisk** and explains its basic functionality.



Related tasks

Disk Erase on page 22

Installation

After purchasing **Active@ KillDisk** a registration key will be emailed to you as well as a download link to installation package named **KILLDISK-<VERSION>-SETUP.EXE** (Windows versions) , **KillDiskLinux.run.tar.gz** (Linux version) or **KillDiskMacOS.dmg** (Apple macOS/OS X). This file contains everything you need to get started - just double click the file and installation wizard will take you through the setup process. You need to have Administrator's privileges to be able to install it properly.

Note: If you purchased the Ultimate version you receive installation executable file to run on Windows. To access the Linux installation files install **KillDisk** on your Windows machine and navigate to the application directory. In `Linux` sub-folder you will find the Linux installation files. The path to the Linux application will look something like: `C:\Program Files\LSoft Technologies\Active@ KillDisk Ultimate\Linux\KillDisk_Linux_Installer.tar.gz`

After installation **Active@ KillDisk** still starts as a FREEWARE (unregistered) version having limited functionality. You need to register it first to have all professional features activated.

The installed package contains two main applications:

- **Active@ KillDisk** - Run this application to inspect local disks and erase/wipe your data
- **Active@ Boot Disk Creator** - Create a bootable CD/DVD/BD/USB disk to boot from and run **KillDisk**. Using **KillDisk** this way allows you to wipe out confidential data from the system volumes

while gaining exclusive use to partitions because the operating system runs outside the partition that you are securing.

Windows versions:

In order to install the application double click **KILLDISK-<VERSION>-SETUP.EXE** file and follow the instructions in the installation wizard.

Linux versions:

In order to install **KillDisk** make sure you found the Linux installation file as mentioned in the note above. Double click **KillDisk_Linux_Installer.tar.gz** in your Linux environment and unpack the archive to a proper location.

To start installation simply run the following command in the directory where the archive was unpacked:

```
sudo ./KillDisk_Linux_Installer.run
```

KillDisk will be installed to **/opt/lsoft/KillDisk/** and menu shortcut will be created.

Apple macOS / OS X versions:

In order to install **KillDisk** make sure you found the installation file as mentioned in the note above. Double click **KillDiskMacOS.dmg** and follow installation steps. Drag and drop **Active@ KillDisk** to **Applications** folder.

KillDisk will be installed as **/Applications/KillDisk.app** and **KillDisk** shortcut appears in **Applications** in Finder.

Note: Boot Disk Creator and Boot Disks are not supplied for macOS / OS X because newest Apple M1/M2 processors much differ from Intel architecture and do not support Windows-based or Linux-based bootable environments. If purchased commercial version, you can still request **Boot Disk Creator for macOS /OS X** plus related Boot Disks from us, however prepared bootable media will boot and erase the only legacy Intel-based Macs (not M1/M2).

Navigation

Once the **KillDisk** application is launched the main application's dashboard appears. From here you can use any of **KillDisk**'s tools. This section describes main components of the application and navigation. The full functionality and features of these components are discussed in corresponding sections later.

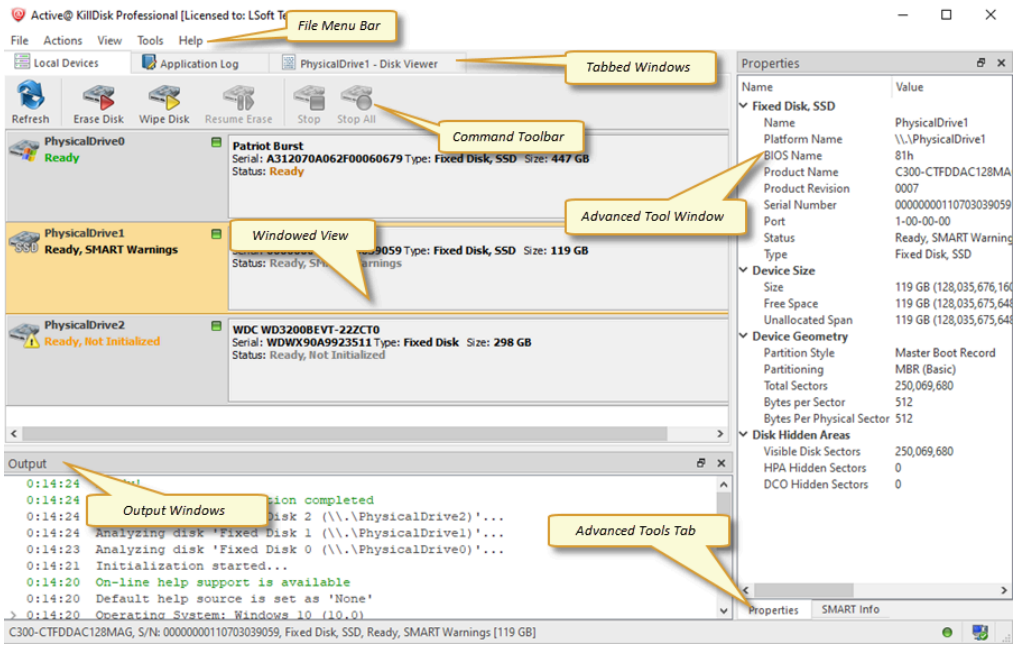


Figure 9: KillDisk Dashboard

Where:

File Menu Bar
The file menu bar contains actions to perform nearly any operation in **KillDisk** such as accessing Settings and Help sections, changing Views and what is visible in the dashboard, opening tools as well as navigating between **KillDisk**'s windows.

Tabbed Windows
Here you can navigate between **KillDisk** tabbed windows such as Disk Explorer, Application Log etc..

Command Toolbar
The command toolbar is a dynamic toolbar that allows the user to perform Tabbed Window-specific actions (depending on the context).

Windowed View
Contains the window that is currently active. By default you can see here all HDD/SSD/USB disks attached to the workstation.

Output Window
Contains the log of actions **KillDisk** has performed.

Advanced Tools Tabs
These tabs allow to navigate between the different Advanced Tools.

Advanced Tools Window
This window shows the data for the Advanced Tool selected. The window can be moved, popped out and re-sized.

To browse through each of these Views click on the appropriate tab. You may also open a View from the **View** menu:

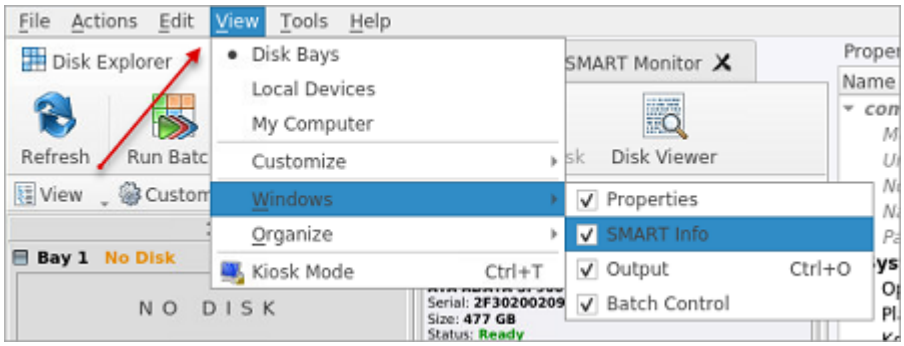


Figure 10: Access to Views via Menu

To open any View being closed, just select it from the **View** menu.

The status bar at the bottom of the workspace shows the current status of the application or status of the activity in progress.

Related information

Property Views on page 49

Disk Explorer

Disk Explorer is a default workspace for the **KillDisk** application. All attached HDD/SSD/USB disks are visualized here and can be selected for different actions. Commands like **Disk Erase** can be initiated from here as well as progress displayed for actions performed with disks.

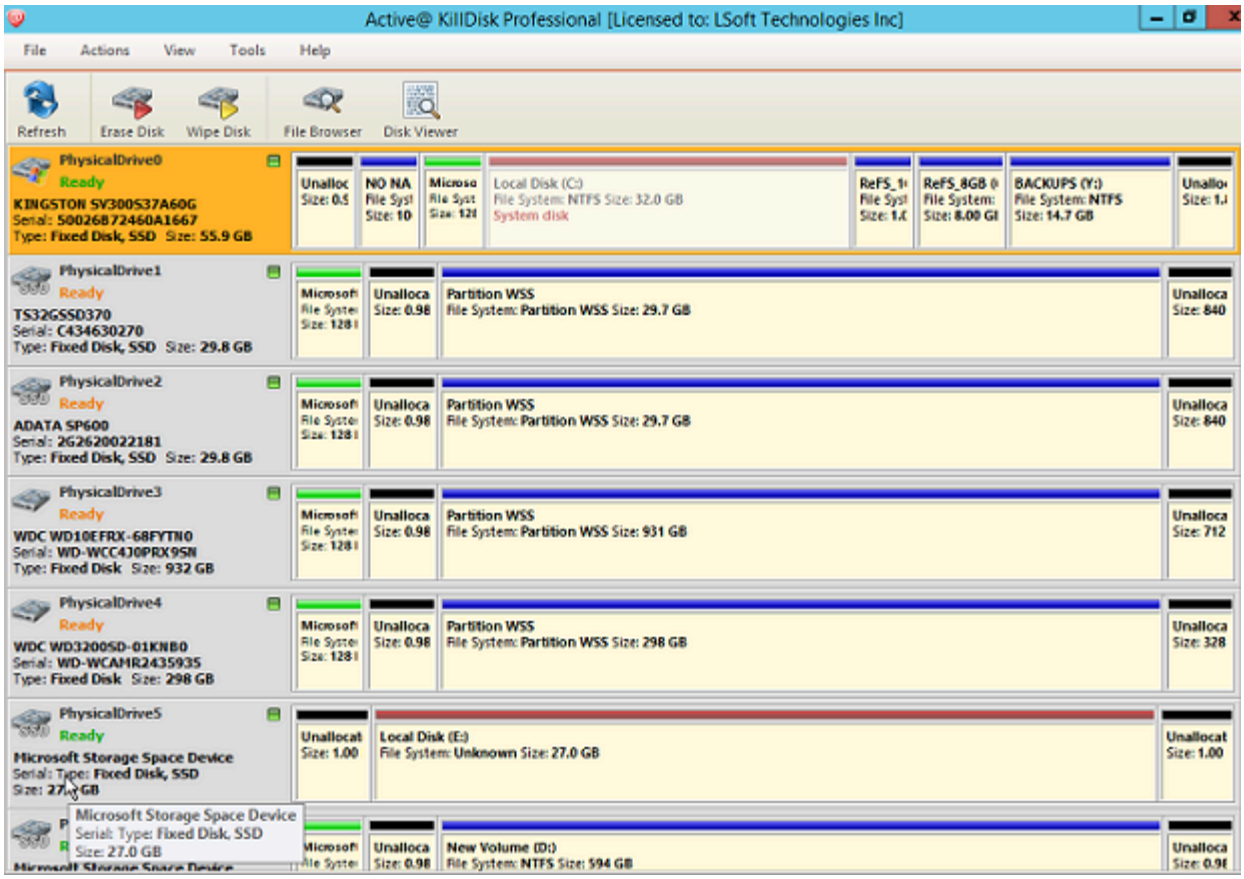


Figure 11: Disk Explorer View

Related information

Preferences on page 60

Create a Boot Disk

Boot Disk Creator helps you to prepare a bootable CD/DVD/BD or USB storage device that you may use to boot any PC and use **KillDisk** to destroy all data on the attached HDD and SSD.

To prepare a bootable disk:

1. Run Boot Disk Creator

   Run application from the Windows Start menu on Windows platform. **Boot Disk Creator** wizard appears.

2. Register software

   This is an optional step: if software hasn't been registered yet, you need to register software first. Click **Registration** link in the bottom-left corner.

3. Select bootable media

   Select desired bootable media to be created: **CD/DVD/Blu-ray Disc**, **USB Flash Drive** or **ISO Image File**. If several media disks are inserted, open Flash Drives combo box and choose a particular device. Click **Next** to proceed to the next step.

   Note: A USB Drive or blank CD/DVD/BD must be inserted and explicitly chosen on the first step before you can proceed further.

   Note: If inserted USB Flash Drive doesn't appear in drop-down list, click **USB not listed: Initialize Disk** link. You should be able to find removable disk in list of all attached devices and initialize it to make compatible with the application. Initialization process **destroys all data** on the selected USB device.

4. Select target platform

   Select the target platform for booting up: **Windows-based Boot Disk**, **Linux-based LiveCD/LiveUSB** or **Console-based Boot Disk** (text mode application). Depending on version purchased one or more target platforms are available for selection. Click **Next** to proceed to the next step.

5. Configure boot disk

   Specify additional and customized boot disk options:

   a) Configure System Boot Settings

      To customize boot options click the **System Boot Settings** tab. You can change the default settings to be used: **Time Zone**, **Additional Language**, **Display Resolution**, **Display Scale**, **Default Application Start** and **Auto-start Delay**.

      Network and **Security** sub-tabs allow to configure IP & Firewall settings, mapping a network resource and protecting Boot Disk with a password.

   b) Add your files

      To add your custom files to the bootable media click **User's Files** tab. Add files or folders with files using the related buttons at the right side. Added items will be placed in the **User_Files** folder at the root of bootable media.

   c) Add extra drivers

      To add specific drivers to be loaded automatically, click **Add Drivers** tab. Add all files for the particular driver (*.INF, *.SYS, ...). Added items will be placed in the **BootDisk_Drivers** folder at

the root of bootable media. At boot time all *.INF files located in this folder will be installed (if compatible with a platform).

d) Add scripts

To add specific scripts to be launched after Boot Disk is loaded, click **Add Scripts** tab. Add your scripts (*.CMD files). Added files will be placed in the **BootDisk_Scripts** folder at the root of bootable media. At boot time all *.CMD files located in this folder will be executed (if properly created for the particular platform).

e) Add command line parameters

To add command line parameters for **KillDisk** start up, click **Application Startup** tab and type all parameters required (read documentation first). This tab is only enabled when **KillDisk** has been set up as a **Default Application** at Boot Disk start up.

f) Configure KillDisk environment

To specify paths for **KillDisk** Certificate Logo file (LPG/PNG/BMP), Settings file (XML), Digital Signature file (PFX) and Volume name to store Certificates/Logs/Reports, click **App Config** tab and enter configuration information. You can configure storing Erase Certificates and reports to a mapped network share.

Click **Next** to proceed to the final step.

6. Create Boot Disk

Verify selected media, boot up environment and **KillDisk** configuration. Click **Create** button to start bootable media creation process. A progress bar appears while the media is being prepared. Click **Finish** to exit the wizard.

You can use prepared bootable media to boot up any 64-bit PC and erase/wipe all attached disks.

Note: Not all the additional boot disk options are accessible for all platforms. For example, *Add Drivers* section is available to Windows Operating System only.

Related information

Software Licensing on page 10
Common Tips on page 82
Command Line Mode on page 52

Usage Scenarios

KillDisk is a powerful tool to provide disk erasure solutions for personal and corporate use. This section describes the key features of **KillDisk** and how to use this software's many features. The software is highly customizable and this guide will help get you started with configuring **KillDisk** for your system and using it to the full potential.

Usage scenarios include: Disk Erase, Disk Wipe, Secure Erase, Certificates, Labels, Reports, Command Line Mode and Batch Mode operations.

Disk Erase

KillDisk is a powerful tool for disk sanitation. Individual disks can be erased with just few clicks using many international sanitizing standards.

Disk Erase complete process is described below.

1. Select disks

   Use mouse in Disk Explorer to select one or more physical disks. Selected disks displayed with orange borders.

   For multiple selection use **Ctrl+Left Mouse** click.

   To select all attached disks, press **Ctrl+A**.

   To select a particular partition or volume, click the object in the Local Devices view.
2. Start erase

   Open Disk Erase dialog using one of the following methods:

   - Click **Erase Disk** command on the action toolbar
   - Click **Actions** > **Erase Disk** command from main menu
   - Click **Erase Disk** command from disk's context menu

3. Confirm erase options

   Confirm sanitation options after Disk Erase dialog pops up:

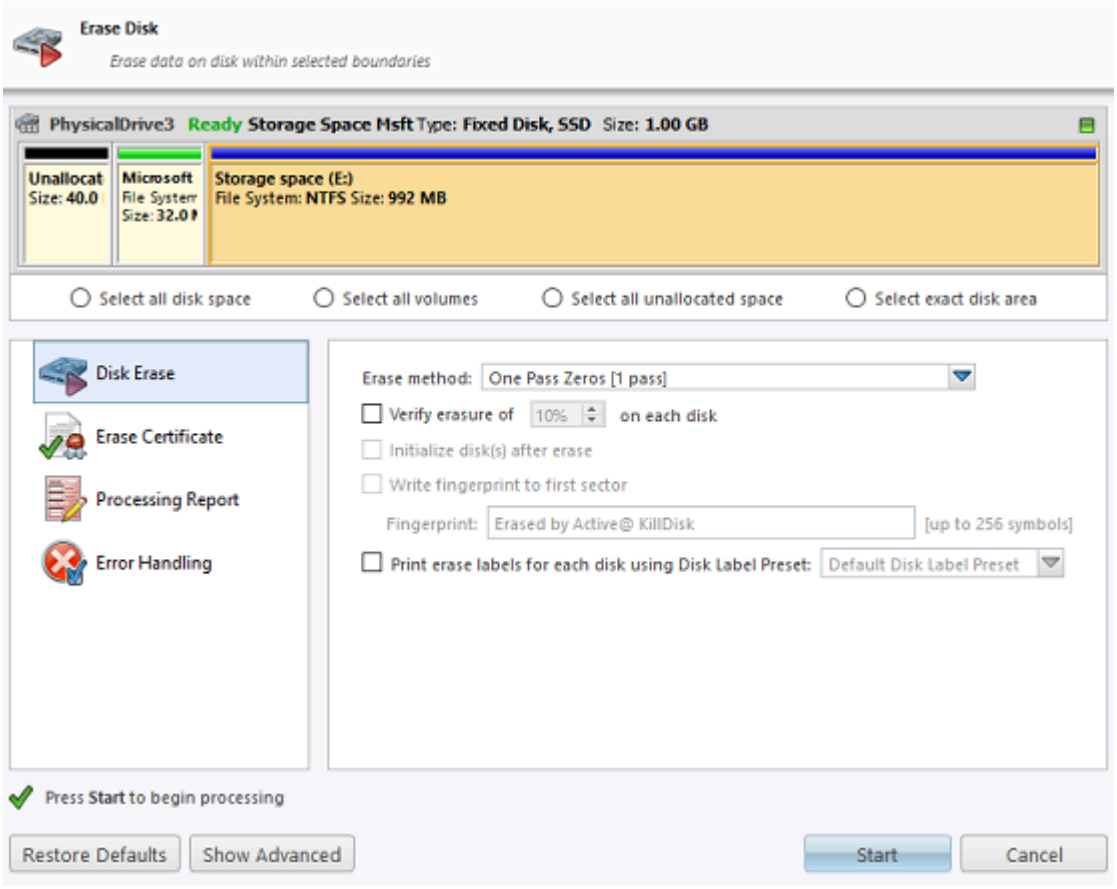


Figure 12: Erase Options

Use tabbed views to adjust disk erasure options if necessary. Available options are:

- Disk Erase on page 63
- Erase Certificate on page 66
- Processing Report on page 71

If single disk is selected from Local Devices view, then exact area for the erase can be optionally specified:

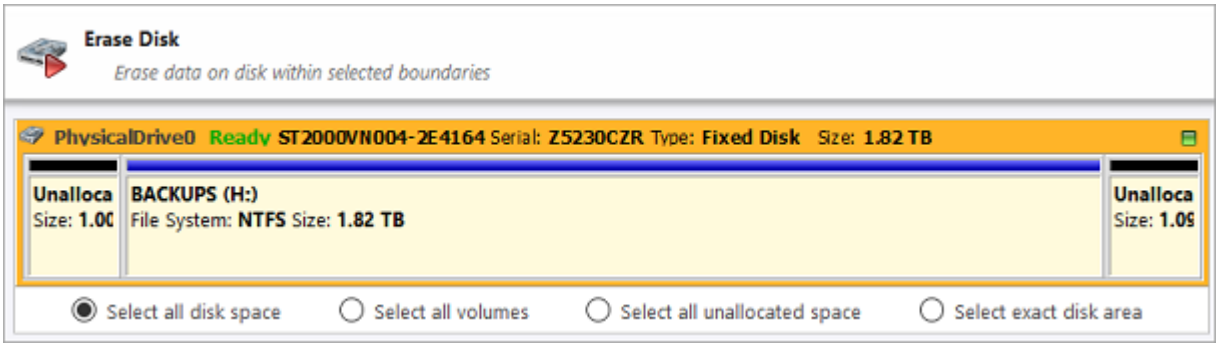


Figure 13: Area selection for Disk Erase

Select all disk space

Entire surface of the disk will be erased

Select all volumes

Select for erase the only disk space where the live volumes located

Select all unallocated space

Select for erase the only disk unallocated area (the space where no live volumes exist)

Select exact disk area

Allows you to use sliders on the visualization of your disk to select a particular range of sectors for erasure.

4. Start erase

   Click **Start** button to go to the final Confirm Action dialog (depending on erase settings this dialog can be skipped). This is an additional precaution measure. If you proceed with confirmation - all data on the selected disk(s) or on selected disk area will be destroyed permanently - without any possibility to be recovered.

   Click **OK** button to confirm erase and start erase process.

5. Observe progress

   After starting erase a progress bar is displayed at the disk area. The progress bar represents the percentage of disk space being sanitized. As the procedure progresses the percentage increases and time left recalculates.

   To stop erase process, click **Stop** at any time (via action toolbar, main menu or context menu).

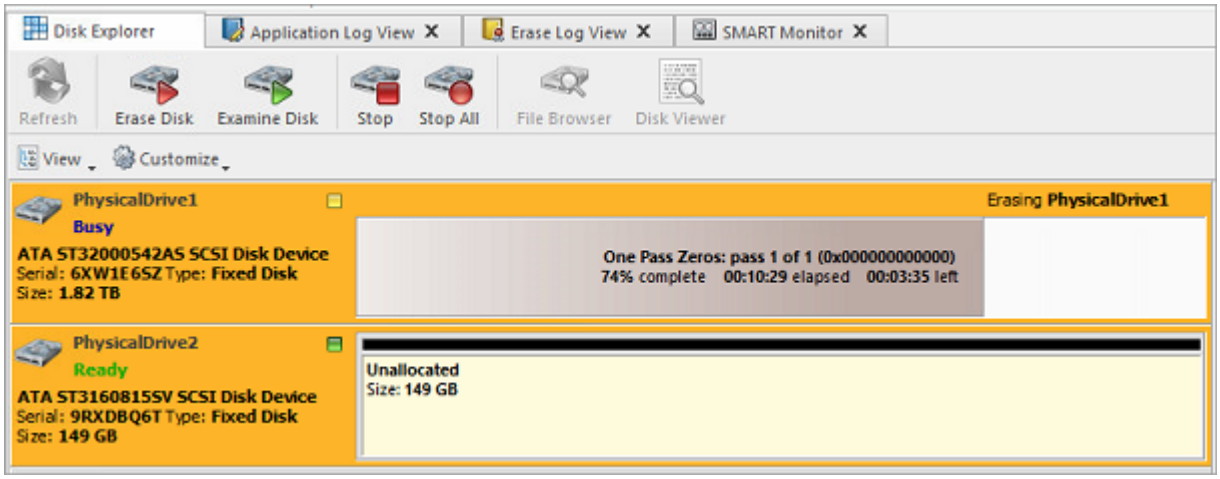


Figure 14: Disk Erase progress

6. Verify erase completion

   After erase is complete, the results (**Success, Failed, Canceled**) are displayed on top of the disks in different colors.

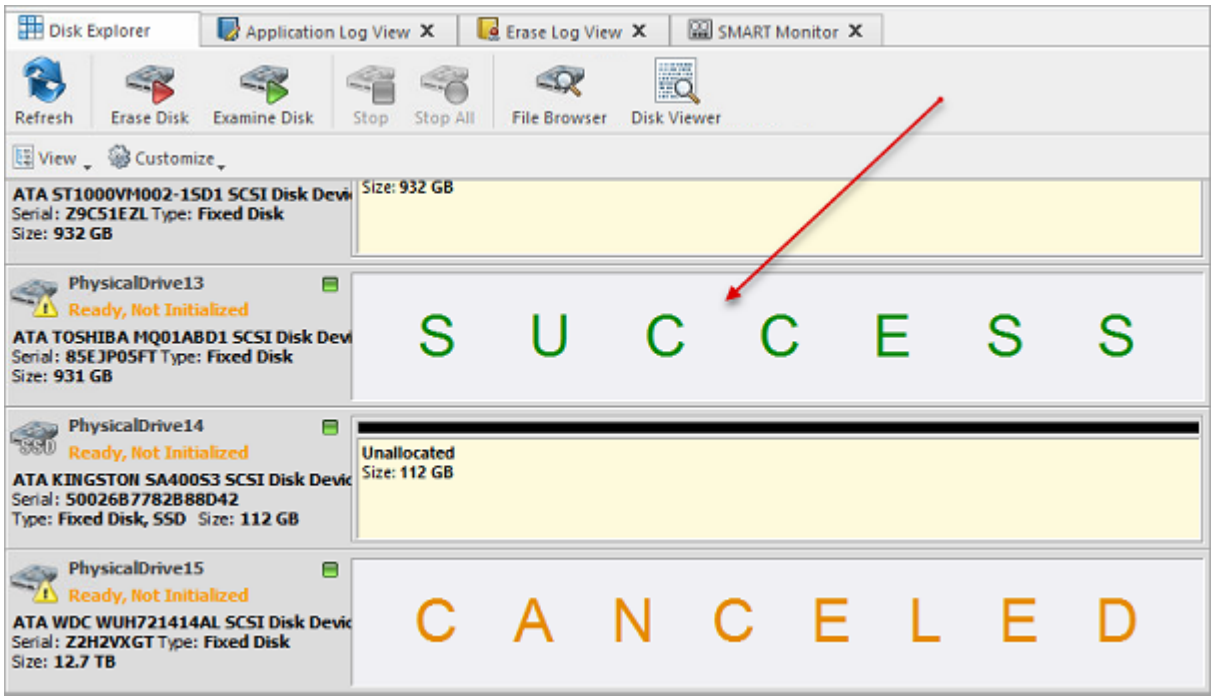


Figure 15: Erase Completed

After erase completion there are options for reviewing results (logs, processing reports and attributes), printing Erase Certificates and Disk Labels for processed disks.

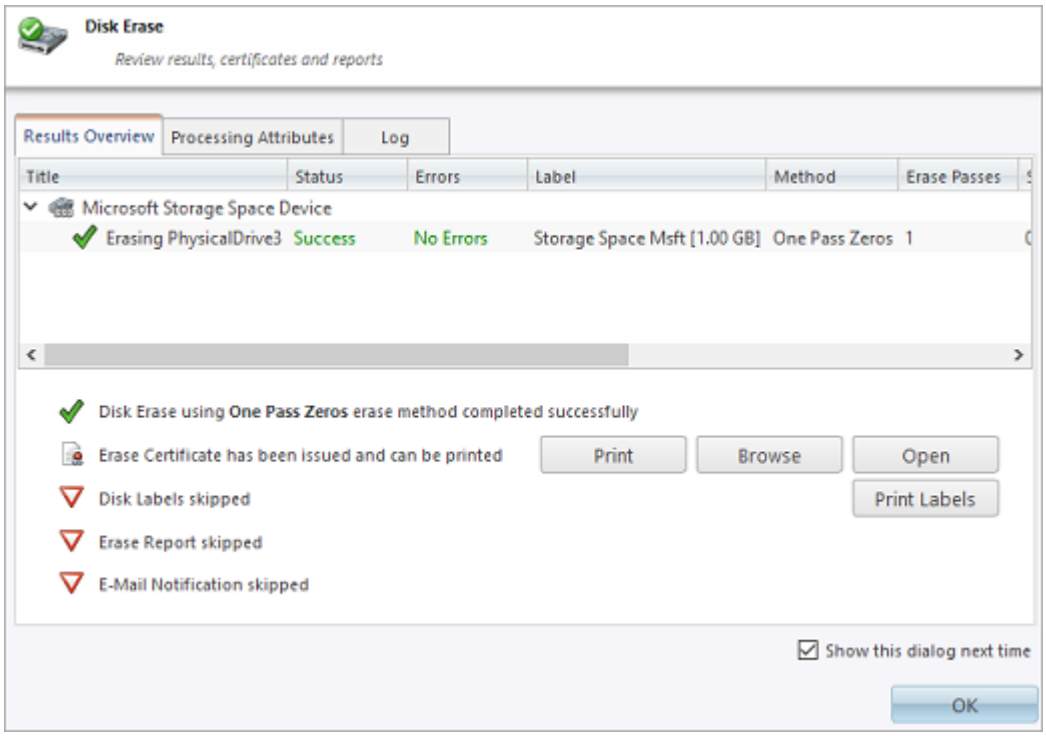


Figure 16: Erase Summary

Related information

Erase Methods on page 97
Processing Summary on page 34
Certificates, Labels and Reports on page 37

Disk Area to Erase

KillDisk has an option to specify a particular area on the disk to erase. To access this feature you have to select the single disk first. In Local Devices view initiate the **Erase Disk** command.

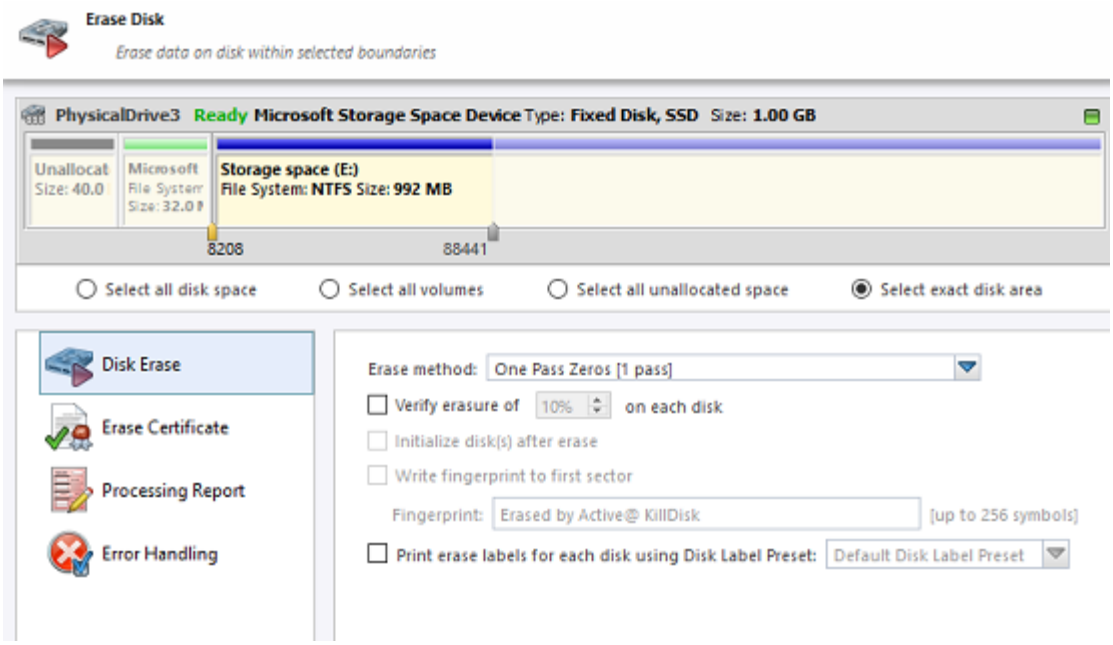


Figure 17: Erase a Specific Area

Disk area options for the erase are:

Select all disk space
This is a default disk area option and applies to entire disk surface to be erased

Select all volumes
This option erases all existing volumes and partitions on the disk

Select all unallocated space
This option erases only unallocated disk areas, where volumes and partitions do not exist

Select exact disk area
Use sliders on the disk visualization in order to select a particular range of sectors. You can also click on sector numbers and type particular sectors manually.

You may also click on individual partitions and they will be selected for erasure.

Disk Wipe

When you select a physical device the **Wipe** command processes all logical drives consecutively erasing data in unoccupied areas (free clusters and system areas) and leaving existing data intact. Unallocated space, where no partitions exists has been erased as well.

Note:

If you want to erase ALL data (both existing and deleted files) from the device permanently, use Disk Erase.

If **KillDisk** detects that a partition has been damaged, it does not wipe data in that area, because partition might contain an important data. There are some cases where partitions on a device cannot be wiped. Examples: an unknown or unsupported file system, a system volume or an application start up disk. In these cases **Wipe** command is disabled. If you select a device and **Wipe** button is disabled, select individual partitions (volumes) and wipe them separately.

Disk Wipe complete process is described below.

1. Select disks

   Use mouse in Disk Explorer to select one or more physical disks. Selected disks displayed with orange borders.

   For multiple selection use **Ctrl+Left Mouse** click.

   To select all attached disks, press **Ctrl+A**.

   To select a particular partition or volume, click the object in the Local Devices view.

2. Start wipe

   Open Disk Wipe dialog using one of the following methods:

   - Click **Actions** > **Wipe Disk** command from main menu
   - Click **Wipe Disk** command from the context menu for disk or volume

3. Confirm wipe options

   Use tabbed views to adjust Wipe options if necessary.

   Available options are:

   - Disk Wipe on page 65
   - Erase Certificate on page 66
   - Processing Report on page 71
   - Error Handling on page 80

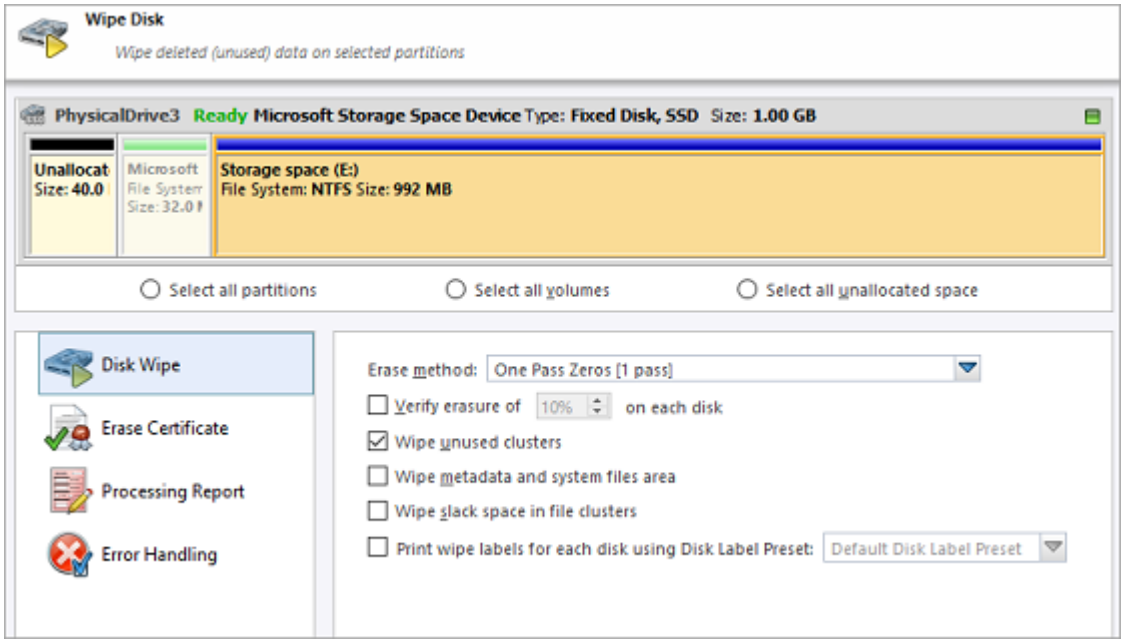


Figure 18: Wipe Options

If single disk is selected from Local Devices view, then exact area for the wipe can be optionally specified:

Select all partitions

Select for wipe the only disk space where partitions located

Select all volumes

Select for wipe the only disk space where live volumes located

Select all unallocated space

Select for wipe the only disk unallocated area (the space where no live volumes exist).

4. Start wipe

   Click **Start** button to reach the final step before wiping out deleted data. Click **Yes** to confirm **Wipe** action and process starts.

5. Monitor progress

   The progress of the wiping procedure will be displayed on the disk or volume. To stop the process at any time click the **Stop** button for the particular disk or volume. Click the **Stop All** button to cancel wipe for all disks.

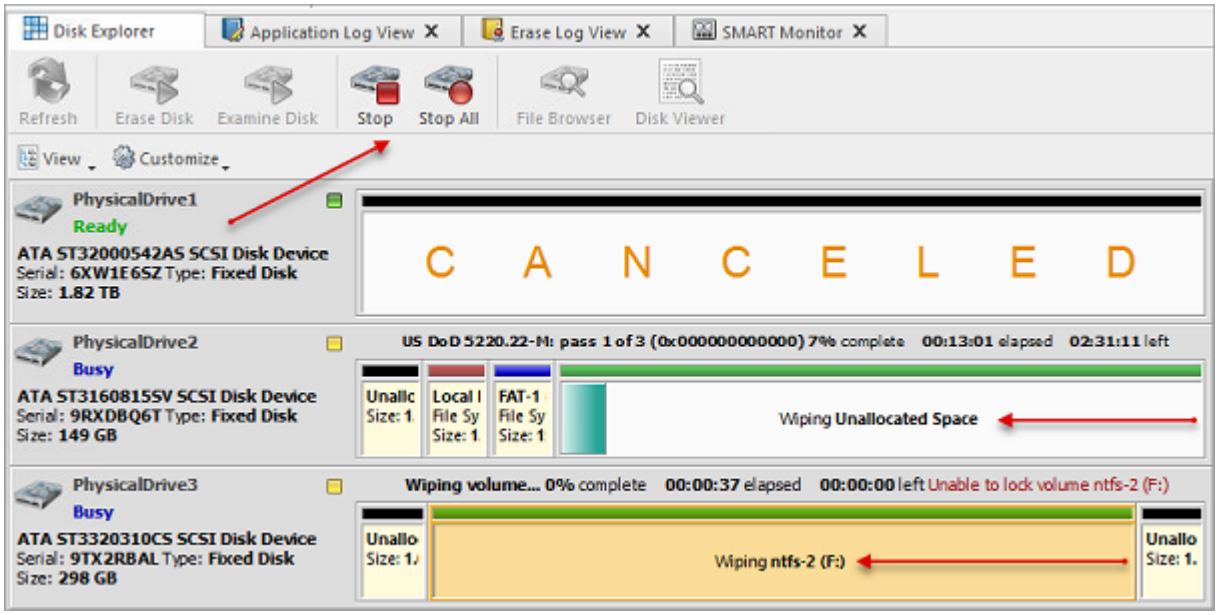


Figure 19: Disk Wipe Progress

6. Verify results

   This is an optional step. Select the wiped volume and click **Open in File Browser** toolbar button to inspect the work that has been done. **KillDisk** scans system records of the partition. The **Browser** tab appears. Existing file/folder names appear with a multicolor icon and deleted file/folder names appear with a gray-colored icon. If the wiping process completed correctly the data residue in these deleted file clusters and the place these files hold in the directory/system records has been removed. You should not see any gray-colored file names or folder names within the volume being wiped out.

You will see a confirmation dialog when the process is complete. Here you can check the Processing Summary, print Labels and Certificates.

All deleted files and system records on wiped volumes became unrecoverable.

Note:

If there are any errors, for example due to bad sectors, these errors will be reported and placed to the log file. If such a message appears you may cancel the operation or continue wiping out disks.

Related information

Disk Wipe on page 65
Processing Summary on page 34
Certificates, Labels and Reports on page 37

Resume Stopped or Interrupted Erase

Disk erase can be a time consuming task. Erasing larger disks (10TB+) with sanitizing standards including several overwrite passes could last for hours. If something happens in a middle of erase (user stopped an action, failing disk just turned off, computer re-booted, etc.) user has options:

- Start Erase for the disk all over again

- Resume Erase from the point it stopped on a disk (time saving option)

When application starts all detected disks being analyzed for any erases interrupted previously, and if such erases detected for one or more disks, **Resume Erase** button become active for these disks. Disks with stopped or interrupted erase are marked with a red label **Interrupted Erase**.

Note:

If disks with interrupted erase being detected after program start, pop up dialog appears automatically suggesting you to Resume Erase. You can run Resume Erase from here, or select the particular disks later on.

Resume Erase complete process is described below:

1. Select disks

   Select a particular disk or group of disks to launch Resume Erase for.
2. Resume erase

   Open Resume Erase Disk dialog using one of the following methods:

   - Click **Resume Erase** command on the action toolbar
   - Click **Actions** > **Resume Erase** command from main menu
   - Click **Resume Erase** command from disk's context menu
3. Confirm options

   After Resume Erase Disk dialog appears, all disks where **Resume Erase** option is available will be displayed. You can select more disks for resume erase (if available) or deselect some selected disks.

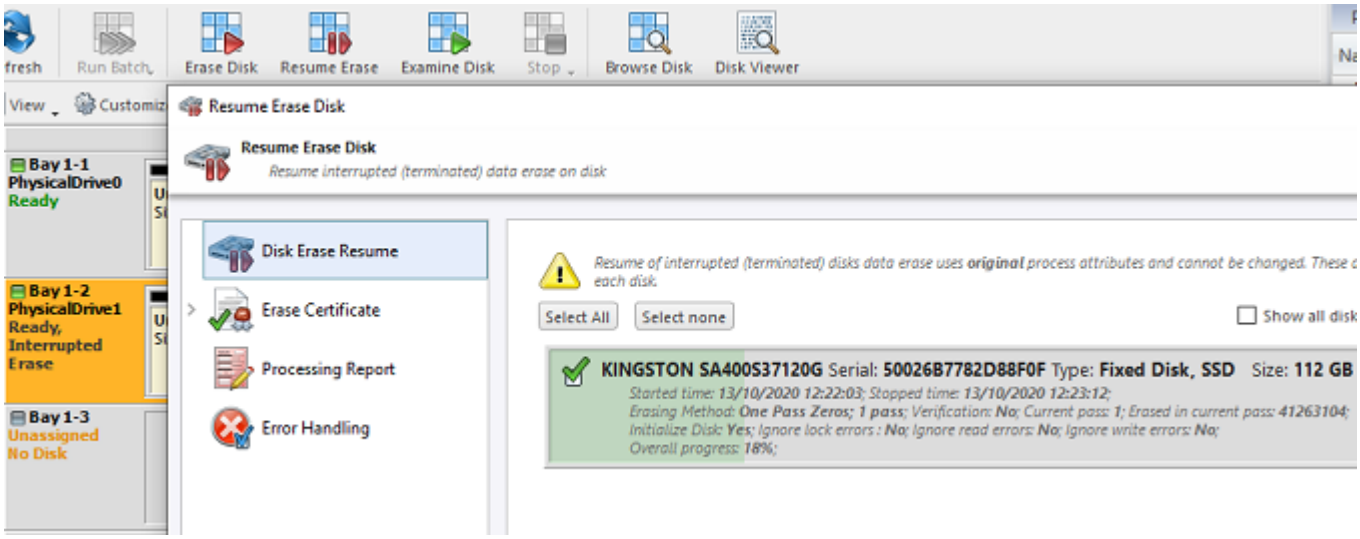


Figure 20: Resume Erase Options

Verify selected disks, certificate and report options and click **Start** button to resume interrupted erase. Wait until erase is complete.

After erase completion there are options for reviewing results (logs, processing reports and attributes), printing Erase Certificates and Disk Labels for processed disks.

Related tasks

Disk Erase on page 22

Related information

Processing Summary on page 34
Certificates, Labels and Reports on page 37

Secure Erase

Most of Solid State Drives (SSD) support Secure Erase for the low-level purging of all memory blocks on the media. **KillDisk** is able use **SATA Secure Erase** feature and perform fast unrecoverable erasure. By doing this, you can increase the performance of SSDs for future use. All of the data will be lost without recovery options. Before using this feature make sure user fully understands the concepts.

Warning:

100% FATAL DAMAGE GUARANTEED TO MEDIA IF THE PROCESS INTERRUPTED (POWER OUTAGE, UNAUTHORIZED SSD EXTRACTION, ETC.)

Make sure your hardware setup is safe from sudden lost of power.

Do not interrupt the process of *Secure Erase* in any manner!

Note:

If there is a need to erase ALL data (existing and deleted) from the hard drive device permanently with sanitation standards (US DoD 5220.22-M, Canadian OPS-II, NSA 130-2, etc.) use Disk Erase feature.

Important:

Secure Erase is available for Linux-based packages only (**KillDisk Industrial**, **Active@ KillDisk Linux**, **KillDisk Console** and KillDisk LiveCD in **Active@ KillDisk Ultimate**).

Secure Erase is not available in Windows-based packages, including applications running under Active@ Boot Disk (which is based on WinPE). For security reasons Microsoft intentionally blocked IOCTL_ATA_PASS_THROUGH function in all the latest Windows editions starting from Windows 8.

Secure Erase complete process is described below.

1. Select SSD disks

   Select disks marked as 

in **Local Devices** view. You may select multiple disks to be erased simultaneously.
2. Start secure erase

   Open **Secure Erase** dialog using one of the following methods:

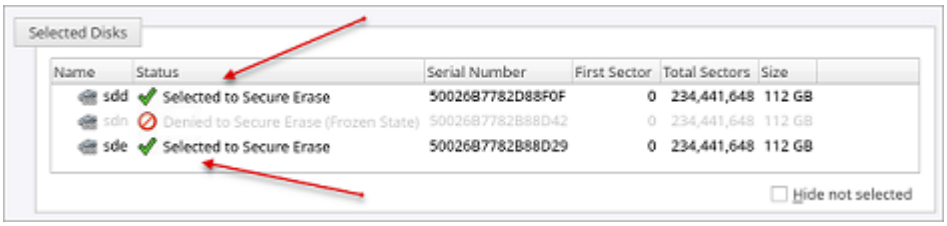
   - Click **Actions** > **Secure Erase** command from main menu
   - Click **Secure Erase** command from disk's context menu
3. Confirm options

   Use tabbed views to adjust secure erase preferences if necessary.

   Available preferences are:

   - Secure Erase on page 64
   - Erase Certificate on page 66
   - Processing Report on page 71
   - Error Handling on page 80

Important: Only disks which state is NOT frozen SSDs can be selected for Secure Erase



Warning:

In case if SSD which state is Frozen has been selected for Secure Erase the following message appears:

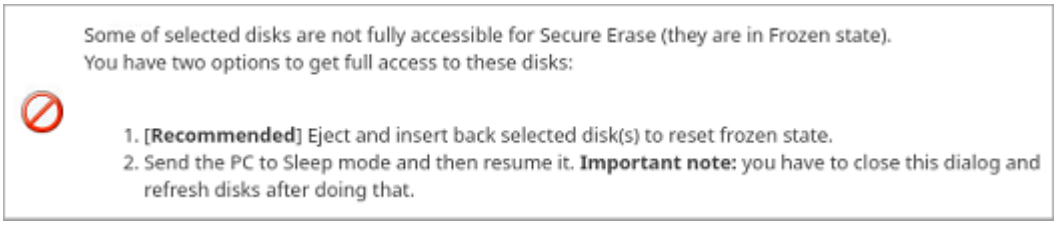


Figure 21: Frozen SSD Warning

You have options either to eject and insert back the SSD, or send PC to Sleep mode and resume it back to get full access to the disk and proceed with a Secure Erase.

4. Start secure erase

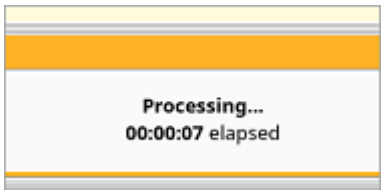
   Click **Start** button to reach the final step before erasing disk data completely without any possibility to be recovered. Confirm Secure Erase action by typing a predefined keyphrase.

   Click **OK** button to confirm erase and start erase process.

5. Observe progress

   There is no progress indicator and Stop action available for the Secure Erase. The feature is implemented inside SSD controller.

   The only time elapsed is available and can be displayed.



After Secure Erase process is completed the Processing Summary dialog appears:

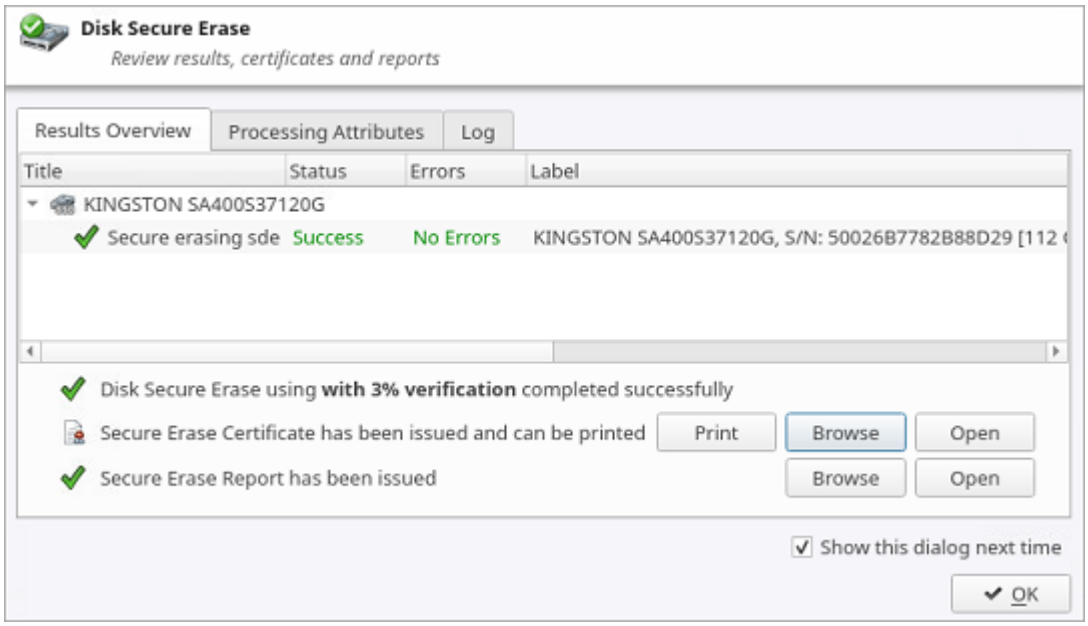


Figure 22: Secure Erase Processing Summary

Now you may **Print** and **Open** Erase Certificate and work with XML Reports.

If there are any errors they will be reported.

Related information

Secure Erase on page 64
Processing Summary on page 34
Certificates, Labels and Reports on page 37
Secure Erase (SSD) on page 122
Secure Erase Concepts on page 90
Secure Erase (ANSI ATA, SE) on page 99

Processing Summary

Once **KillDisk** finishes processing tasks such as Disk Erase, Secure Erase or Disk Wipe, a Processing Summary dialog appears. It contains all of the information regarding to the operation(s). For example, information which disks were erased, status of erasure, logs and associated certificates and reports.

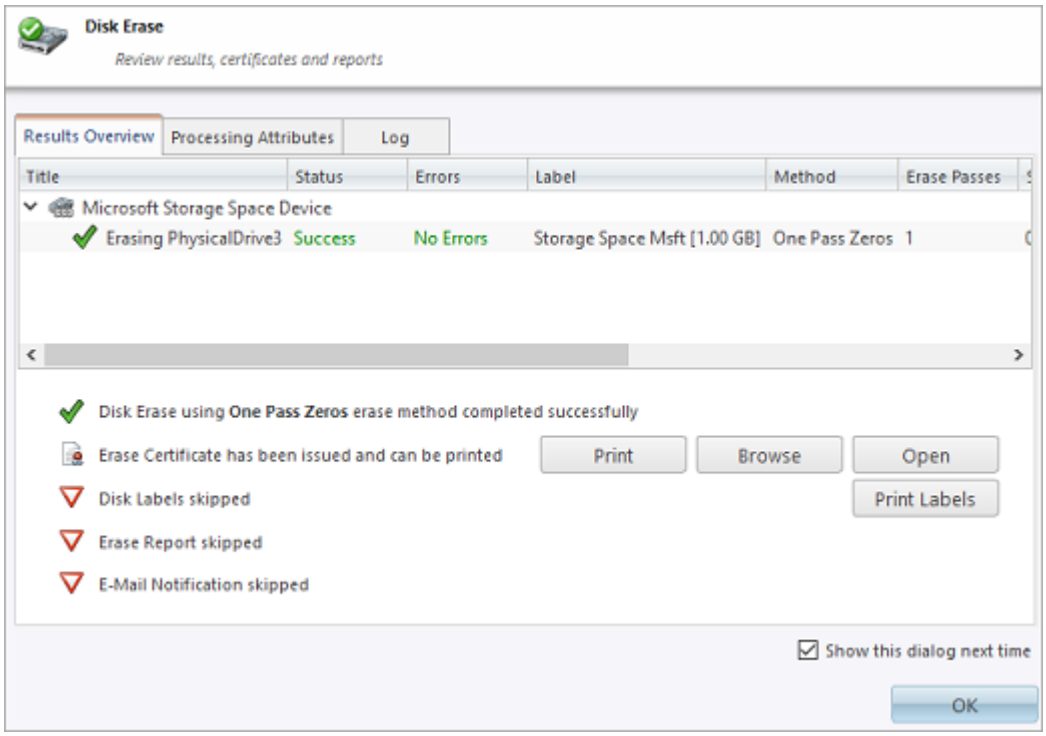


Figure 23: Example of Processing Summary

Results Overview

Tab contains the following information:

Title
All the devices processed are displayed with their erase status
Status
An actual erase status (success/fail)
Errors
Displayed number of errors detected (if any)
Label
Volume or partition description
Method
Erase/Wipe sanitizing method being used
Erase Passes
Number of overwriting passes performed
Started at
Time & date of operation's start
Duration
Duration of the operation.

Processing Attributes

Tab contains detailed information about operation status and processing attributes:

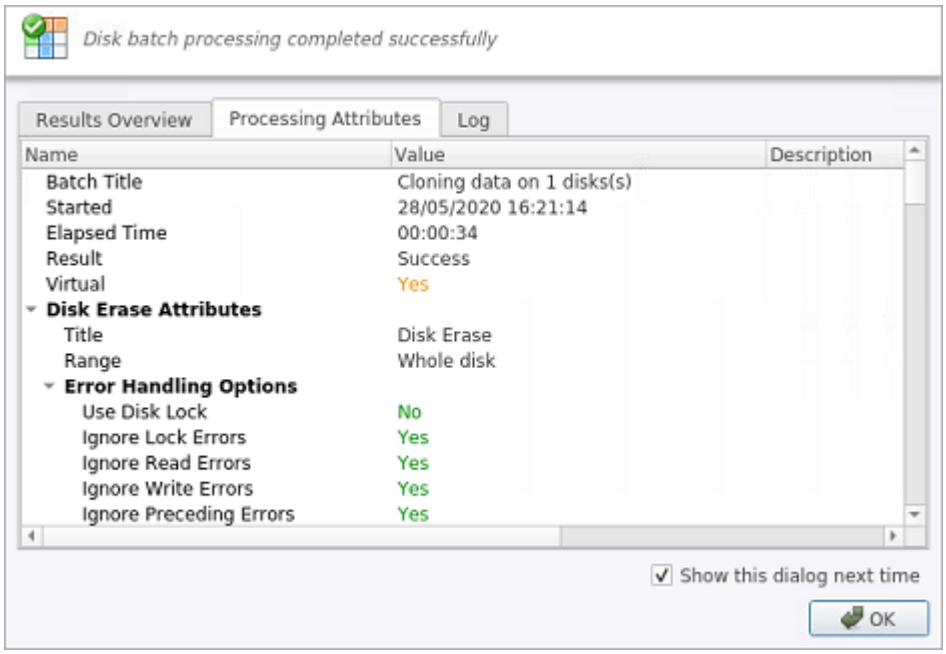


Figure 24: Processing Attributes Sample

Log

Tab shows actual processing log:

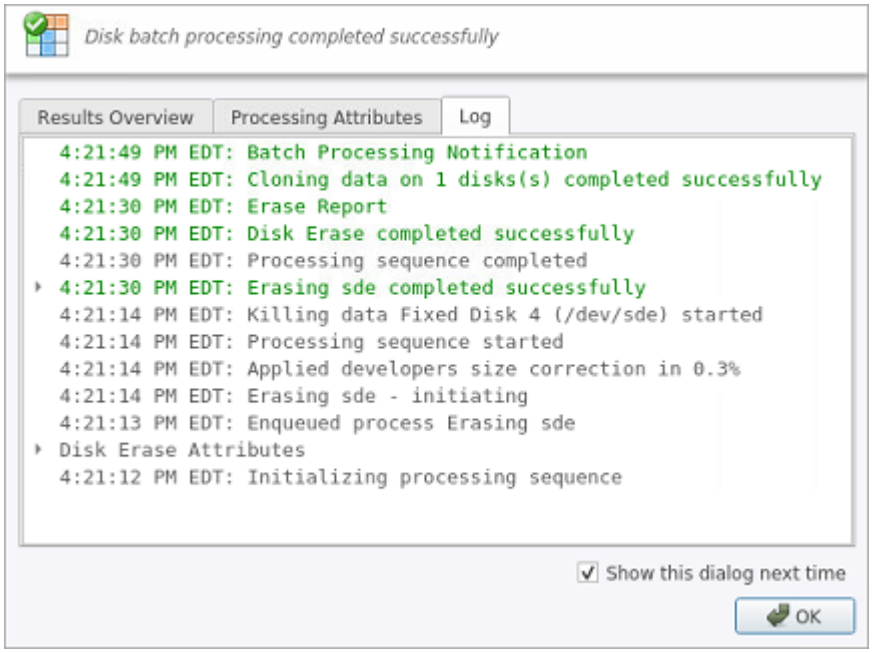


Figure 25: Log Sample

Note:

The Wipe operation will produce a similar processing summary for the Disk Wipe.

Additional actions

Additional processing options and actions are:

Disk Certificate
Status of the saved PDF certificate. Allows user to print certificate (**Print** button), browse certificate directory with a file browser (**Browse** button) or examine certificate (**Open** button).

Print Labels
Examine, customize, change options and print Labels by clicking the **Print Labels** button.

Disk Processing Report
Status of the saved Disk Processing Report. Examine the disk processing report *.xml* file (click **Browse** button to navigate to the containing folder) or preview the report (**Open** button).

Related information

Certificates, Labels and Reports on page 37

Certificates, Labels and Reports

KillDisk maintains the highest standards in disk erasure and provides extensive documentation options for its operations through Reports , Labels and Certificates.

Erase Certificates

KillDisk provides PDF certificates upon the completion of Disk Erase, Secure Erase or Disk Wipe. These certificates can be customized to include company-specific information and hardware/procedure description. Configuring custom settings is described in the Certificate Preferences section of this guide.

Certificate Elements

Company logo
Company logo can be placed to the certificate instead of the default **KillDisk**'s logo at the top right corner.

Barcode
A barcode in selected format with encoded tags and attributes for scanning using a barcode scanner.

Company information
Displays all company information provided in the preferences. The user in the sample above only provided a business name. But other company information may also be included in the certificate.

Technician information
Displays the technician information provided in the preferences. This section is for the name of the operator and any notes they may want to include in the certificate report.

Erasure results information
Displays information pertaining to the erasure procedure conducted on the hard drive(s). Type of erasure algorithm, custom settings, date and time started and duration of the erasure are all listed here.

Disk information
Uniquely identifies the disk being erased. Includes information like Name, Serial Number, Size and Partitioning Scheme.

System information
Provides details on the system used to run **KillDisk** such as Operating System and Architecture type.

Hardware information
Provides details on the hardware used to run **KillDisk** such as Manufacturer, Number of Processors, etc.

Note:

The system information here only applies to the system running **KillDisk**, not the system that was erased by the application!

Storing Certificate to PDF

There are options for storing a certificate to file in PDF format as well as encrypting with passwords and digitally signing output PDFs. You can re-print stored to PDF certificates later on, as well as you can validate their integrity and validity.

Certificate location
Save erase certificate as a file in PDF format to the specific location.

File name template
Specify the template for the certificate file name. See the tags available in Appendix tags section.

Encrypt with password
If password field is not empty, output certificate (PDF file) will be encrypted and protected with specified password. This password needs to be typed in any PDF viewer the next time user opens a certificate for reviewing or printing.

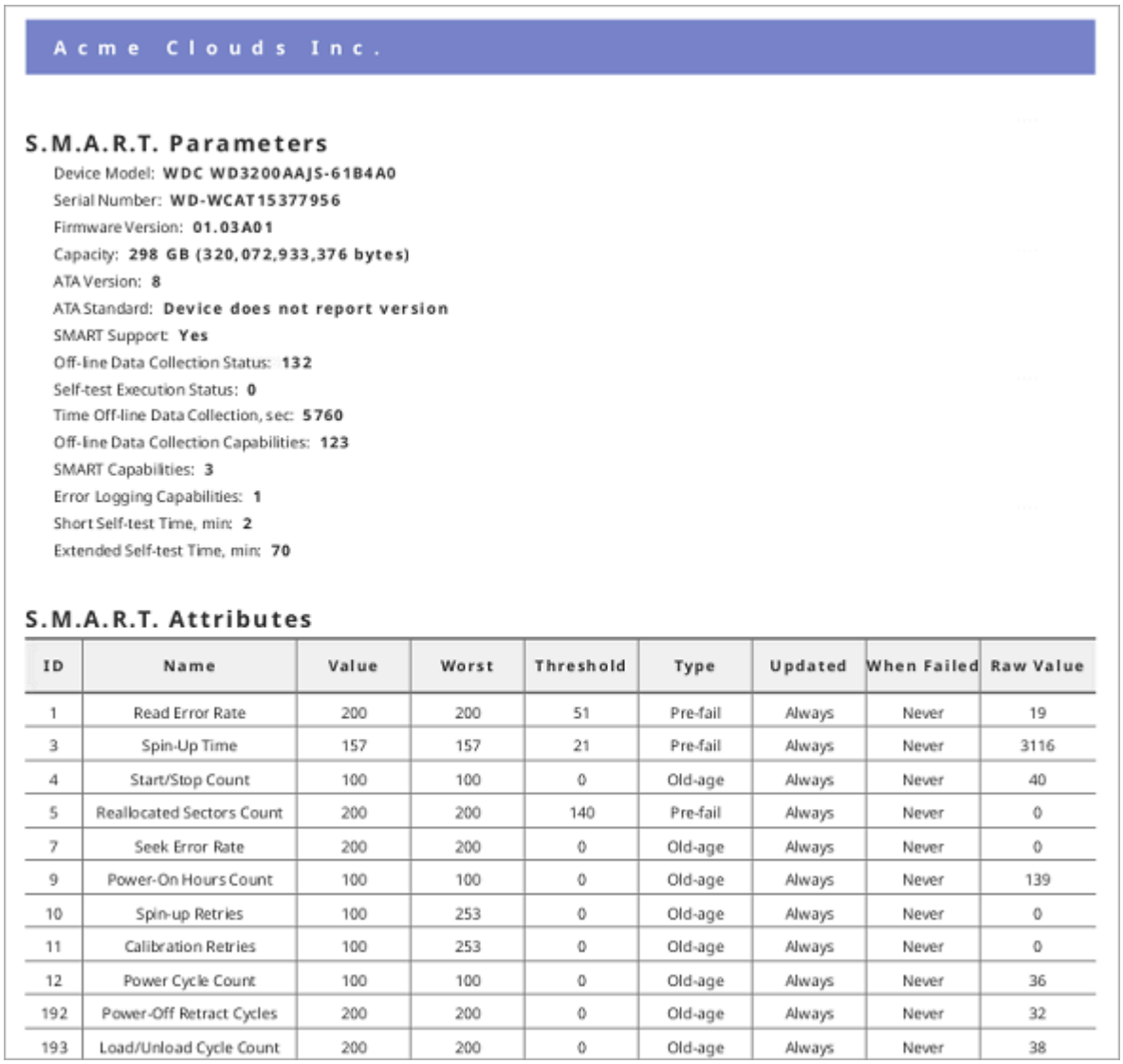
Sign certificate with digital signature
Certificate file (PDF) can be signed with a default digital signature (supplied **KillDisk.pfx** certificate) or with your custom digital signature (.PFX file). Digital signature can be verified later on. If Adobe Reader successfully verified PDF document, it is guaranteed that its content hasn't been modified since issue. If custom digital signature is required, please issue a certificate and specify full path to the custom certificate (.PFX file), as well as .PFX open password (if any) in the related fields.

Display digital signature
Digital signature can be displayed as an overlay text on the first page of certificate. After turning this option on, you can specify overlay text using tags (see tags section), its position on the first page, rectangle dimensions and text size.

Note: Encrypting certificates with a password and digital signing options are not available when running KillDisk under 32-bit Operating Systems. Only 64-bit platforms supported.

Sample of Erase Certificate

Figure 26: Erase Certificate - 1-st Page



Acme Clouds Inc.

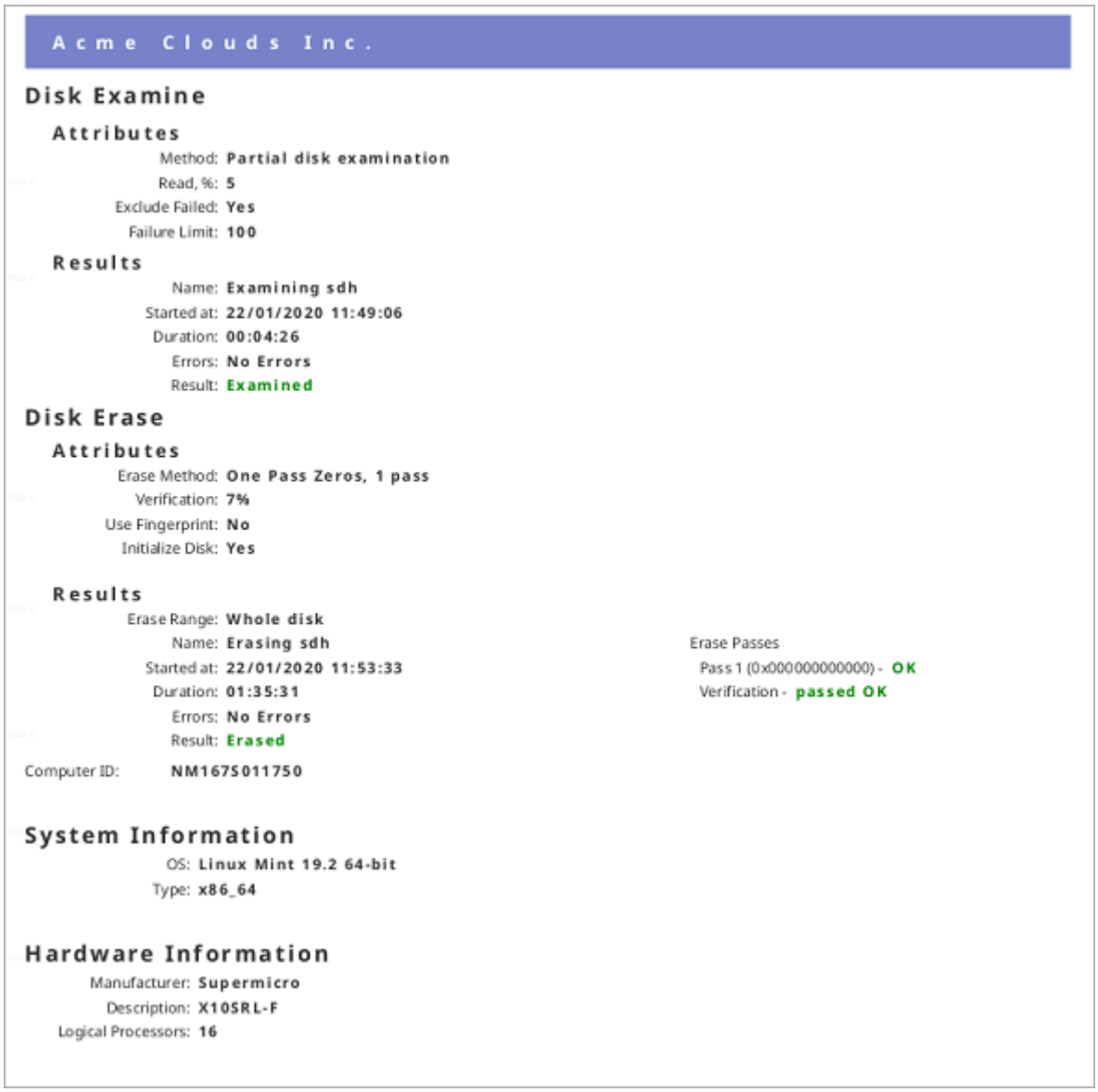
S.M.A.R.T. Parameters

Device Model: **WDC WD3200AAJS-61B4A0**
Serial Number: **WD-WCAT15377956**
Firmware Version: **01.03A01**
Capacity: **298 GB (320,072,933,376 bytes)**
ATA Version: **8**
ATA Standard: **Device does not report version**
SMART Support: **Yes**
Off-line Data Collection Status: **132**
Self-test Execution Status: **0**
Time Off-line Data Collection, sec: **5760**
Off-line Data Collection Capabilities: **123**
SMART Capabilities: **3**
Error Logging Capabilities: **1**
Short Self-test Time, min: **2**
Extended Self-test Time, min: **70**

S.M.A.R.T. Attributes

ID	Name	Value	Worst	Threshold	Type	Updated	When Failed	Raw Value
1	Read Error Rate	200	200	51	Pre-fail	Always	Never	19
3	Spin-Up Time	157	157	21	Pre-fail	Always	Never	3116
4	Start/Stop Count	100	100	0	Old-age	Always	Never	40
5	Reallocated Sectors Count	200	200	140	Pre-fail	Always	Never	0
7	Seek Error Rate	200	200	0	Old-age	Always	Never	0
9	Power-On Hours Count	100	100	0	Old-age	Always	Never	139
10	Spin-up Retries	100	253	0	Old-age	Always	Never	0
11	Calibration Retries	100	253	0	Old-age	Always	Never	0
12	Power Cycle Count	100	100	0	Old-age	Always	Never	36
192	Power-Off Retract Cycles	200	200	0	Old-age	Always	Never	32
193	Load/Unload Cycle Count	200	200	0	Old-age	Always	Never	38

Figure 27: Erase Certificate - 2-nd Page



Acme Clouds Inc.

Disk Examine

Attributes

Method: **Partial disk examination**
Read, %: **5**
Exclude Failed: **Yes**
Failure Limit: **100**

Results

Name: **Examining sdh**
Started at: **22/01/2020 11:49:06**
Duration: **00:04:26**
Errors: **No Errors**
Result: **Examined**

Disk Erase

Attributes

Erase Method: **One Pass Zeros, 1 pass**
Verification: **7%**
Use Fingerprint: **No**
Initialize Disk: **Yes**

Results

Erase Range: **Whole disk**
Name: **Erasing sdh**
Started at: **22/01/2020 11:53:33**
Duration: **01:35:31**
Errors: **No Errors**
Result: **Erased**

Erase Passes
Pass 1 (0x000000000000) - **OK**
Verification - **passed OK**

Computer ID: **NM1675011750**

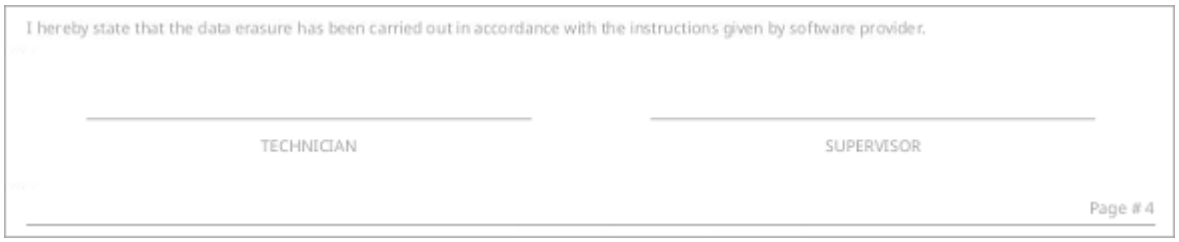
System Information

OS: **Linux Mint 19.2 64-bit**
Type: **x86_64**

Hardware Information

Manufacturer: **Supermicro**
Description: **X10SRL-F**
Logical Processors: **16**

Figure 28: Erase Certificate - 3-rd Page



I hereby state that the data erasure has been carried out in accordance with the instructions given by software provider.

TECHNICIAN

SUPERVISOR

Page # 4

Figure 29: Erase Certificate - Last Page

Sample of Secure Erase Certificate

Figure 30: Secure Erase Certificate - 1-st Page

Related information

Disk Labels on page 41
XML Reports on page 44

Disk Labels

Along with the PDF certificate **KillDisk** allows you to print Disk Labels to attach to the disks being erased. Disk Labels with erase status and essential disk information could be issued for any disk processing (such as Disk Erase Secure Erase and Disk Wipe). These labels may be completely customizable to print on label tape or on sheet with any dimensions. Simply specify the parameters and **KillDisk** will prepare the printable labels for you.

Print Labels Option

Upon the completion of a major **KillDisk** operation you will see a report dialog. In the list of completed tasks you will see the **Print Labels** button. Click it to open the Print Labels Dialog.

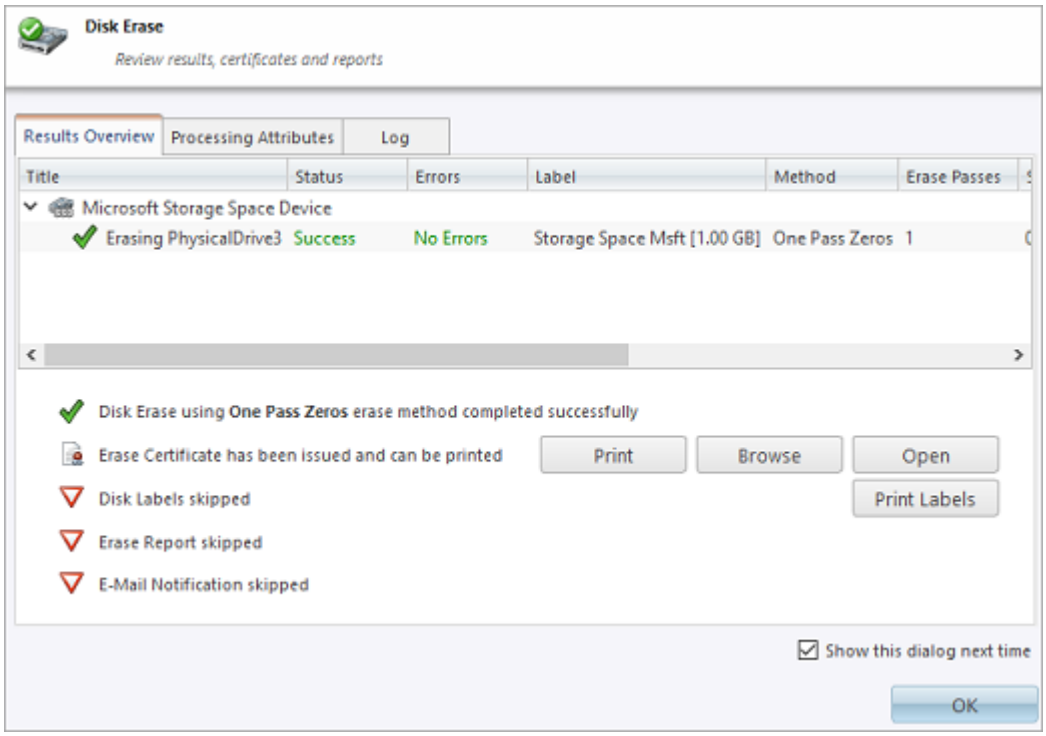


Figure 31: Print Labels from Processing Summary

Print Labels Dialog

This dialog allows you to configure the labels and prepare them for printing. The top of the dialog shows a list of the drives that will have labels generated for them. At any point in the operation a sample of the label is shown in the **Preview** window on the left side. The right side of the dialog has the styling and template configuration options.

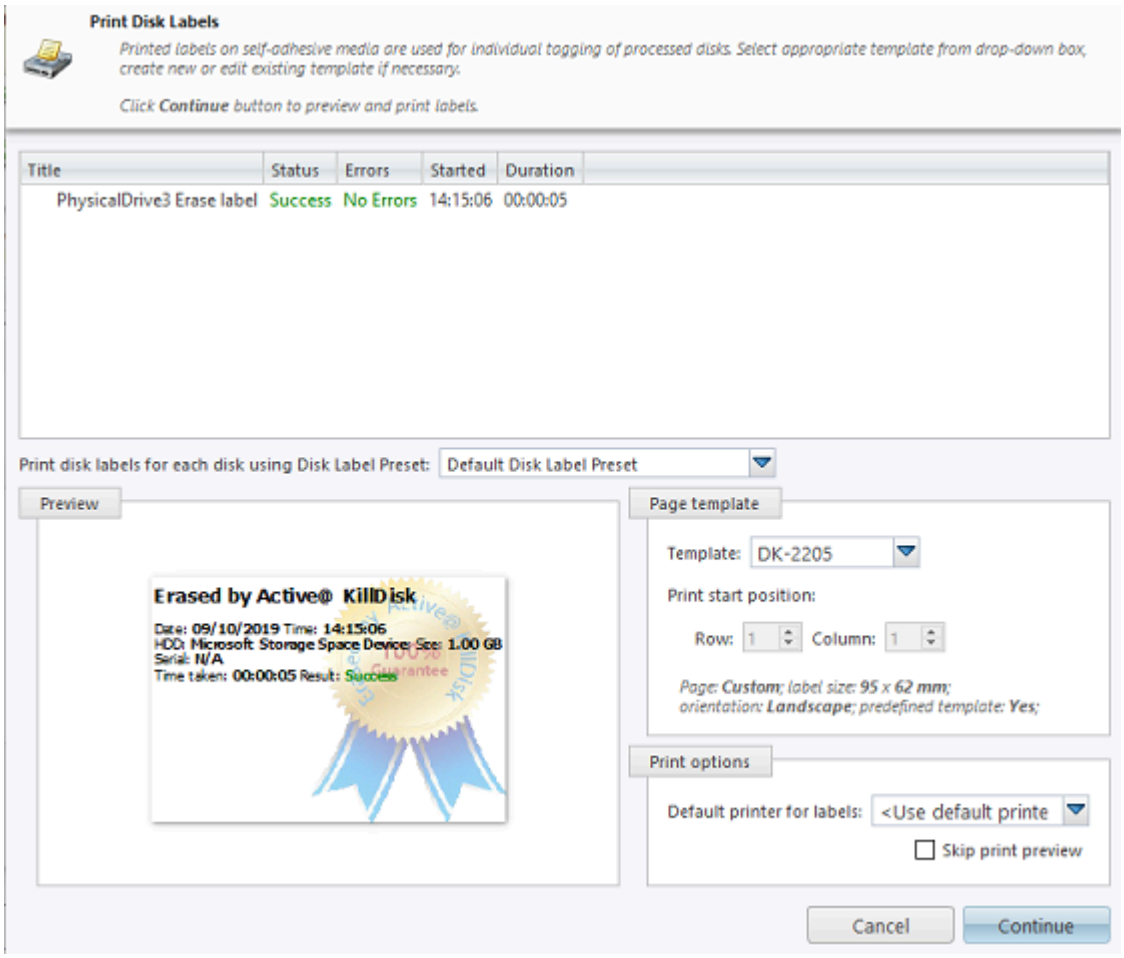


Figure 32: Print Labels Dialog

Page template options

The print label dialog gives you an access to a number of predefined standard presets and custom templates you may create. These templates may be easily selected without opening any additional dialogs. All the details of the selected template will be displayed below the selection box.

Print start position

The print start position section of the dialogue allows you to select what label on the page start printing from. The labels won't always start from the 1x1 position so you can adjust this setting accordingly.

Print preview and actual printing

Once all the settings are configured you may see the Print Preview by clicking the **Continue** button. The Preview displays what the print is going to look like and from here the print job can be sent to a printer that is configured in the system .

Skip Print Preview

Disables system Print Preview dialog and prints labels immediately.

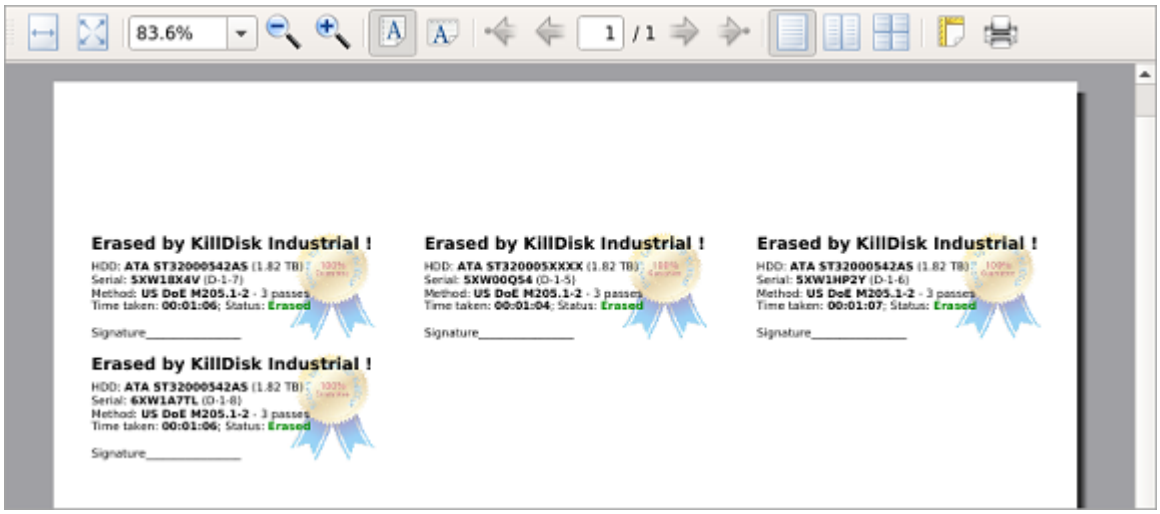


Figure 33: Example of Print Preview

Related information

Erase Certificates on page 37
Disk Label Presets on page 74

XML Reports

KillDisk gives you the option to store XML reports for any major operation it performs (Disk Erase Secure Erase and Disk Wipe) on a disk.

Configure Processing Report Preferences in order to get XML reports generated and saved to particular location.

These reports may include detailed information regarding erase processes, such as:

Company Information

- Name
- License
- Location
- Phone
- Disclaimer

Technician Information

- Name
- Comments

System & Hardware Info

- OS version
- Architecture
- Kernel
- Processors
- Manufacturer

Erase Attributes

- Erase Verify
- Passes
- Method
- Verification Passes

Error Handling Attributes

- Errors Terminate
- Skip Interval
- Number of Retries
- Source Lock
- Ignore Write Error
- Ignore Read Error
- Ignore Lock Error

Disks

- Device Size
- Device Type
- Serial Number
- Revision
- Product Number
- Name
- Geometric Information
- Partitioning Scheme

Batches

- Name
- Disks
- Time

Additional Attributes

- Fingerprint Information
- Initialization

Erase Result

- Bay
- Time and Date Started
- Disk Information
- Status
- Result
- Time Elapsed
- Errors
- Name of Operation

```
<?xml version="1.0" encoding="UTF-8"?>
<report created="03/02/2020 16:29:06" provider="KillDisk for Industrial Systems" version="3.9.29"
kernel-version="9.12.30 kd">
    <!--Technician (operator) Information-->
    <technician>
        <name>John Smith</name>
        <note></note>
    </technician>
    <!--Company (provider) Information-->
    <company>
        <name>Acme Clouds Inc.</name>
        <licensed>John Smith</licensed>
        <location>1111 Front Str. East, Toronto, Ontario, M5V 9S1</location>
        <phone>(416) 223-8062</phone>
        <disclaimer>I hereby state that the data erasure has been carried out in accordance with
the instructions given by software provider.</disclaimer>
    </company>
    <title>Disk Examine</title>
    <!--Examination attributes-->
    <examine method="Partial disk examination" read-percent="5" exclude-failed="yes">
        <failure-limit>100</failure-limit>
    </examine>
    <!--Error handling attributes and settings-->
    <errors locksource="no" retries="3" errorLimit="99" skip="512" timeout="3000" terminate="disk">
        <ignore lock="yes" read="no" write="no"/>
    </errors>
    <device name="sdh" product="ATA WDC WD800AAJS-00" revision="01.00A01" serial="WD-WMAM9UP70893"
type="Fixed Disk" size="74.5 GB">
        <geometry partitioning="" sectors="156,301,488" first="0" bps="512" spt="" tpc=""/>
        <smart-parameters>
            <param title="Device Model">WDC WD800AAJS-00TDA0</param>
            <param title="Serial Number">WD-WMAM9UP70893</param>
            <param title="Firmware Version">01.00A01</param>
            <param title="Capacity">74.5 GB (80,026,361,856 bytes)</param>
```

Figure 34: XML Report Sample

Helper Features

KillDisk has a number of extra features to ensure the most complete sanitation operations, flexibility to meet the most strict requirements and compatibility with a wide range of systems. This section outlines these features.

Map Network Shares

Map Network Shares is very useful feature when running application under Boot Disk and in Batch Mode. This feature creates a specific local drive letter for remote locations to save logs and certificates to, as well as provides a central location for erase reports to be stored.

To map a network share:

1. Open Mapping Dialog

   Navigate to **File > Map Network Share...** from the main menu.

2. Configure Mapping

   Assign a drive letter, type a network folder location or click **Browse** button to browse local network and select a proper network share. If sharing policy requires, type user name and password:

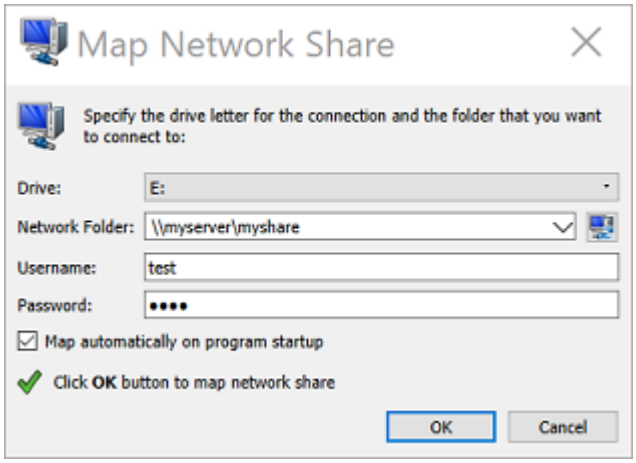


Figure 35: Mapping a Network Drive

   If you want to save configured mapping for future use, make sure **Map automatically on program start up** is marked.

   Note:

   KillDisk will identify all connected network drives, so you may use the drop-down list to select the one you'd like to use

3. Attach a Network Share

   Click **OK** to attach a network share mapped to the local drive letter.

After your network drive is configured, you may select it as a destination for certificates and reports in Preferences.

Set Disk Serial Number

If you notice that disk serial number displayed in **KillDisk** does not match the number displayed on the label attached to the physical disk, **KillDisk** let you option to change it manually. To access this feature right-click the disk and select **Set Serial Number** from the context menu.

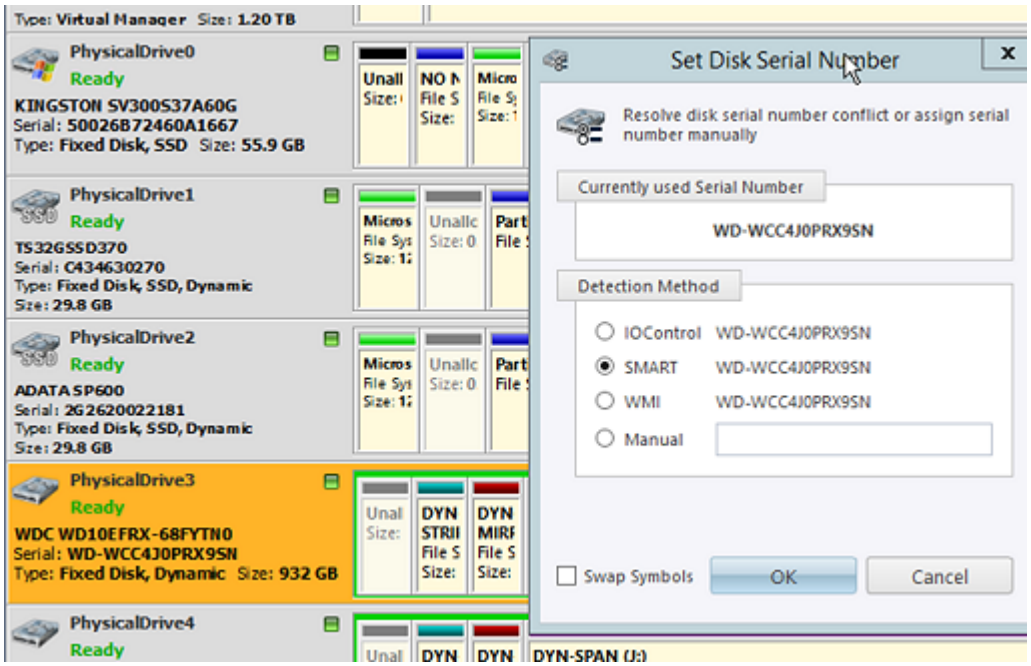


Figure 36: Set Disk Serial Number

There are several methods of disk serial number detection, application pulls it from various sources: **IOControl**, **SMART** and **WMI** (some of them can be disabled and grayed out, depending on Operating System support). Click the different options to apply different serial number detection method for the particular disk. Default serial number detection method applied to all disks can be set up in Preferences.

Note:

If you don't see your serial number in any of the detection methods try marking the **Swap Symbols** check box. If this doesn't help you can input disk serial number manually to be printed on certificates properly (ultimate option).

Reset Hidden Areas

KillDisk is able to perform erasing of a disk's hidden zones: **HPA** and **DCO**.

To perform this task, right click on the disk and select **Reset Hidden Areas** from the context menu:

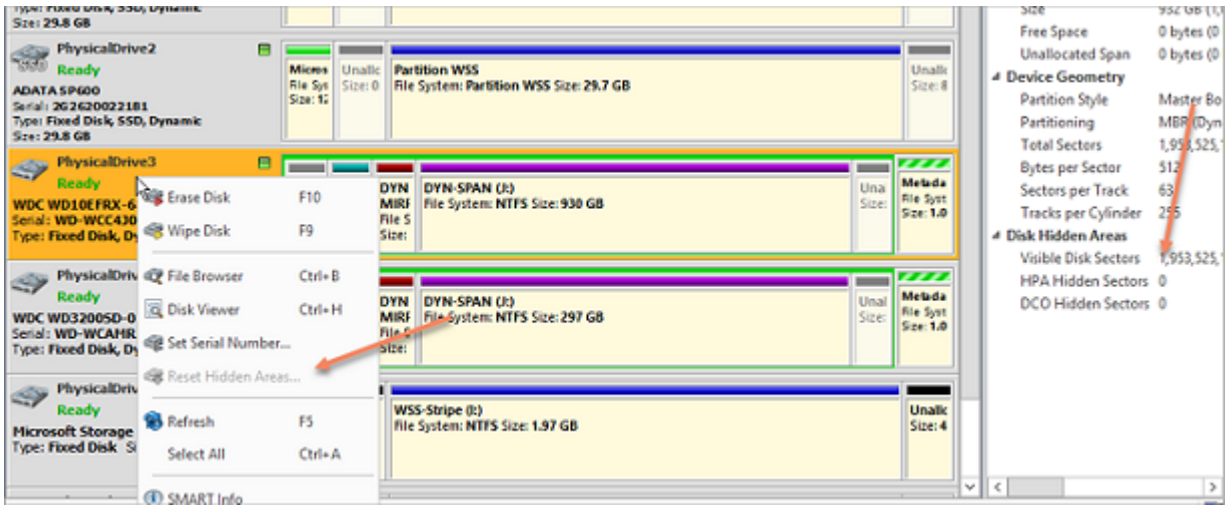


Figure 37: Disk Hidden Areas Reset

When related context menu item is disabled, this means that there are no hidden areas on the disk has been detected, so nothing to reset for the particular disk.

Related information

Disk Hidden Zones on page 114

Property Views

To show detailed information about any subject of an application (such as disk, partition, volume, file etc.) **KillDisk** uses information views. When displayed these views show information about the object being selected in the Disk Explorer. If selected object is changed, displayed information refreshes.

Property View

To open Property View for selected item do one of the following:

- Click **View** > **Windows** > **Properties** from the main menu
- Press **F4** (keyboard shortcut)
- Click **Properties** command from object's context menu

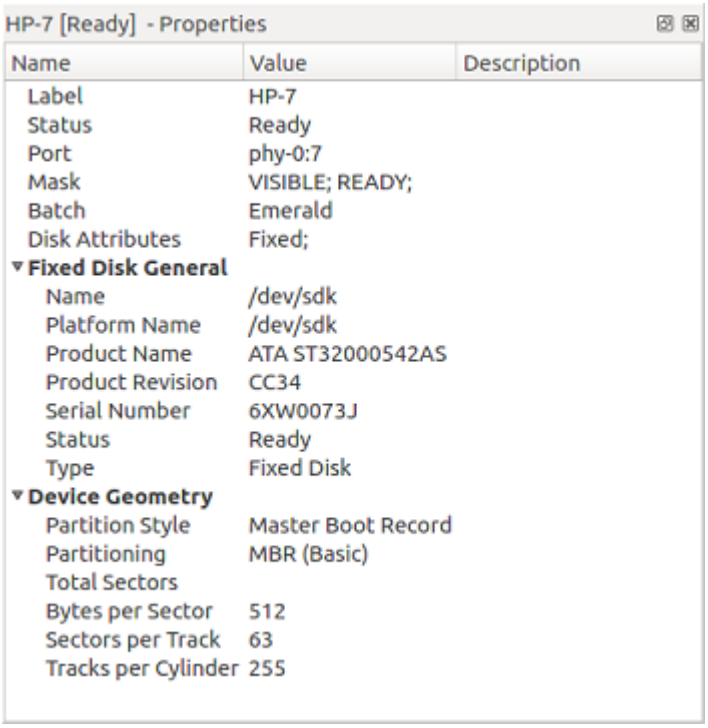


Figure 38: Property View Example

Besides displaying a valuable data it also allows you to copy that information into a clipboard by using context menu commands.

Context menu commands:

Copy Value
Copy Value of selected field to the clipboard (value only)
Copy Field
Copy formatted Name and Value pair to the clipboard
Copy All
Copy all information as formatted set of Name and Value pairs

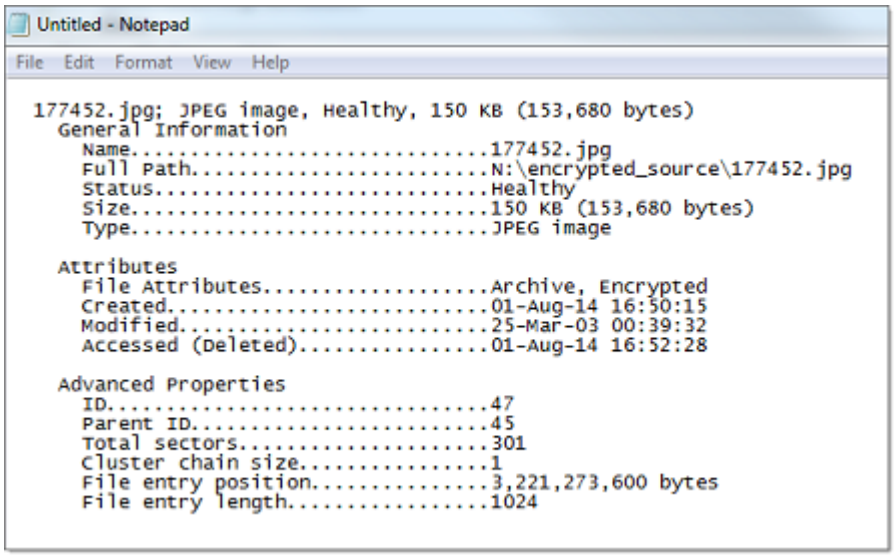


Figure 39: Copied Information Example

S.M.A.R.T. Information

Another informational view displays S.M.A.R.T. (Self Monitoring, Analysis and Reporting Technology) data for the selected disk (if the device supports it).

To show this view do one of the following:

- Click **View** > **Windows** > **SMART Info** from the main menu
- Use **SMART Info** context menu command for the selected disk

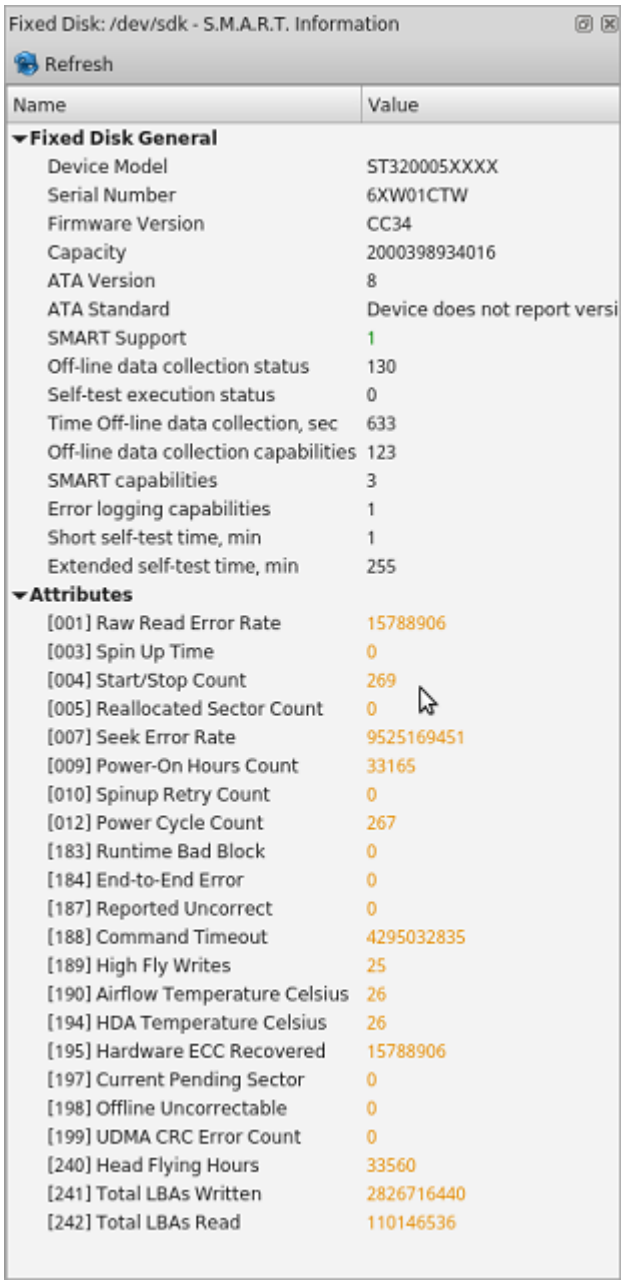


Figure 40: SMART Information View Example

S.M.A.R.T. data can be used to detect problem disks as long as important disk information has been reflected such as Power-on Hours, Reallocated Sectors and Current Pending Sectors.

Note:

When Current Pending Sectors parameter differs from zero, this means the disk has bad sectors. It will cause problems in the future. Dispose these disks as soon as possible.

Related information

Preferences on page 60

Command Line and Batch Mode

KillDisk can be executed with some predefined settings when started from a command prompt with specific command line parameters.

KillDisk can be also launched in fully automated mode (Batch Mode) which requires no user interaction.

KillDisk execution behavior depends on either command line parameters (highest priority), settings configured in interactive mode and stored in settings file (lower priority) or default values (lowest priority).

Command Line Mode

To run **KillDisk** in command line mode just open a command prompt and go to installation directory.

At the command prompt start **KillDisk** (Windows version) by typing:

```
KILLDISK.EXE -?
```

In Linux environment, type:

```
./KillDisk -?
```

A list of parameters appears. Their description is in the table below:

Table 1: Command Line Parameters

Parameter	Short	Default	Options
no parameter			With no parameter an interactive screen will appear
-erasemethod=[0-27]	-em=	2	0 - One pass zeroes (quick, low security)
			1 - One pass random (quick, low security)
			2 - US DoD 5220.22-M (slow, high security)
			3 - US DoD 5220.22-M (ECE) (slow, high security)
			4 - Canadian OPS-II (slow, high security)
			5 - British HMG IS5 Baseline (1 pass, quick)
			6 - British HMG IS5 Enhanced (slow, high security)
			7 - Russian GOST p50739-95(slow, high security)
			8 - US Army AR380-19 (slow, high security)
			9 - US Air Force 5020 (slow, high security)
			10 - NAVSO P-5329-26 RL (slow, high security)
			11 - NAVSO P-5329-26 MFM (slow, high security)
			12 - NCSC-TG-025 (slow, high security)
			13 - NSA 130-2 (slow, high security)
			14 - German VSITR (slow, high security)
			15 - Bruce Schneier (slow, high security)
			16 - Peter Gutmann (very slow, highest security)

Parameter	Short	Default	Options
			17 - User Defined Method. Number of passes and overwrite pattern supplied separately
			18 - NIST 800-88 (1 pass zeroes, quick)
			19 - NIST 800-88 (1 pass random, quick)
			20 - NIST 800-88 (3 passes, slow, high security)
			21 - Canadian CSEC ITSG-06 (3 passes, verify, slow, high security)
			22 - US DoE M205.1-2 (3 passes, verify)
			23 - Australian ISM-6.2.93 (1 pass random, verify, quick)
			24 - NIST 800-88 rev.1 (1 pass zeroes, quick)
			25 - NIST 800-88 rev.1 (1 pass random, quick)
			26 - NIST 800-88 rev.1 (3 passes, slow, high security)
			27 - IEEE Std 2883-2022 (2 passes, verify)
-passes=[1-99]	-p=	3	Number of times the write heads will pass over a disk area to overwrite data with User Defined Pattern. Valid for User Defined Method only
-verification=[1-100]	-v=	10	Set the amount of area the utility reads to verify that the actions performed by the write head comply with the chosen erase method (reading 10% of the area by default). Verification is a long process. Set the verification to the level that works best for you
-retryattempts=[1-99]	-ra=	2	Set the number of times that the utility will try to rewrite in the sector when the drive write head encounters an error
-erasehdd=[0,1..63]	-eh=		Number in BIOS of the disk to be erased. First physical disk has a zero number. In Linux first disk usually named /dev/sda. In Windows Disk Manager first disk is usually named Disk 0. On older systems (DOS, Windows 9x) first disk is usually named 80h (obsolete syntax is still supported in the parameter)
-eraseallhdds	-ea		Erase all detected disks
-excluderemovable	-xr		Exclude all removable disks from erasing when erase all disks selected
-excludefixed	-xf		Exclude all fixed disks from erasing when erase all disks option selected
-excludedisk=[0,1..63]	-xd=		Exclude disk from erasing when erase all disks option selected
-ignoreerrors	-ie		Do not stop erasing each time a disk error is encountered. When you use this parameter, all errors are ignored and just placed to the application log
-initdisk	-id		Initialize disk(s) after erase
-fingerprint	-fp		Initialize disk(s) and write fingerprint to the disk's first sector

Parameter	Short	Default	Options
-computerid=[1,2]	-ci=		1 - Display BIOS ID on the certificate
			2 - Display Motherboard ID on the certificate
-clearlog	-cl		Use this parameter to clear the log file before recording new activity. When a drive is erased, a log file is kept. By default, new data is appended to this log for each erasing process. By default the log file is stored in the same folder where the software is located
-exportlog	-el		Export a log file as XML report
-logpath=[“fullpath”]	-lp=		Path to save application log file. Can be either directory name or full file name. Use quotes if path contains spaces
-certpath=[“fullpath”]	-cp=		Path to save erase/wipe certificate. Use quotes if path contains spaces
-inipath=[“fullpath”]	-ip=		Path to the configuration file (KILLDISK.INI) for loading the advanced settings.
-noconfirmation	-nc		Skip confirmation steps before erasing starts. By default confirmation steps will appear in command line mode for each hard drive
-beep	-bp		Beep after erasing is complete
-wipeallhdds	-wa		Wipe out unallocated space on all recognized volumes located on all detected disks
-wipehdd=[0,1...63]	-wh=		Wipe out unallocated space on the disk specified by BIOS number
-test=["fullpath"]			If you are having difficulty with **KillDisk** use this parameter to create a hardware information file to be sent to our technical support specialists. You must specify the name of the file where to store technical information
-batchmode	-bm		Execute in batch mode based on command line parameters and INI file settings (without user interaction, all operations being stored to log file)
-userpattern=[“path”]	-u=		File to get user-defined pattern from. Applied to User Defined erase method. Each line in the file corresponds to the particular pass pattern
-shutdown	-sd		Save log file and shutdown PC after completion
-nostop	-ns		Prevent erase/wipe stop action
-help or -?			Display this list of parameters

Note: Parameters -test and -help must be used alone. They cannot be used with other parameters.

Note: Commands –erasehdd, -eraseallhdds, -wipehdd and -wipeallhdds cannot be combined.

Type the command and parameters into the command prompt console. Here is an example for Windows :

```
killdisk.exe -eh=80h -bm
```

The same in Linux:

```
./KillDisk -eh=0 -bm
```

In this example data on device 80h will be erased using the default method (US DoD 5220.22-M) without user confirmation and application quits (control returns to the command prompt) when complete.

Here is another Windows example:

```
killdisk.exe -eh=80h -nc -em=2
```

The same in Linux:

```
./KillDisk -eh=0 -nc -em=2
```

In this example all data on the first detected disk (which has 'zero' number or 80h) will be erased using US DoD 5220.22-M method without confirmation. After erase completes, processing summary report will be displayed.

Note: In Linux environment to detect and work with physical disks properly **KillDisk** must be launched under Super User account. So, if you are not a Super User, you should type a prefix **sudo**, or **su** (for different Linux versions) before each command.

After you have typed **KillDisk** and added command line parameters press **Enter** to complete the command and start the process.

Information on how drives have been erased is displayed on the screen when the operation has completed successfully. **KillDisk** execution behavior depends on either command line parameters (highest priority), settings configured in interactive mode and stored in the settings file (lower priority), or default values (lowest priority).

Related information

Batch Mode on page 55

Batch Mode

Note: This feature is intended for advanced users only

Batch Mode allows **KillDisk** to be executed in fully automated mode without any user interaction. All events and errors (if any) are placed to the log file. This allows system administrators and technicians to automate erase/wipe tasks by creating scripts (*.CMD, *.BAT files) for different scenarios that can be executed later on in different environments.

To start **KillDisk** in batch mode just add the `-bm` (or `-batchmode`) command line parameter to the other parameters and execute **KillDisk** either from the command prompt or from a custom script.

Here is an example of Batch Mode execution with the wipe command:

```
KillDisk -wa -bm -em=16
```

This command will wipe all deleted data and unused clusters on all attached physical disks without any confirmations using most secure Peter Gutmann's method and control returns to the command prompt when erase completes.

If `-ns` (`-nostop`) command line parameter is specified no user interaction is possible after erase/wipe action started. So user cannot cancel the command being executed.

After command execution completed, application returns the following exit codes to the Operating System.

Return codes:

0 (Zero)

KillDisk returns Zero when all disks erased successfully

1 (One)

KillDisk returns One if errors occurred or nothing has been erased/wiped

2 (Two)

KillDisk returns Two if erase/wipe has been completed, but minor warnings occurred

Related information

Command Line Mode on page 52

Advanced Tools

KillDisk offers a number of advanced tools to work in conjunction with the software to make operations easier to perform and the disks easier to explore. **KillDisk** makes it possible to explore disks both on a file level (in file Browser) and on a low level (in Hexadecimal Viewer). Disk health analysis can be performed with S.M.A.R.T. monitor. Logs and reports export to the external SQL databases is fully supported in **KillDisk Industrial** version.

This section describes these features:

- File Browser
- Hexadecimal Viewer

File Browser

KillDisk includes a built-in File Browser to examine disks' surface for verification purposes, for proper disk selection for the erase, and for deleted files validation after wipe. File Browser is able to preview volumes and display files and folders located on all existing file systems used in Windows, Linux, Unix or Mac OS.

Note:

KillDisk detects existing files as well as files that have been deleted but NOT sanitized. They appear in Gray color and indicate deleted files with a high probability of being recovered with a special file recovery tools.

Browse Disk View

To browse the contents of a specific disk simply select the disk and click **Open in File Browser** from the **Action** menu or select the related command from the context menu.

Another way is to use a keyboard shortcut which is **Ctrl-B**. This will open the File Browser window:

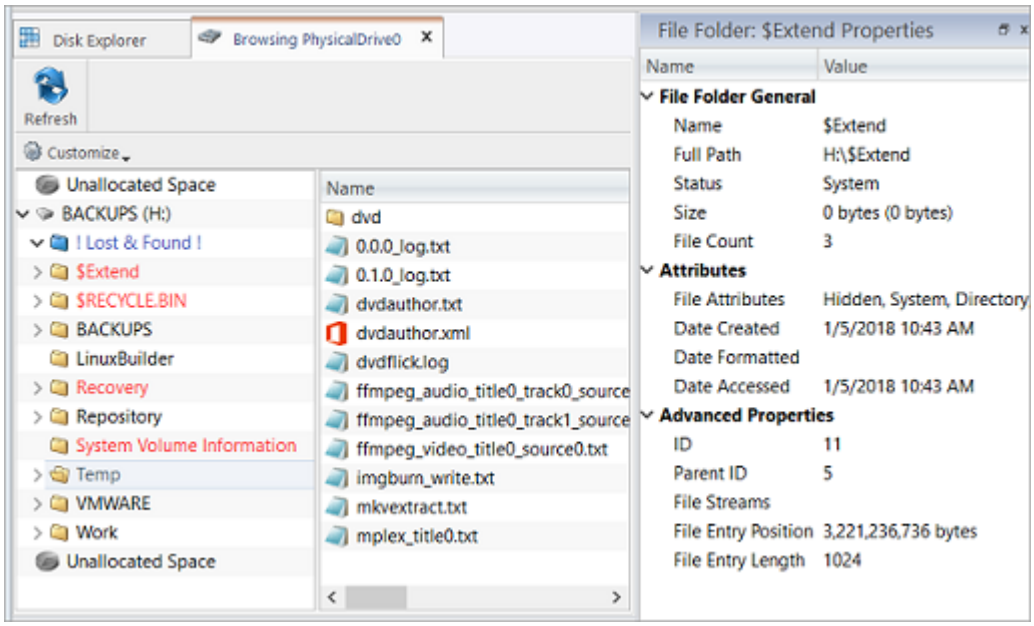


Figure 41: File Browser Window

The File Browser tab displays files and folders on the disk being selected. Browsing over the folders tree performed the same way as in Windows Explorer.

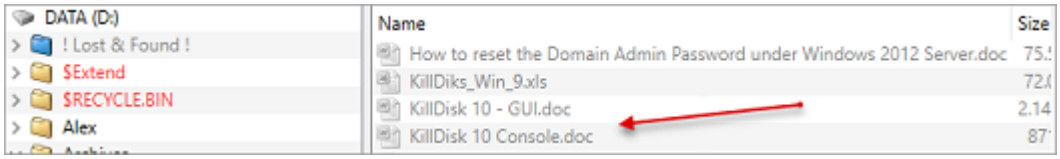


Figure 42: Deleted Files in File Browser

Grey files indicate deleted files have not been sanitized. These files are recoverable. Running **KillDisk**'s Wipe operation ensures these files are unrecoverable and make these gray files disappear from the File Browser.

Note:

Found deleted files appear in their original directory (before they were deleted). The **! Lost & Found !** folder is a virtual directory created for deleted files which are found without directory information.

Disk Viewer

Disk Viewer allows users to view the contents of connected drives on a sector's level in a hexadecimal, ASCII and Unicode representations. Disk Viewer for the selected disk can be launched from the main view as well as through the main menu bar. Shortcut is **Ctrl-H**.

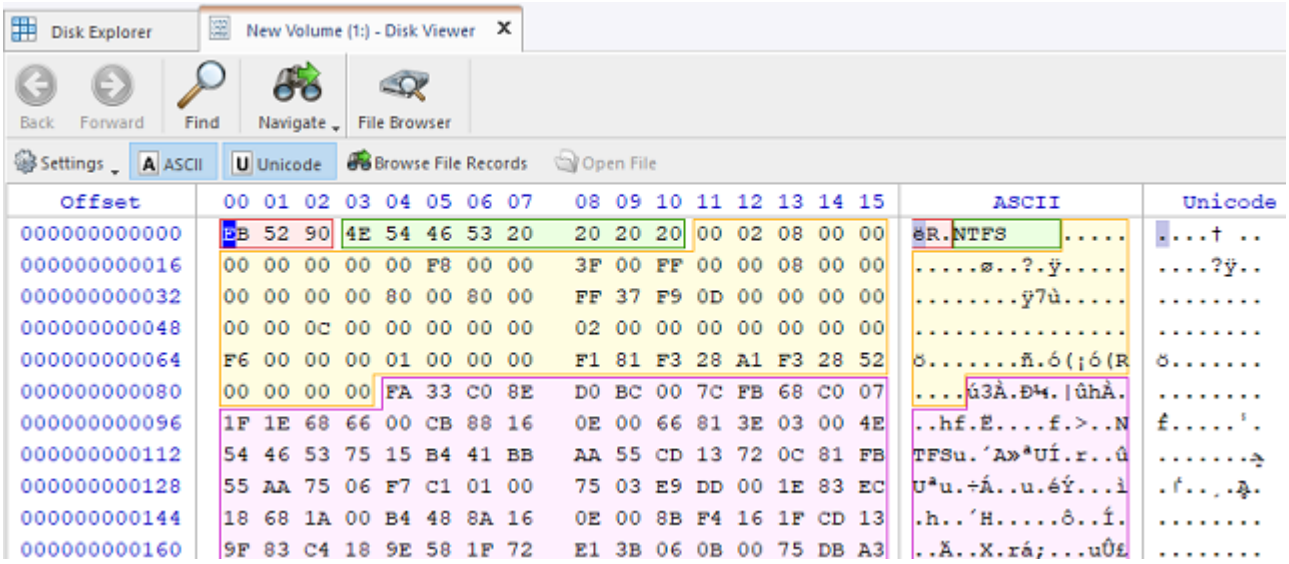
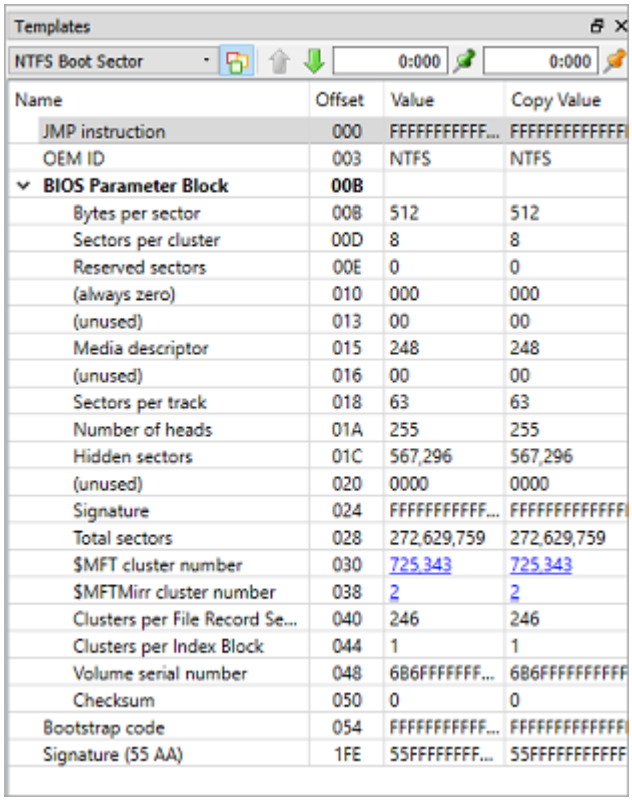


Figure 43: NTFS Volume in Disk Viewer

Templates

KillDisk also offers a list of templates to help display volume structure on the disk by colored sections. Example above displays what happens when NTFS volume is opened in the Disk Viewer. In this case NTFS Boot Sector template has been attached automatically. Below is NTFS Boot Sector template details in Templates view.



Name	Offset	Value	Copy Value
JMP instruction	000	FFFFFFFFFF...	FFFFFFFFFFF
OEM ID	003	NTFS	NTFS
BIOS Parameter Block	**00B**		
Bytes per sector	00B	512	512
Sectors per cluster	00D	8	8
Reserved sectors	00E	0	0
(always zero)	010	000	000
(unused)	013	00	00
Media descriptor	015	248	248
(unused)	016	00	00
Sectors per track	018	63	63
Number of heads	01A	255	255
Hidden sectors	01C	567,296	567,296
(unused)	020	0000	0000
Signature	024	FFFFFFFFFF...	FFFFFFFFFFF
Total sectors	028	272,629,759	272,629,759
$MFT cluster number	030	725,343	725,343
$MFTMirr cluster number	038	2	2
Clusters per File Record Se...	040	246	246
Clusters per Index Block	044	1	1
Volume serial number	048	6B6FFFFFFF...	6B6FFFFFFFF
Checksum	050	0	0
Bootstrap code	054	FFFFFFFFFF...	FFFFFFFFFFF
Signature (55 AA)	1FE	55FFFFFFFF...	55FFFFFFFFF

Figure 44: NTFS Boot Sector Template View

Low-level Search

Disk Viewer has an advanced search feature for locating specific data in sectors while low-level disk scan. Click **Find** toolbar button to open Find Text dialog.

Find what
Input the characters you are searching for in ANSI, Hex or Unicode
Search direction
If you have an idea of where the data may be located specify where to search
Not
Search for characters that do not correspond to the **Find what** parameter
Ignore case
Disables case-sensitivity in text search
Use
Switch between Regular Expressions and Wildcards
Per block search
if you are familiar with the location of the data in the data block you can specify a search with an offset of the object to speed up the search process

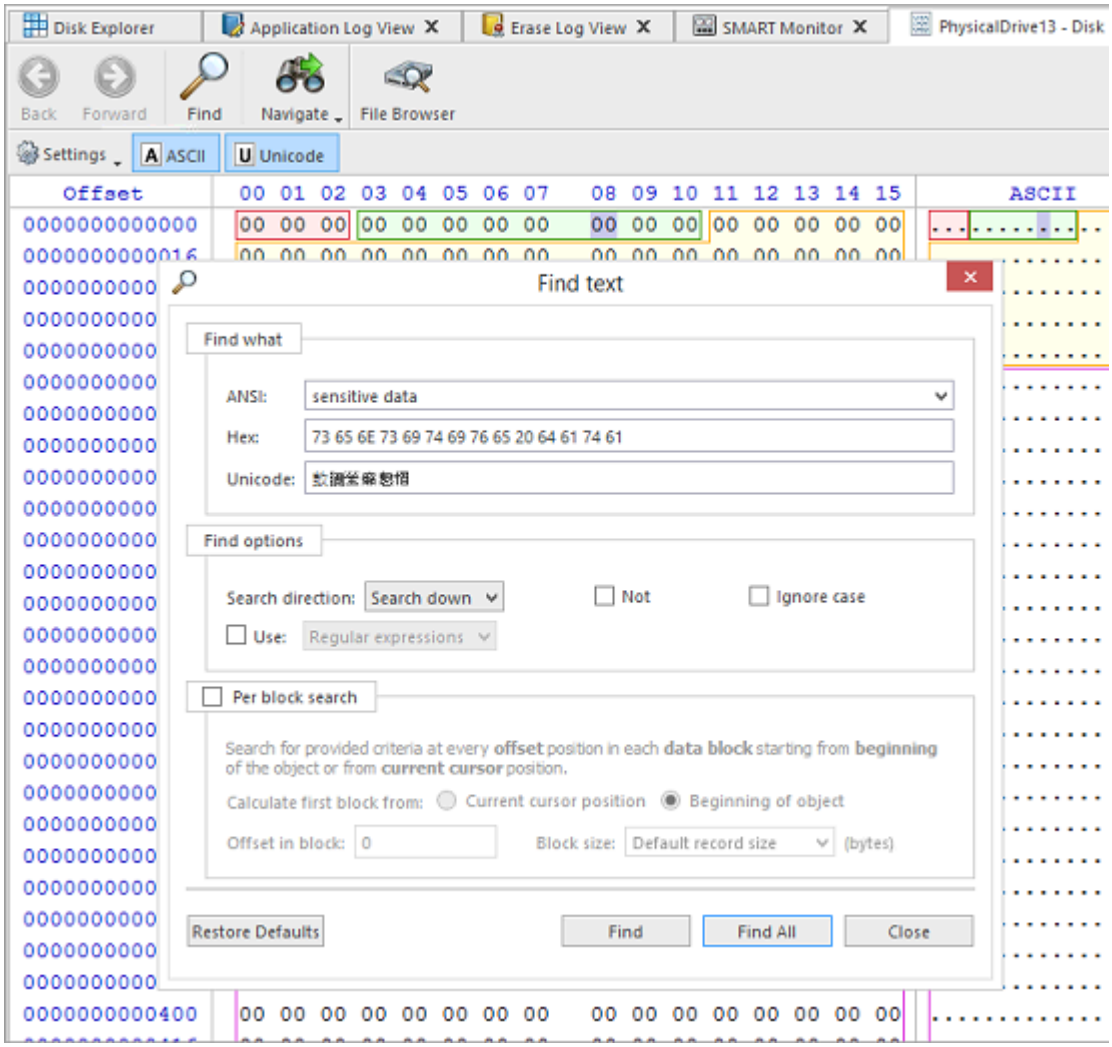


Figure 45: Find Text Dialog

Navigation

Disk Viewer's Navigate options simplify navigation on the disk. Click **Navigate** toolbar button to access these options, which are:

Go to offset
Jumps to the particular offset that needs to be entered manually in a decimal or hexadecimal form
Go to sector
Jumps to the particular sector or cluster on the disk
Partition table
Jumps to the sector where partition table is located
Particular partition
Lists all partitions and allows to jump to the boot sectors, to the beginning and to the end of any available partition

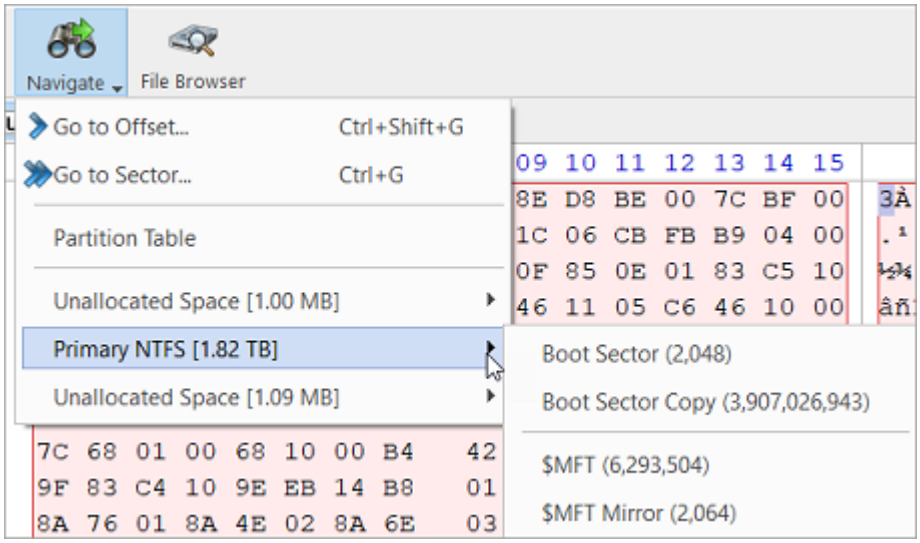


Figure 46: Disk Viewer Navigation Options

Preferences

KillDisk Preferences dialog is the central location where **KillDisk** features and settings can be configured.

To open **Preferences** dialog:

- From main menu choose **Tools** > **Preferences...**

  or
- Press **F2** keyboard shortcut at any time

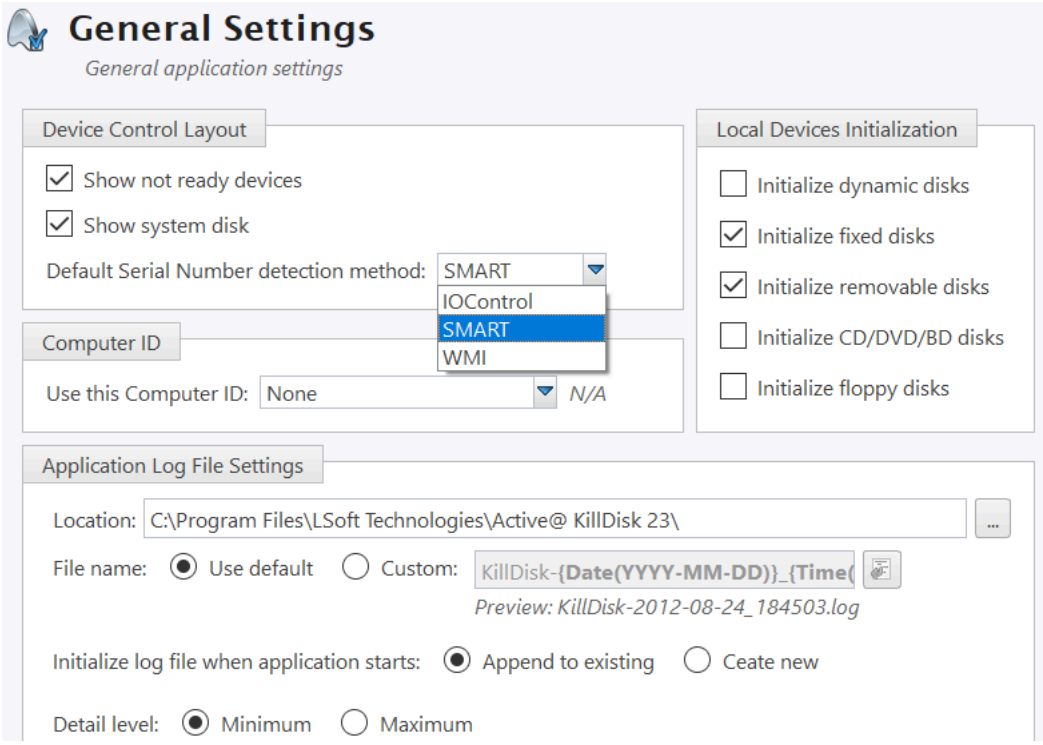
Preferences dialog divided into several sections:

- General Settings
- Disk Erase
- Secure Erase
- Disk Wipe
- Erase Certificate
- Company Information
- Technical Information
- Processing Report
- Processing CSV Log
- Disk Label Presets
- Disk Viewer
- Error Handling
- E-Mail Notifications

Preferences allow to configure all the settings needed for the application proper operation.

General Settings

The General Settings section allows to configure general preferences as well as the applications' visual and sound representation.



Device Control Layout

These settings control visual disk behavior in Disk Explorer and allow to Show or Hide a System Disk and devices which are not ready (offline).

Default serial number detection method

Select how **KillDisk** retrieves the disk serial number by default. Values are: **SMART**, **IOControl** & **WMI**.

Local devices initialization

Select which types of devices appear in **KillDisk** by default: **Dynamic Disks, Fixed disks**, **Removable disks**, **CD/DVD/BD** and **Floppies**.

Computer ID

Configure how the **KillDisk** workstation is identified in logs & reports. Values are: **None**, **BIOS Serial Number**, **Motherboard Serial Number**.

Application Log File Settings

These settings apply to the log file generated by the application. All operations performed in a **KillDisk** session will be saved in this log.

Log file location

Allows the user to specify where the application log file is saved. By default this is set to a **KillDisk** installation directory.

Application log detail level

Manipulate the amount of details included in the logs. Options are: **Minimum** and **Maximum**.

Initialize application log when application starts

This setting configures whether **KillDisk** generates a new log file for every session (erasing the log of the previous session) or appends new sessions to one log file. Moreover, logs can be placed to the files being named using naming pattern specified.

Environment

These are configurable options pertaining to the applications user interface and user experience.

Application style

Configures the color scheme used in the application. Values are: **Blue**, **Olive**, **None (Use OS default)**, **Silver** and **Dark**.

Default toolbars style

Configures how icons are shown in the toolbar. Values are: **Large icons, no text**; **Large icons, with text beside icon**; **Large icons, with text under icon**; **Small icons, with text beside icon;** **Small icons, no text.**

Default help source

If available, user can select help documentation source to be addressed when requested. Values are: **PDF**, **Context Help** and **On-line web help.**

Show notification dialog after process complete

Show or hides final process confirmation dialog.

Reset all dialogs

Resets all the settings to the default state.

Sound Notifications

These are configurable options related to application sounds: you can use either predefined values or assign your own sounds (User defined sound file).

Use Sound Notifications

Toggles sound tones being used for notifying the user of the completion of a task, errors and notification during an operation: **Success**, **With Warnings**, **With Errors**, **Failure**.

Action Triggers

Configure actions performed while application is running.

Automatically check for software updates

If this option set, application will check for a new update after every start up.

Action after all processes complete

Select either **None**, **Hibernate**, **Shutdown** or **Restart** system after all running processes completed.

CAUTION:

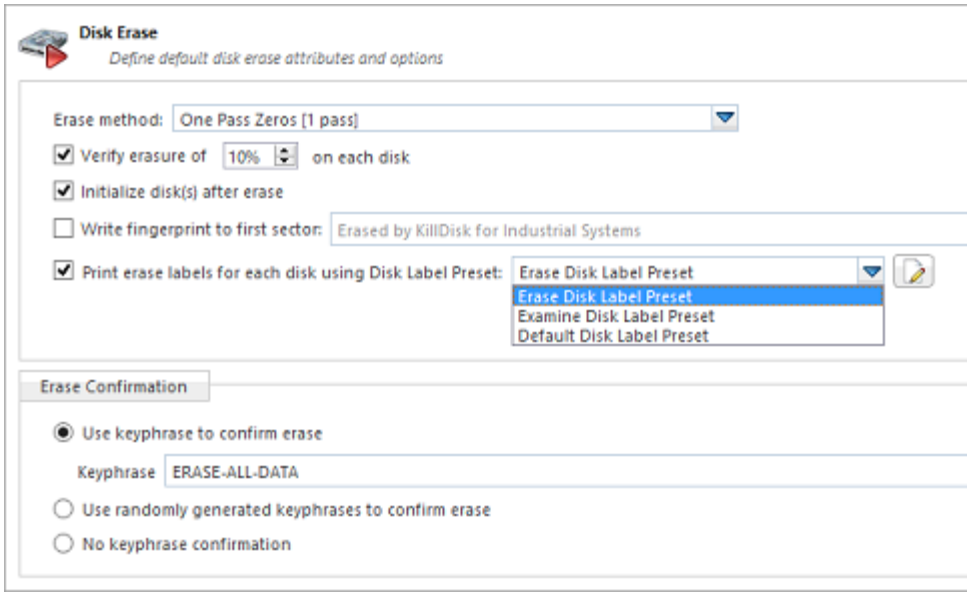
You will have 30 seconds to abort system hibernation, restart or shutdown.

Export erase certificates and application log to all detected removable media

Upon erase completion all certificates and logs will be automatically exported to attached USB disks (all detected media of removable type).

Disk Erase

The Disk Erase section provides settings' configuration for the **KillDisk** erase procedures.



Erase method

Choose one of more than 20 sanitizing methods including many international standards and custom patterns.

Erase verification

Percentage of disk to be verified after disk erasure. The large percentage, the more time it takes to verify written data.

Note:

In some erase methods such as the US DoD 5220.22-M this option is mandatory. After the erase operation has completed this feature will scan the entire drive evenly and verify the integrity of the erase operation. This option is the percent of the sectors to check across the disk. Most standards specify 10% as an accurate sample size for the verification.

Initialize disk(s) after erase

Writes proper MBR to disk's first sector after erasure complete. This is needed for disk to be visible and accessible by most Operating Systems.

Write fingerprint to first sector

This feature writes the specified fingerprint to the first sector of the erased drive. If erased disk is plugged into the system and system boots from this disk the user will see a message on the screen about the disk being erased by KillDisk.

Print erase labels

This feature prints erase label automatically after erase completion using specific Disk Label configuration.

Erase confirmation

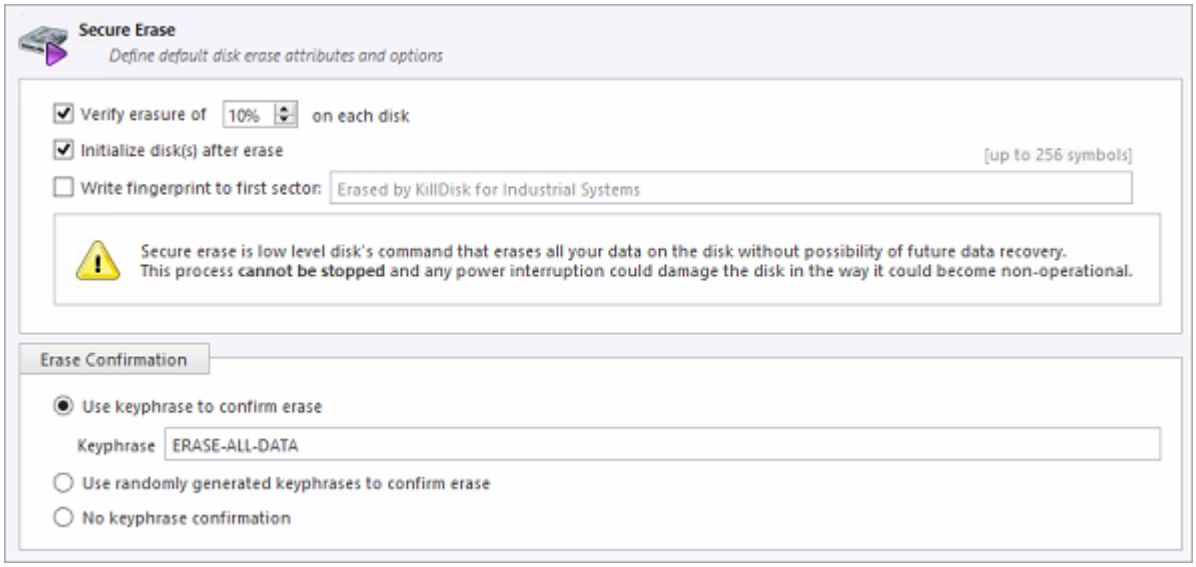
As a safety precaution to prevent accidental removal of disks' data **KillDisk** uses the *user-typed keyphrase* mechanism just before the erase procedure is initiated (see below). By default this precaution mechanism is initialized with the key phrase **ERASE-ALL-DATA**. The key phrase can be modified, configured as a randomly generated set of characters or disabled. The keyphrase should be typed correctly in order to start the erase procedure.

Related information

Erase Methods on page 97
Erase Disk Concepts on page 88
Disk Label Presets on page 74

Secure Erase

The Secure Erase section provides settings' configuration for the Solid State Drive (SSD) specific erase procedures.



Verify erasure

Percentage of disk to be verified after Secure Erase completes.

Initialize disk(s) after erase

Writes proper MBR to disk's first sector after erasure complete. This is needed for disk to be visible and properly accessible by most Operating Systems.

Write fingerprint to first sector

This feature writes the specified fingerprint to the first sector of the erased drive. If erased disk is plugged into the system and system boots from this disk the user will see a message on the screen about the disk being erased by KillDisk.

Erase confirmation

As a safety precaution to prevent accidental removal of disks' data **KillDisk** uses the *user-typed keyphrase* mechanism just before the erase procedure is initiated (see below). By default this precaution mechanism is initialized with the key phrase **ERASE-ALL-DATA**. The key phrase can be modified, configured as a randomly generated set of characters or disabled. The keyphrase should be typed correctly in order to start the erase procedure.

Related tasks

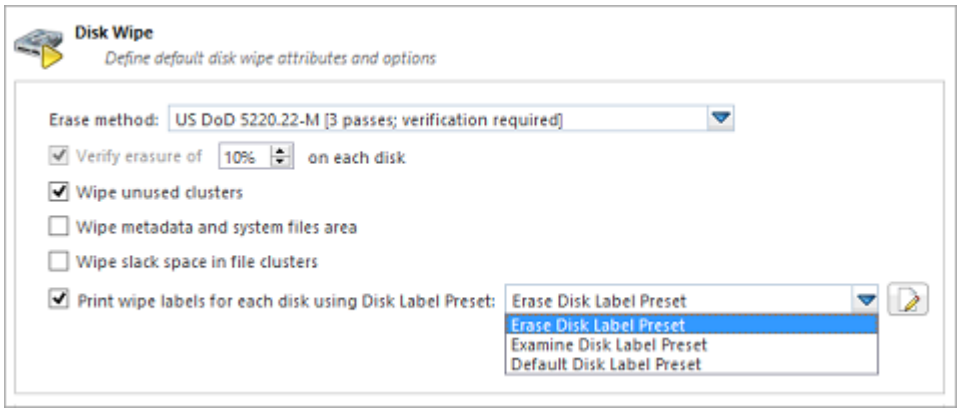
Secure Erase on page 32

Related information

Secure Erase (SSD) on page 122
Secure Erase Concepts on page 90
Secure Erase (ANSI ATA, SE) on page 99

Disk Wipe

The Disk Wipe section provides settings' configuration for Wipe procedure and allows you to specify the erase method to use, verification and a few additional wipe-specific options.



Erase method

Choose one of more than 20 sanitizing methods including many international standards and custom patterns.

Verify erasure

Percentage of disk to be verified after wiping out unused disks' clusters.

Wipe unused clusters

Erase areas of the hard drive that are not formatted and not currently used by the Operating System (data has not been recently written there unless this is a recently deleted partition).

Wipe metadata and system files area

Erase areas on the disk containing information about previous files on the volume. Wiping prevents recovery of files using their remained directory records.

Wipe slack space in file clusters

Erase slack space within files. Because files are usually never exactly the size of the space allocated to them there may be unused space within a file that may contain traces of data stored there previously. This algorithm wipes that space to remove these data traces.

Print wipe labels

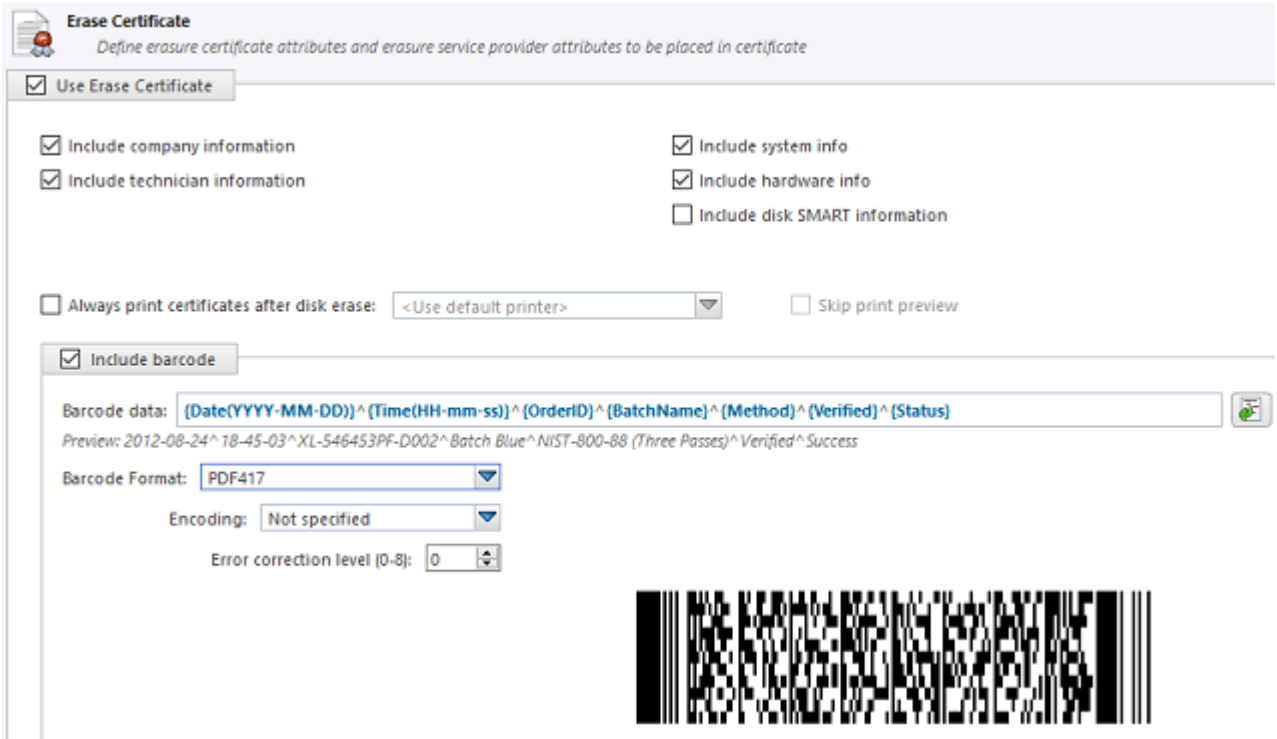
This feature prints wipe labels automatically after wipe is completed using a specific Disk Label configuration.

Related information

Erase Methods on page 97
Wipe Disk Concepts on page 92
Disk Label Presets on page 74

Erase Certificate

Erase Certificates section configures options for appearance and storage of certificates in PDF format. If **Use Erase Certificate** check box is selected, PDF certificates will be created and available for the immediate printing and storage for future use. Certificates can be customized with Company Information, Technician Information and other information.



Include company information

Use this option to include company's information section to the certificate.

Include technician information

Use this option to include technician's information section to the certificate.

Show KillDisk logo on certificate

Use this option to display a default KillDisk logo at the top right corner of the first page.

Include system info

Ensures that the Operating System specific information for the workstation used for erasure is saved to the certificate, such as:

- Operating system
- Kernel version
- Architecture

Include hardware info

Ensures that the Chassis-specific information for the workstation used for erasure is saved to the certificate, such as:

- Motherboard manufacturer
- Motherboard description
- Number of processors

Include disk SMART information

Use this option to include S.M.A.R.T. information section for the disk being erased.

Print Options

Always print certificate after disk erase

Prints erase certificate after erase completion automatically.

Skip print preview

Prints erase certificate skipping certificate preview step.

Default printer

Select a default printer for printing erase certificates.

Barcode

If **Include Barcode** check box is selected, a barcode section has been added to the certificate in desired format. Barcode section includes the following options:

Barcode data

Is a string of available tags and attributes concatenated by ^ (*CARET*) delimiter. User is able to compose a custom string with selected values from drop-down list or by simple typing.

Preview

Shows the composed data representation. Barcode data encoded to the actual barcode.

Barcode format

There is a drop-down list of available barcode formats.

Encoding

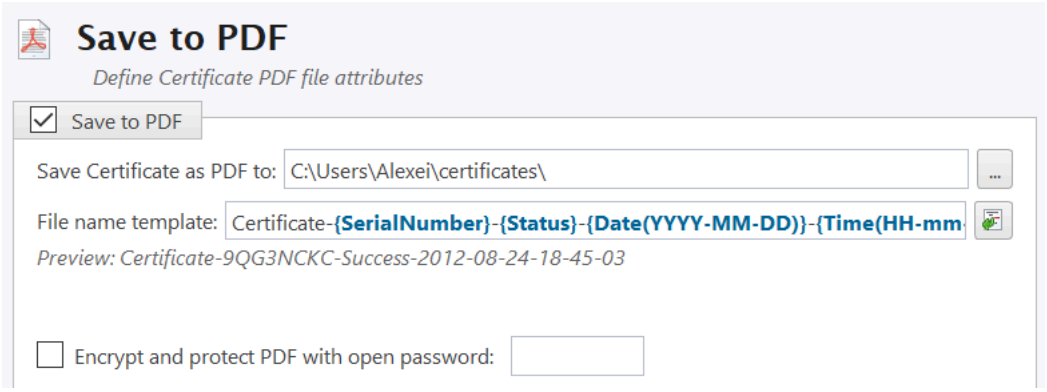
There is a drop-down list of available encoding schemes for the particular barcode format. The selected encoding is used to encode the barcode data.

Error correction level (0-8)

Affects a size of the barcode. Increasing the level value provides a better scanner readability. Values depend on the barcode format selected.

Save to PDF Options

Section **Save to PDF** offers options for storing a certificate to file in PDF format as well as encrypting it with a password.



Certificate location

Use this option to save erase certificate as a file in PDF format to the selected location.

File name template

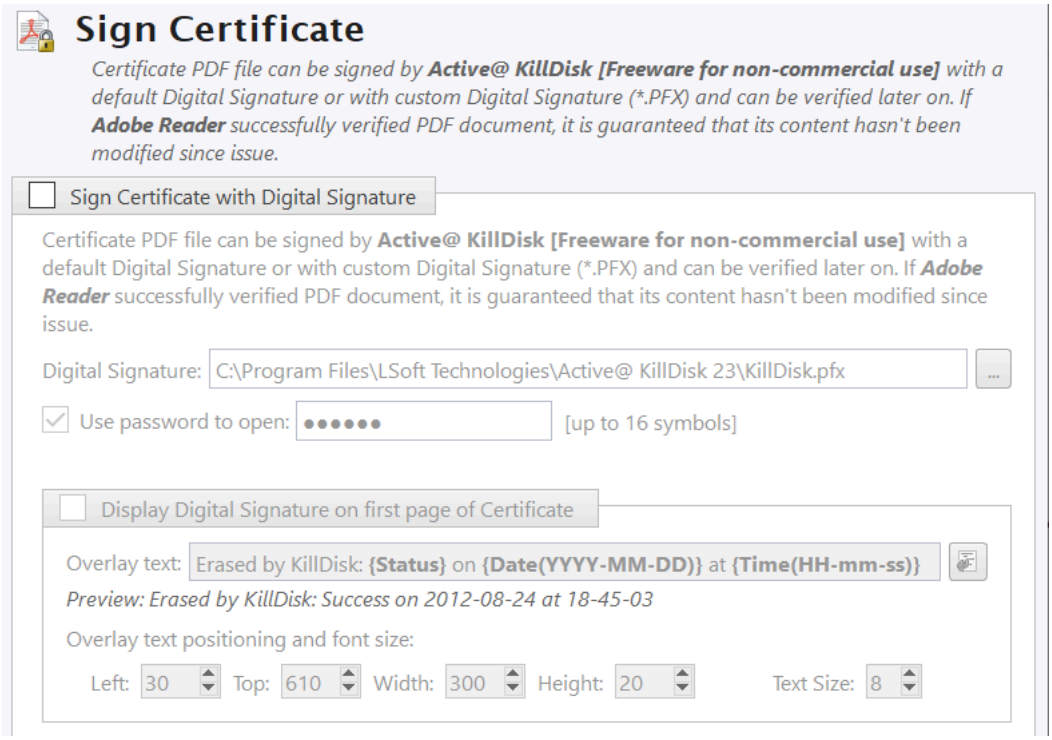
Specify the template composed of different tags for the Erase Certificate. See the tags available in Appendix tags section.

Encrypt with password

If password field is not empty, output certificate (PDF file) will be encrypted and protected with specified password. This password needs to be typed in any PDF viewer next time user opens a certificate for printing or previewing.

Sign Certificate

Section **Sign Certificate** offers options for signing an output PDF certificate with digital signature.



Sign certificate with digital signature

Certificate file (PDF) can be signed with a default Digital Signature (supplied **KillDisk.pfx**) or with your custom Digital Signature (*.PFX) and can be verified later on. If Adobe Reader successfully verified PDF document, it is guaranteed that its content hasn't been modified since issue.

If custom Digital Signature is required, please issue a certificate and specify full path to the custom certificate (*.PFX file) as well as its open password in the related fields below (**Digital Signature** and **Use password to open**)

Display digital signature

Digital Signature can be displayed as an overlay text on the first page of the certificate. After you turn this option on, you can specify overlay text using tags (see tags section) and configure signature position on the first page, rectangle dimensions and text size.

Related information

Name Tags on page 111

Company Information

Company Information section allows to configure business specific information for Erase Certificates, Processing Reports and Disk Labels.

To specify a Company Logo image use the **Set** button. Select a desired logo image file. Most of the image formats are supported: JPEG, TIFF, BMP and PNG. The logo is previewed in the Company Logo space.

Tip:

It is recommended to use company logo with resolution suitable for printing (300dpi) with a side not exceeding 300px.

Add company's information to the related fields: **Licensed to**, **Business name**, **Location**, **Phone**, **Disclaimer**.

When the **Add company supervisor signature field to certificate** check box is marked the related field is added to the certificate.

Related information

Erase Certificate on page 66
Processing Report on page 71

Technician Information

Technician Information section allows to configure a specific technician information for Erase Certificates, Processing Reports and Disk Labels.

Type **Operator name** and **Comments** to the related fields.

When the **Add technician (operator) signature field to certificate** check box is marked the related field is added to the certificate.

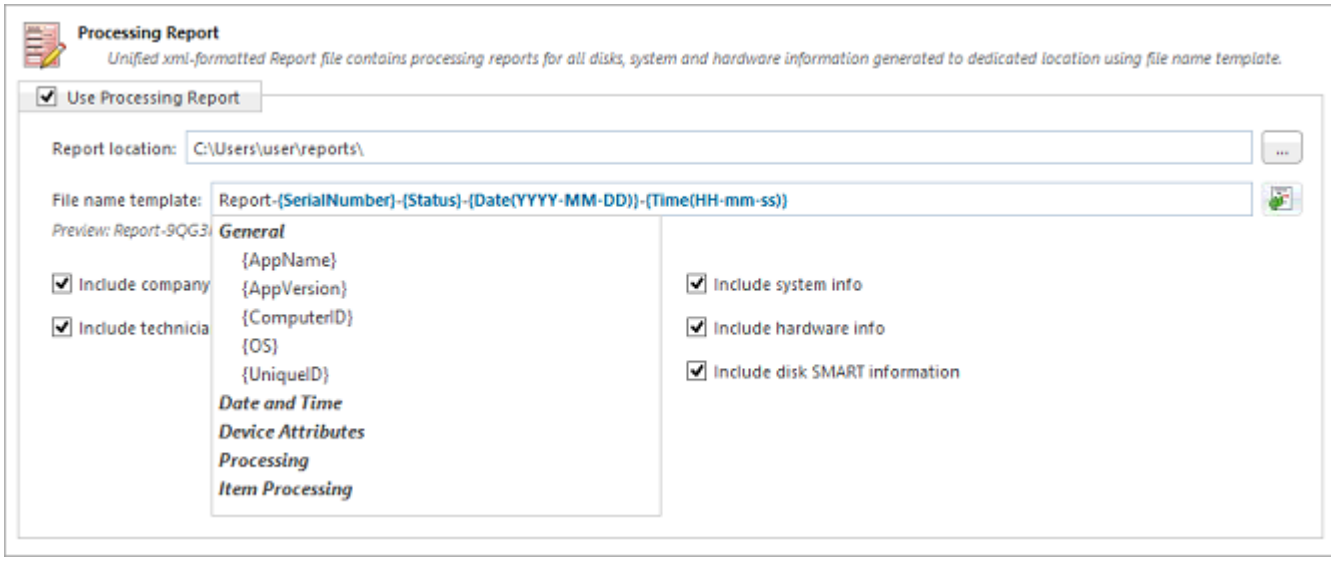
Related information

Erase Certificate on page 66

Processing Report on page 71

Processing Report

Processing Report section allows to configure the XML reports generated by **KillDisk** after operation is complete.



Report location

Configure where XML erasure reports will be stored. You can use mapped network resource as a storage target.

File name template

Define a template for the file name for the reports. The main tags available are:

Available element:	Tag:
Serial ID	{Serial ID}
Erasure Status	{Status}
Date of Erasure	{Date(YYYY-MM-DD)}
Time of Erasure	{Time(HH-mm-ss)}

More tags are available, see the tags section in Appendix.

Include company information

Adds the company information (defined in Company Information) into the XML erasure report.

Include technician information

Adds the technician information (defined in Technician Information) into the XML erasure report.

Include system info

Ensures that the system-specific information is saved in the XML report, such as:

- Operating system
- Kernel version
- Architecture (x86, x64)

Include hardware info

Ensures that the system-specific information is saved in the XML report, such as:

- Motherboard manufacturer
- Motherboard description
- Host (name, domain)
- CPU (logical, physical)
- Memory

Include SMART information for each disk

Adds the information about disk health based on S.M.A.R.T. attributes into the XML erasure report.

The **KillDisk** XML report contains the following parts:

Type of Information	Specific data
Technician Information	*Name*
	Note
Company Information	*Name*
	Licensed
	Location
	Phone
	Disclaimer
System Information	*OS version*
	Platform
	Kernel
Hardware Information	*Motherboard Manufacturer*
	Motherboard Description
	Number of Processors
Erase Attributes	*Erase Verify*
	Passes
	Method
	Verification Passes
Error Handling Attributes	*Errors Terminate*

Type of Information	Specific data
	Skip interval
	Number of Retries
	Lock
	Source?
	Ignore Write?
	Read?
	Lock?
Disks	*Device Size*
	Device Type
	Serial Number
	Revision
	Product Number
	Name
	Geometric Information
	Partitioning Scheme
Additional Report Attributes	*Fingerprint Information*
	Initialize disk?
Results	*Bay*
	Time and Date Started
	Disk Information
	Status
	Result
	Time Elapsed
	Errors
	Name of operation
Conclusion	*Overall result of the operation*

Note:

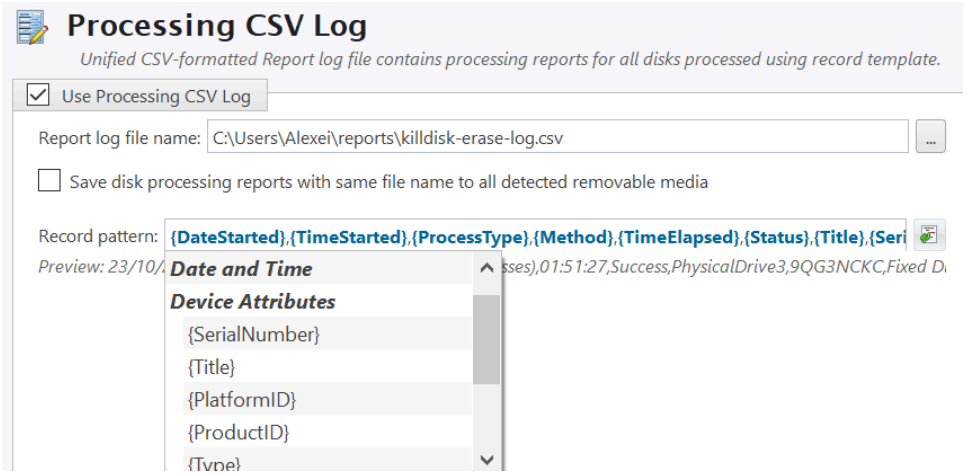
If internal tag <task> is present, Results are appeared inside.

Related information

Name Tags on page 111

Processing CSV Log

Processing CSV Log section allows to configure CSV (Comma-separated values) log file generated by **KillDisk** and appending there erase results. First line in CSV log file stores column names: Start Time, Device Name and Serial, Erase Result, etc.



Report log file name

Configure location where CSV log file will be stored. You can use mapped network resource as a storage target.

Save to removable media

Exports CSV log file to all detected removable media (USB Flash Disks).

Record pattern

Define a template for each line in CSV log file. The main tags available are:

Available element:	Tag:
Disk Serial Number	{SerialNumber}
Disk Name	{ProductID}
Erase Method	{Method}
Start Date	{DateStarted}
Start Time	{TimeStarted}
Time Elapsed	{TimeElapsed}
Erase Result (Success/Failure)	{Status}

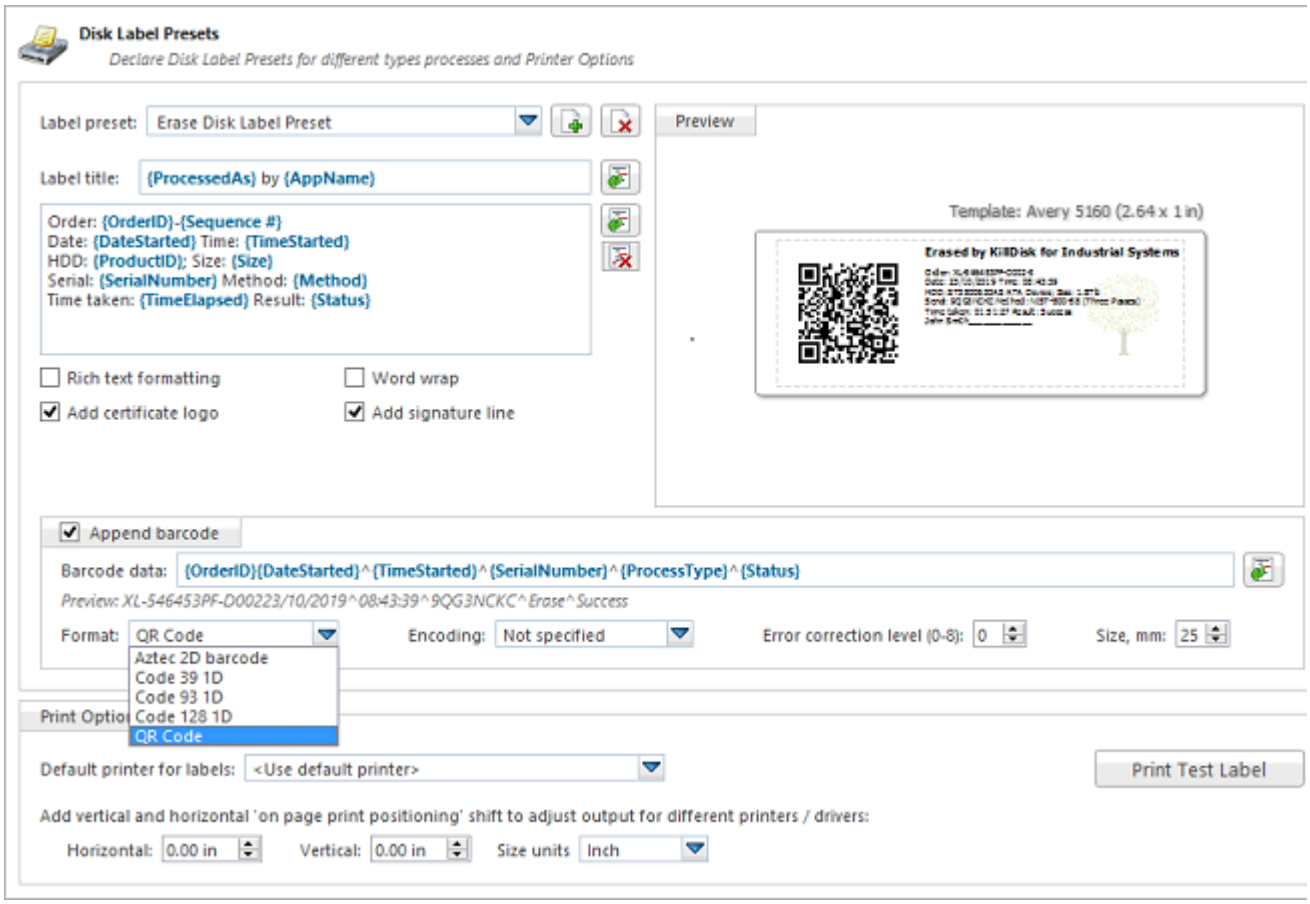
More tags are available, see the tags section in Appendix.

Related information

Name Tags on page 111

Disk Label Presets

Disk Label Presets section allows to adjust label settings for the **KillDisk**. Labels can be formatted for any printer, page or label type using **KillDisk** highly customizable labels' formatting features.



Label preset

Displays and let you select a default Label Preset or create a new one. Click **Add New Label Preset** button  to create a custom label preset with your own specifications. Click **Delete** button  to delete the selected label preset .

Label title

Sets a title to be printed (in bold) at the top of the labels. It can be a company name, batch name or any other descriptors you may consider useful to identify the operation. Static text can be typed in or any dynamic attributes (tags) can be inserted at current cursor's position. Click **Insert Name Tag** button  to insert predefined tag from the drop-down list.

Label area

Label's content for the preset. Static text can be typed in or any dynamic attributes (tags) can be inserted at current cursor's position. Click **Insert Name Tag** button  to insert predefined tag from the drop-down list. Click **Clear Pattern** button to empty all label's area.

Label attributes

You can use **RTF formatting** and set **Word Wrapping** behavior using related check boxes.

Add signature line

Adds a line at the bottom of the label for the technician to sign off on upon completion of the operation.

Add certificate logo

Includes the logo used in the certificate as a label's watermark background.

Label preview

Displays a preview of the label with the current input settings. Refreshes automatically when any adjustments are made to the settings.

Barcode options

Selecting **Append barcode** check-box will print QR Code or Barcode on the label to be able to be scanned thereafter for third party inventory database

Barcode data

String including essential erase parameters to be encoded and transformed to QR Code or Barcode. Static text can be typed in or any dynamic attributes (tags) can be inserted at current cursor's position. Click **Insert Name Tag** button  to insert predefined tag from the drop-down list.

Preview

Displays a preview of encoded string with the current input settings. Refreshes when any adjustments are made to the settings.

Format

List of supported QR Code and Barcode formats. Currently supported: **Aztec 2D barcode**, **Code 39 1D**, **Code 93 1D**, **Code 128 1D**, **QR Code**. Note that different types of Barcodes can accept different size of encoded string.

Encoding

If barcode string contains symbols other than English letters, you can specify encoding (code page) for the particular language.

Error correction level

The lower the error correction level, the less dense the QR code image is, which improves minimum printing size. The higher the error correction level, the more damage it can sustain before it becomes unreadable.

Size, mm

Size in millimeters for the Barcode/QR Code to be printed on the label.

Print options

Define options for label printing including special label printers (Brother QL-700, etc):

Default printer

Define printer to be used exclusively to print labels from the list of installed printers.

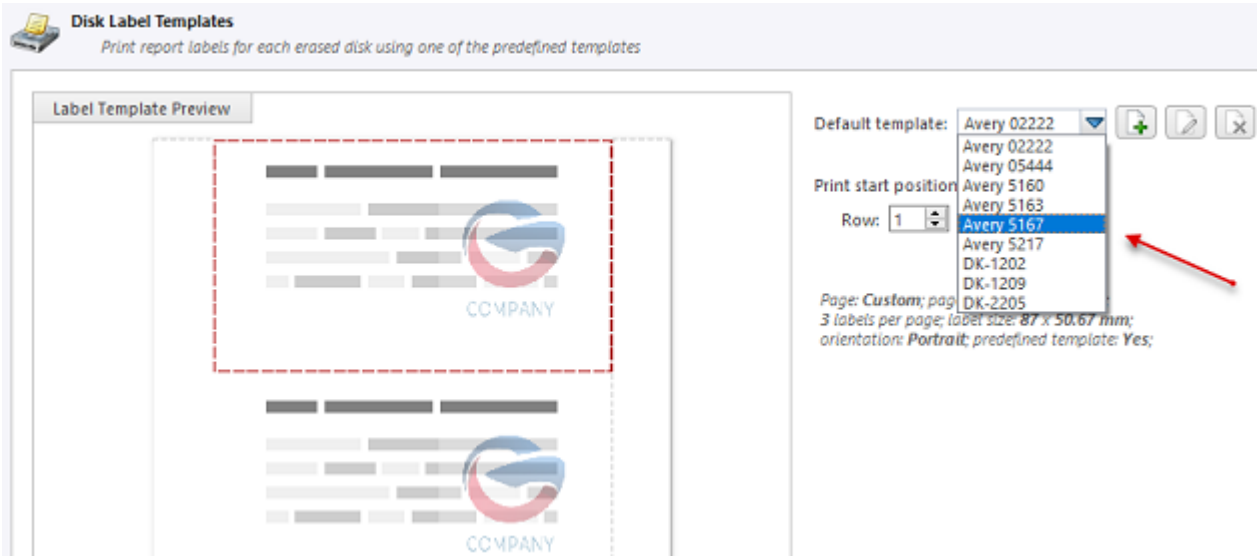
Print output adjustments

The print output adjustments section of the dialogue allows you to vertically or horizontally displace the position measured in specific print units to adjust to different printers.

Print test label command let you print Disk Label sample to verify your settings and selected layout attributes.

Disk Label Templates

Disk Label Templates section defines set of predefined label templates for usage in different scenarios.



Disk Label Templates dialog gives you an access to a number of predefined standard templates and to any custom templates you can create. These templates may be easily selected without opening any additional dialogs. The details of the selected template are displayed below the selection box. If your custom labels differ from any of the templates available, the button allows you to create a custom template with your own specifications. Additionally, the button allows you to modify an existing template and the button deletes the selected template.

Print Start Position

The Print Start Position section of the dialogue allows you to select the starting position of the label on the page to print from. The printing won't always start from the 1x1 position, so you can adjust this setting accordingly.

Creating a New Template

To open a Template Editor, click the button on the Disk Label Templates dialog .

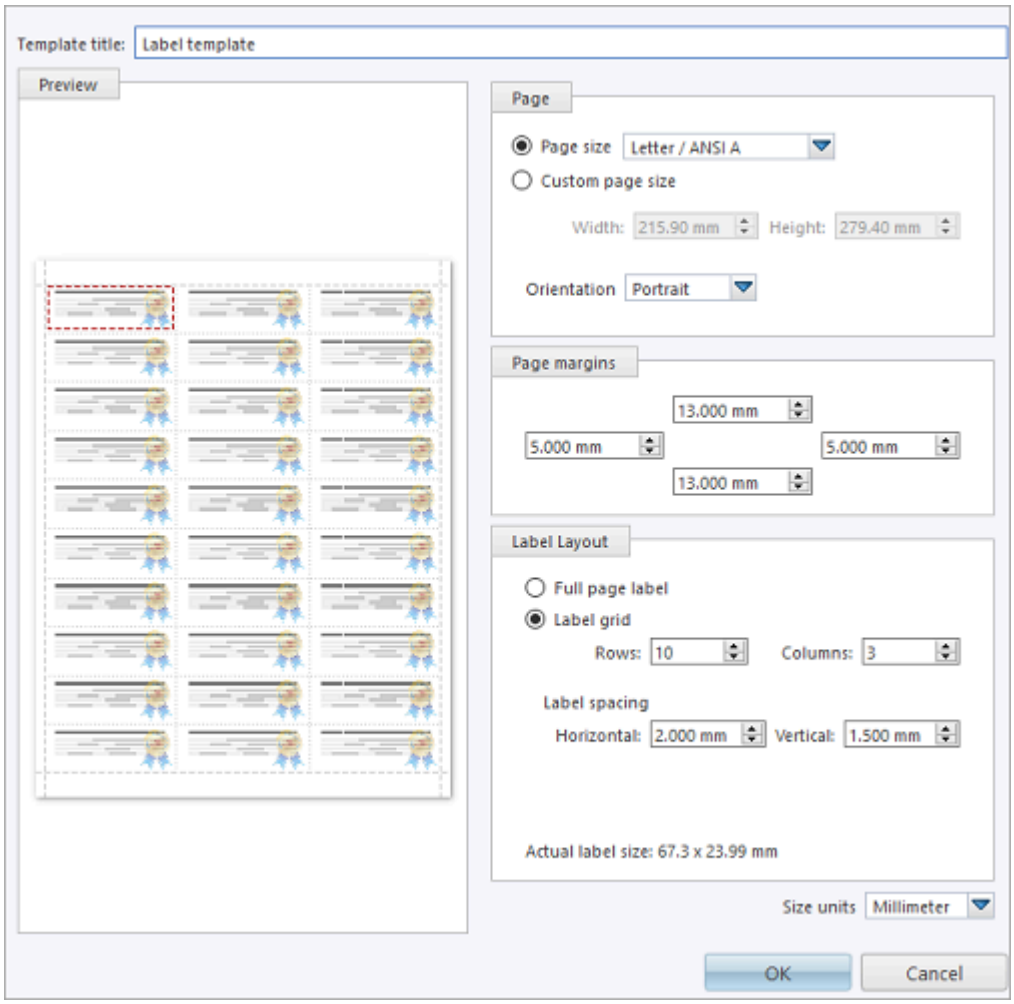


Figure 47: Erase Labels Page Template

Template title

Sets a custom title for your template. This is the name to refer this template when selecting it in the Print Label dialog.

Page

Specify the dimensions of the page being used to print the labels. Select page size from the list of standard sizes or define custom size using exact measurements. Define page orientation.

Page margins

Page margins are defined for the top, bottom, left and right sides of the page.

Label layout

Define how the labels appear on the page. Define the spacing in between labels on the page and the dimensions of the label grid. Once you entered the proper measurements, **KillDisk** takes care of all formatting.

Size units

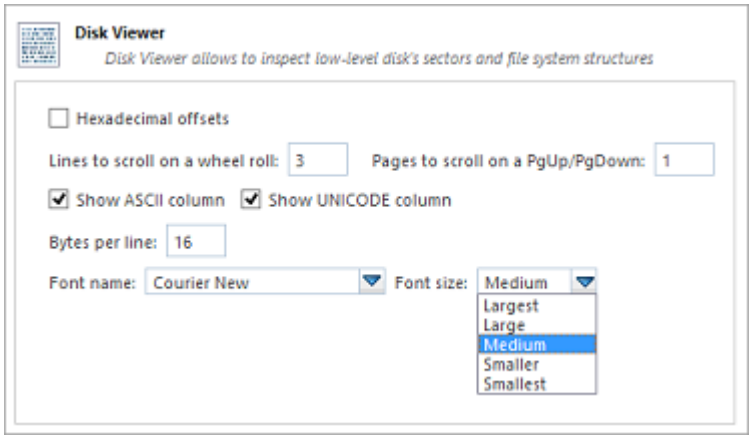
The units of measurement may vary between millimeters, inches, pixels and points. If a value is entered in one measurement and then size unit is changed, the appropriate conversion takes place.

Related information

Name Tags on page 111

Disk Viewer

Disk Viewer section allows to set hexadecimal view settings, font and user interaction parameters.



Hexadecimal offsets

Toggles offset format between decimal and hexadecimal.

Lines to scroll

Number of lines to scroll for a single mouse wheel sweep.

Pages to scroll

Number of pages to skip for a single **Page Up** or **Page Down**.

Show ASCII column

Toggles display content in ASCII format.

Show UNICODE column

Toggles display content in UNICODE format.

Bytes per line

Defines amount of bytes per line in hexadecimal display.

Font name

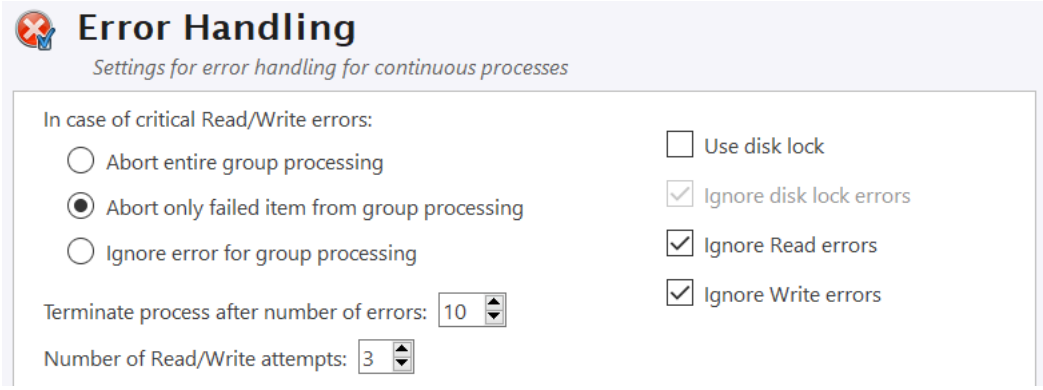
Select any mono-space font from the list of available ones for better view experience.

Font size

Font size to be used in hexadecimal display.

Error Handling

Error Handling section has the advanced settings to configure error handling while erasing or cloning the data.



Error handling attributes

KillDisk allows to select one of ways to handle Read/Write Errors:

Abort entire group processing
If erase Batch is in progress and one of the disks has errors, the erase process for ALL the disks in the Batch will be terminated.

Abort only failed disk from group processing
This is the default setting. Failed disks return an error and terminate the erase process. Other disks in the Batch will continue current operation.

Ignore error for group processing
Ignores the read/write error and continues erasing whatever is possible on the disk. None active or forth going operations will be terminated.

Terminate process after number of errors
Sets the error threshold to a certain amount before the disk operation is terminated and deemed unsuccessful.

Number of read/write attempts
Sets the number of attempts **KillDisk** makes to perform an operation when an error is encountered before it stops execution.

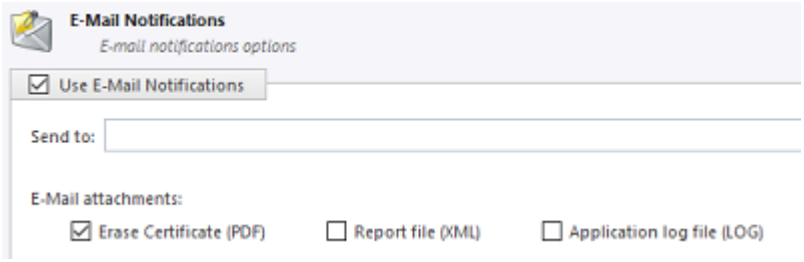
Use disk lock
Locks disks from being used by any other applications while operation is in progress.

Ignore disk lock errors
Errors encountered with **KillDisk** not being able to access locked disks will be ignored.

Ignore read/write errors
Toggle whether read errors or write errors will be just ignored.

E-mail Notifications

E-mail Notifications sections allows to configure how client can be notified after operation is complete. **KillDisk** can deliver results of its sanitation process (certificates, reports, logs) by e-mail.



Send to

Type e-mail address where erasing/wiping reports will be sent to.

E-mail attachments

Certificate, XML Report or Log File can be emailed, just mark the related check box.

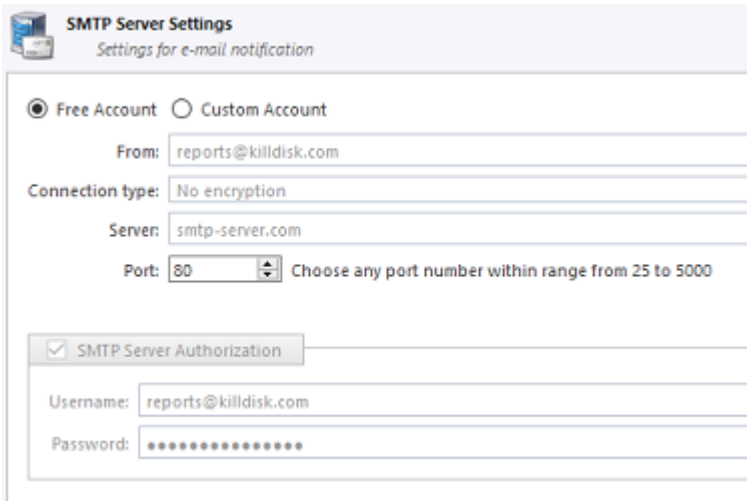
Note:

E-mail notifications feature is accessible in commercial packages only.

When you mark **Use E-Mail Notifications** check box, the **SMTP Server Settings** section becomes accessible for the configuration.

SMTP Server Settings

These settings allow to configure mailer settings for delivering erasing/wiping reports to user's mailbox. Simple Mail Transport Protocol (SMTP) is responsible for transmitting e-mail messages and SMTP Server settings need to be configured properly.



Account type

KillDisk offers you a free SMTP account located on **www.smtp-server.com** that can be used for sending reports out. By default all the required parameters are filled up and configured properly. If your corporate policy does not allow using services other than its own you need to switch this option to the Custom Account and configure all the settings manually. Ask your system/network administrator to get these parameters.

From

Type e-mail address which you expect these reports to come from.

Connection type

Select encryption type to use: **No encryption**, **SSL** or **TLS**.

SMTP server

KillDisk offers you the use of smtp-server.com for a free SMTP account. This account is pre-configured for **KillDisk** users. Ask your system/network administrator to get the proper SMTP server domain to be used.

SMTP port

For the free SMTP account **KillDisk** allows you to use smtp-server.com on port 80. This is a standard port being used by all web browsers to access the Internet. This port most likely is open on a corporate and home networks. Other ports can be filtered by and restricted by a network firewall. Ask your system/network administrator to set up a proper SMTP port for the custom SMTP server.

SMTP server authorization

To avoid spam and other security issues some SMTP servers require each user to be authorized before sending e-mails. In this case proper Username and Password required to be typed. Ask your system/network administrator to get proper authorization settings.

Troubleshooting

In the events of technical difficulties with **KillDisk** you may choose to either troubleshoot the system yourself or, within an active maintenance period (you receive 1 year free with your purchase), you can contact our support team. Attach your application log and hardware configuration (hardware diagnostic file) with your support request.

Common Tips

Common Problems

Disk data can not be erased

Ensure that disk is fully functional (no physically damages) and is accessible by Operating System.

Ensure you are not erasing the system disk or the disk KillDisk launched from (application won't let you erase these disks).

Data still found after a Wipe operation

The Wipe operation sanitizes the only data that has already been deleted and not visible by Operating System. To sanitize ALL the data including existing files and the Operating System itself, use the **Erase Disk** operation.

Erased the wrong disk

Stop erase operation as soon as possible. Once the data completely sanitized, it won't longer be accessible. Use a tool like **Active@ File Recovery** (https://www.file-recovery.com) to recover remains of data that has not been sanitized yet.

Boot Disk Creator Problems

All the Operating Systems options are grayed out

Make sure you have KillDisk and Boot Disk Creator is registered and activated. You should see your registered name at bottom of the dialog.

Image file not found

Most likely you have activated the freeware package that does not have the Boot Disk image you wish to create (it does have the only tiny Console bootable image). Download a commercial package using the link provided after the purchase and reinstall the software.

Issues formatting USB drive

This may happen occasionally when the file system causes conflicts in Windows. Launch the **KillDisk** application and erase the first few megabytes of the USB drive you wish to use. Unplug and plug again USB disk, then try again. In most cases this solves the problem.

Issues booting from the boot disk

Make sure the boot disk device is set at the top of your boot priority in BIOS.

Make sure your system time in the BIOS is accurate.

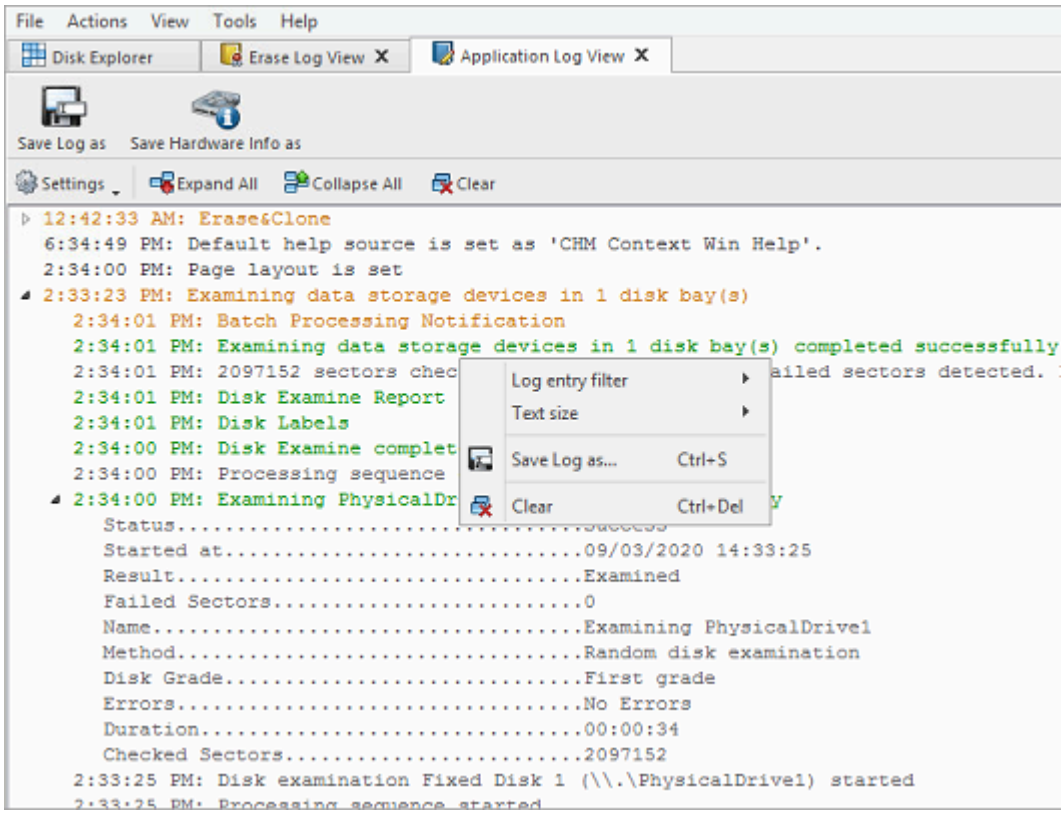
Make sure you are not booting a 64-bit Boot Disk on an old 32-bit PC. In case of old hardware create and use a Console-based boot disk.

Application Log

Application Log View reflects every action taken by the application and displays messages, notifications and other service information. Use these messages to observe and analyze erase processes.

To open Application Log View do one of the following:

- Click **Tools** > **Application Log** from the main menu
- Press **F8** keyboard shortcut



Once Application Log View is open and active, you can use toolbar buttons and the context menu to perform the following tasks:

Save log as

Opens a standard **Save As** dialog. Save the actual application log file to the local disk Default is .LOG file extension.

Save hardware info as

Opens a standard **Save As** dialog. Save the disk diagnostic file to the local disk. Default is .XML file extension.

Log entry filter

Shows or hides specific entry types in Log View:

Minimum details

Shows non-critical warning entries.

Maximum details

Shows advanced entries related to the application behavior and data analysis.

Text size

Changes text size to Large, Normal or Small.

Expand All

Expands all collapsed log nodes.

Collapse All

Collapses all log nodes.

Clear

Clear the log for the current application session.

Tip:

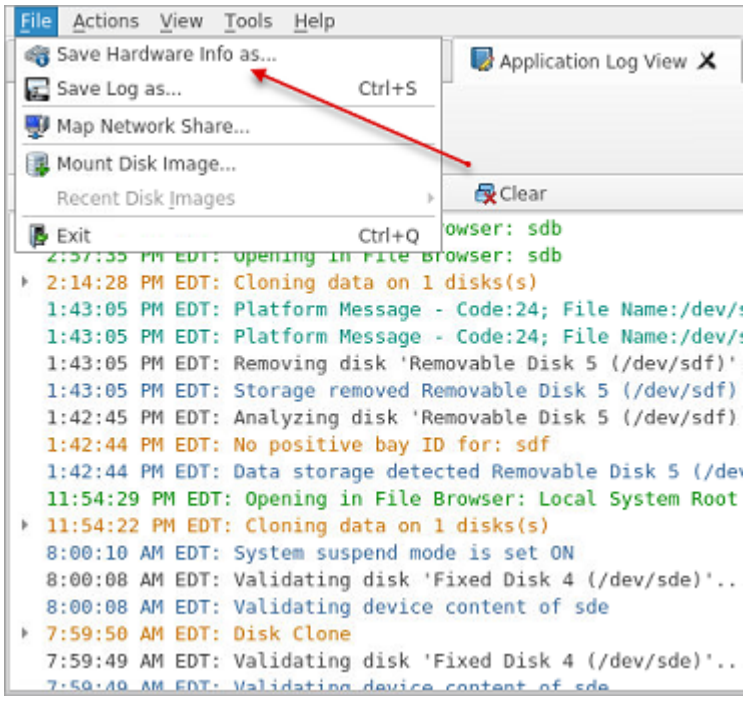
We recommend that you attach a copy of the log file to all requests made to our technical support group. The entries in this file will help us to resolve certain issues.

Hardware Diagnostic File

If you want to contact our technical support a file that contains a summary of your local devices and hardware configuration is very helpful and it is required to submit it for the proper problem investigation.

KillDisk allows you to create a hardware summary file in XML format. This data format is "human-readable" and can help our technical support staff to analyze your computer configuration or point out disk failures or abnormal behavior.

To create a hardware diagnostic file, click **Save Hardware Info as** from the **File** menu .



Note:

To save time on initial contact with our technical support staff we highly recommend that you submit a hardware diagnostic file, otherwise, most likely, it will be requested from you by our support team later on.

Related information

Application Log on page 83

Appendix

How Fast Erasing Occurs?

An actual erase speed depends on many factors:

- Drive Speed: RPM and/or controller sequential write speeds - the most important factor
- Drive Interface: PCI-E IV (2GB/s), SAS (6/12GB/s), SATA III (6GB/s), SATA II (3GB/s), SATA I (1.5GB/s)
- Interface Controller: Motherboard controller interface and/or HBA/RAID card
- Computer overall performance (CPU+RAM) and workload (how many parallel erases occur)

For most modern computers and disks (manufactured within last 5-7 years) SATA III standard is supported, so erase speed is limited by HDD throughput (disk write speed) only.

Our tests give the results: **10 GB per minute (in average) per pass** with decent computer configuration and disks with age of up to 5 years old.

For example, 2 TB Toshiba disk has been erased on Windows platform with one pass within 3 hours and 32 minutes, 14 TB Western Digital disk - within 18 hours 53 minutes.

The following snapshots are real-test results for erasing of:

1) **600 GB** HP SAS 15000rpm disk with [One Pass Zeros] and [US DoD 5220.22-M, 3 passes + verification] showing the average speed of **10 GB/min per pass**

2) **120 GB** SSD Kingston SATA III SSD with [One Pass Zeros] and [US DoD 5220.22-M, 3 passes + verification] showing the average speed of **17 GB/min per pass**

3) **256 GB** Samsung EVO 970 NVME SSD with [One Pass Zeros] and [US DoD 5220.22-M, 3 passes + verification] showing the average speed of **23 GB/min per pass**

4) **1 TB** Kingston U.2 NVME SSD with [One Pass Zeros] and [US DoD 5220.22-M, 3 passes + verification] showing the average speed of **90 GB/min per pass**

5) **2 TB** Toshiba (manufactured in 2015) SATA III (6 GBps) 7200 rpm disk with One Pass Zeros and US DoD 5220.22-M (3 passes + verification) showing the average speed of **9 GB/min per pass**

6) **14 TB** (Western Digital manufactured in 2019) SATA III (6 Gbps) 7200 rpm disk with One Pass Zeros and US DoD 5220.22-M (3 passes + 10% verification) showing the average speed of **12 GB/min per pass**

Active@ KillDisk

ERASE CERTIFICATE

Disk Erase

Attributes

Erase Method: **One Pass Zeros, 1 pass**
Verification: **No**
Use Fingerprint: **No**
Initialize Disk: **No**

Disk Information

Name: **PhysicalDrive1**
Product Name: **WDC WUH721414ALE6L4**
Serial Number: **Z2H2VXGT**
Platform Name: **\\.\PhysicalDrive1**
Size: **12.7 TB**
Total Sectors: **27,344,764,928**
Bytes per Sector: **512**

Results

Erase Range: **Whole disk**
Name: **Erasing PhysicalDrive1**
Started at: **07/05/2020 17:48:54**
Duration: **18:53:08**
Errors: **No Errors**
Result: **Erased**

System Information

OS: **Windows 10 Professional 64-bit**
Type: **x64 (AMD or Intel)**

Hardware Information

Manufacturer: **System manufacturer**
Description: **AT/AT COMPATIBLE**
Logical Processors: **8**
Memory: **15.8 GB**
Name: **System Product Name**
System: **x64-based PC**
Physical Processors: **1**

Active@ KillDisk

ERASE CERTIFICATE

Erased by Active@ KillDisk 100% Guarantee

Disk Erase

Attributes

Erase Method: US DoD 5220.22-M, 3 passes
Verification: 10%
Use Fingerprint: No
Initialize Disk: No

Disk Information

Name: PhysicalDrive1
Product Name: WDC WUH721414ALE6L4
Serial Number: Z2H2VXGT
Platform Name: \\.\PhysicalDrive1
Size: 12.7 TB
Total Sectors: 27,344,764,928
Bytes per Sector: 512

Results

Erase Range: Whole disk
Name: Erasing PhysicalDrive1
Started at: 08/05/2020 12:47:41
Duration: 2d 13:47:06
Errors: No Errors
Result: Erased

Erase Passes
Pass 1 (0x000000000000) - OK
Pass 2 (0xFFFFFFFFFFFF) - OK
Pass 3 (Random) - OK
Verification - passed OK

System Information

OS: Windows 10 Professional 64-bit
Type: x64 (AMD or Intel)

Hardware Information

Manufacturer: System manufacturer
Description: AT/AT COMPATIBLE
Logical Processors: 8
Memory: 15.8 GB
Name: System Product Name
System: x64-based PC
Physical Processors: 1

Erase Disk Concepts

Erasing Confidential Data

Modern methods of data encryption are deterring network attackers from extracting sensitive data from stored database files.

Attackers (who want to retrieve confidential data) become more resourceful and look for places where data might be stored temporarily. For example, the Windows **DELETE** command merely changes the files attributes and location so that the operating system will not look for the file located on FAT/exFAT volumes. The situation with NTFS file system is similar.

One avenue of attack is the recovery of data from residual data on a discarded hard drive. When deleting confidential data from hard drives, removable disks or USB devices, it is important to extract all traces of the data so that recovery is not possible.

Most official guidelines regarding the disposal of confidential magnetic data do not take into account the depth of today's recording densities nor the methods used by the OS when removing data.

Removal of confidential personal information or company trade secrets in the past might have been performed using the **FORMAT** command or the **FDISK** command. Using these procedures gives users a sense of confidence that the data has been completely removed.

When using the **FORMAT** command Windows displays a message like this: `Formatting a disk removes all information from the disk.`

Actually the **FORMAT** utility creates new empty directories at the root area, leaving all previous data on the disk untouched. Moreover, an image of the replaced FAT tables is stored so that the **UNFORMAT** command can be used to restore them.

FDISK merely cleans the Partition Table (located in the drive's first sector) and does not touch anything else.

Moreover, most of hard disks contain hidden zones (disk areas that cannot be accessed and addressed on a logical access level). **KillDisk** is able to detect and reset these zones, cleaning up the information inside.

Sanitization Types

NIST 800-88 international security standard (Guidelines for Media Sanitization) defines different types of sanitization.

Regarding sanitization, the principal concern is ensuring that data is not unintentionally released. Data is stored on media, which is connected to a system. Simply data sanitization applied to a representation of the data as stored on a specific media type.

When media is re-purposed or reaches end of life, the organization executes the system life cycle sanitization decision for the information on the media. For example, a mass-produced commercial software program contained on a DVD in an unopened package is unlikely to contain confidential data. Therefore, the decision may be made to simply dispose of the media without applying any sanitization technique. Alternatively, an organization is substantially more likely to decide that a hard drive from a system that processed Personally Identifiable Information (PII) needs sanitization prior to Disposal.

Disposal without sanitization should be considered only if information disclosure would have no impact on organizational mission, would not result in damage to organizational assets, and would not result in financial loss or harm to any individuals. The security categorization of the information, along with internal environmental factors, should drive the decisions on how to deal with the media. The key is to first think in terms of information confidentiality, then apply considerations based on media type. In organizations, information exists that is not associated with any categorized system. Sanitization is a process to render access to target data (the data subject to the sanitization technique) on the media infeasible for a given level of recovery effort. The level of effort applied when attempting to retrieve data may range widely. NIST SP 800-88 Rev. 1 Guidelines for Media Sanitization Clear, Purge, and Destroy are actions that can be taken to sanitize media. The categories of sanitization are defined as follows:

Clear

Clear applies logical techniques to sanitize data in all user-addressable storage locations for protection against simple non-invasive data recovery techniques; typically applied through the standard Read and Write commands to the storage device, such as by rewriting with a new value or using a menu option to reset the device to the factory state (where rewriting is not supported).
For HDD/SSD/SCSI/USB media this means overwrite media by using organizationally approved and validated overwriting technologies/methods/tools. The Clear pattern should be at least a single write pass with a fixed data value, such as all zeros. Multiple write passes or more complex values may optionally be used.

KillDisk supports Clear sanitization type through the **Disk Erase** command for all R/W magnetic types of media, more than 20 international sanitation methods including custom patterns implemented and can be used.

Purge

Purge applies physical or logical techniques that render Target Data recovery infeasible using state of the art laboratory techniques.
For HDD/SSD/SCSI/USB media this means ATA SECURE ERASE UNIT, ATA CRYPTO SCRAMBLE EXT, ATA EXT OVERWRITE, ATA/SCSI SANITIZE and other low-level direct controller commands.

KillDisk supports Purge sanitization type through the **Secure Erase** command only for media types supporting ATA extensions.

Destroy

Destroy renders Target Data recovery infeasible using state of the art laboratory techniques and results in the subsequent inability to use the media for storage of data due to physical damages.
For HDD/SSD/SCSI media this means Shred, Disintegrate, Pulverize, or Incinerate by burning the device in a licensed incinerator.

It is suggested that the user categorize the information, assess the nature of the medium on which it is recorded, assess the risk to confidentiality, and determine the future plans for the media. Then, the organization can choose the appropriate type(s) of sanitization. The selected type(s) should be assessed as to cost, environmental impact, etc., and a decision should be made that best mitigates the risk to confidentiality and best satisfies other constraints imposed on the process.

Advanced Data Recovery Systems

Advances in data recovery have been made such that data can be reclaimed in many cases from hard drives that have been wiped and disassembled. Security agencies use advanced applications to find cybercrime related evidence. Also there are established industrial spy agencies using sophisticated channel coding techniques such as PRML (Partial Response Maximum Likelihood), a technique used to reconstruct the data on magnetic disks. Other methods include the use of magnetic force microscopy and recovery of data based on patterns in erase bands.

Although there are very sophisticated data recovery systems available at a high price. Almost all the data can also be easily restored with an off-the-shelf data recovery utility like Active@ File Recovery, making your erased confidential data quite accessible.

Using **KillDisk** all data on your hard drive or removable device can be destroyed without the possibility of future recovery. After using **KillDisk** the process of disposal, recycling, selling or donating your storage device can be done with peace of mind.

International Standards in Data Removal

KillDisk conforms to more than 20 international standards for clearing and sanitizing data (US DoD 5220.22-M, Gutmann and others). You can be sure that sensitive information is destroyed forever once you erase a disk with KillDisk.

KillDisk is a professional security application that destroys data permanently on any computer that can be started using a bootable CD/DVD/BD or USB Flash Disk. Access to the drive's data is made on the physical level via the BIOS (Basic Input-Output System) bypassing the operating system's logical drive structure organization. Regardless of the operating system, file systems, or type of machine, this utility can destroy all the data on all storage devices. It does not matter which operating systems or file systems are located on the machine.

Secure Erase Concepts

Secure Erase for SSD is used to permanently delete data from the media and to restore the drive's speed if it starts to drop to noticeably lower performance than stated (at the same time, we don't consider SLC-caching and other "official" reasons for speed reduction since it's hardware drive features).

The essence of the problem that Secure Erase can solve: drive began to work slowly (writing and reading data). There can be a lot of reasons, some of them are related to the hardware component and some to the software component. SSDs are very different in service from classic HDDs, therefore, simply deleting data or formatting the drive does not really mean resetting the cell - you need to clear it before recording,

which slows down the process of recording new data. In theory, there shouldn't be such problems, because TRIM exists - a command to clear the data marked for deletion in cells. This command only works with 2.5" and M.2 SATA drives. For drives connected to the PCIe bus (M.2 or PCIe on the motherboard) there is an analogue - Deallocate. But it happens that these functions are disabled for some reason - an OS error, a user error in setting up a disk through third-party software, or the use of non-standard OS assemblies with unknown software components. So, the disk starts to work noticeably slower and it is quite noticeable without any benchmark performance measurements.

SSDs use a number of mapping layers that hide the physical layout of the flash-based memory, as well as help in managing how flash memory data integrity and lifetime are managed. Collectively, these layers are referred to as the Flash Translation Layer (FTL).

SSDs are also over-provisioned: they contain a bit more flash memory than what they're rated for. This extra memory is used internally by the FTL as empty data blocks, used when data needs to be rewritten, and as out-of-band sections for use in the logical to physical mapping.

The mapping layers, and how the flash controller manages memory allocation, pretty much ensure that either erasing or performing a conventional hard drive type of secure erase won't ensure all data is overwritten, or even erased at all.

One example of how data gets left behind intact is due to how data is managed in an SSD. When you edit a document and save the changes, the saved changes don't overwrite the original data (an in-place update). Instead, SSDs write the new content to an empty data block and then update the logical to physical map to point to the new location. This leaves the space the original data occupied on the SSD marked as free, but the actual data is left intact. In time, the data marked as free will be reclaimed by the SSD's garbage collection system, but until then, the data could be recovered.

A conventional Secure Erase, as used with hard drives, is unable to access all of the SSD's memory location, due to the FTL and how an SSD actually writes data, which could lead to intact data being left behind.

SSD manufacturers understand the need for an easy way to sanitize an SSD, and most have implemented the ATA command, Secure Erase Unit (used with SATA-based SSDs), or the NVMe command, Format NVM (used with PCIe-based SSDs) as a fast and effective method of securely erasing an SSD.

So, SSD drives have a non-trivial system of work, therefore, the scheme for the complete destruction of data should also not be the easiest. But in reality, this is not so at all. Any SSD has a controller that is the "brain" of the drive. He not only tells the system where to write data, but also encrypts the information passing through it and stores the key with himself. If you remove (or rather replace) a given key, then all the information will turn into a random set of 1 and 0 - it will be impossible to decrypt it in any way. Just one simple action by the user can solve the problem of safe data erasure. This method is the fastest and most effective.

Note:

To protect information that is critical, both for serious organizations that are concerned about the safety of data and for public sector enterprises working with information classified as state secrets, information systems should usually use certified sanitation algorithms (US DoD 5220.22-M, Canadian OPS-II, NSA 130-2 etc.).

If you combine these two methods (replacing the key and resetting the cells), you get the perfect algorithm for obtaining a completely sterile disk in the state of its maximum performance. This, firstly, solves the problem that we raised at the very beginning, and, secondly, it can help us answer the question about the degree of drive wear.

It is important to note that some drives with built-in encryption can receive only one algorithm upon receipt of a safe erase command - it depends on the controller settings by the manufacturer. If you "reset" your SSD and compare the actual performance with the declared one, you will get the answer to this question. This procedure does not affect disk wear (which is very important). Note that these actions are designed specifically for analyzing the state of the disk, but it will not be possible to achieve a long-term increase in the read/write speed due to the peculiarities of the operation of SSD disks - the situation may

depend on both the drive model and the controller firmware. And it must be noted that not all drives support encryption. In this case, the controller simply resets the cells.

Wipe Disk Concepts

Wiping Unoccupied Disk's Space

You may have confidential data on your hard drive in spaces where data may have been stored temporarily.

You may also have deleted files by using the Windows Recycle Bin and then emptying it. While you are still using your local hard drive, there may be confidential information available in these unoccupied spaces.

Wiping the logical drive's deleted data does not delete existing files and folders. It processes all unoccupied drive space so that recovery of previously deleted files becomes impossible.

Installed applications and existing data are not touched by this process. When you wipe unoccupied drive space, the process is run from the bootable CD/DVD operating system. As a result, the wipe or erase process uses an operating system that is outside the local hard drive and is not impeded by Windows system caching. This means that deleted Windows system records can be wiped clean.

KillDisk wipes unused data residue from file slack space, unused sectors, and unused space in MTF records or directory records.

Wiping drive space can take a long time, so do this when the system is not being otherwise utilized. For example, this can be done overnight.

Wipe Algorithms

The process of deleting files does not eliminate them from the hard drive. Unwanted information may still be left available for recovery on the computer. A majority of software that advertises itself as performing reliable deletions simply wipes out free clusters. Deleted information may be kept in additional areas of a drive. **KillDisk** therefore offers different wipe algorithms to ensure secure deletion: overwriting with zeros, overwriting with random values, overwriting with multiple passes using different patterns and much more. **KillDisk** supports more than 20 international data sanitizing standards, including US DoD 5220.22M and the most secure Gutmann's method overwriting with 35 passes.

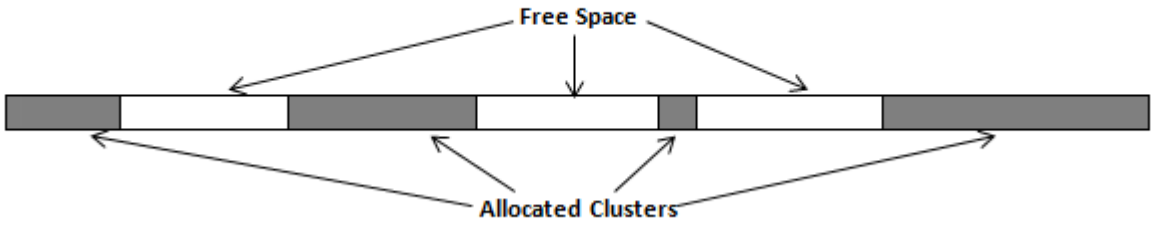


Figure 48: Disk Free Space and Allocated Clusters

Wiping File Slack Space

This relates to any regular files located on any file system. Free space to be wiped is found in the "tail" end of a file because disk space is usually allocated in 4 Kb clusters. Most files have sizes that are not 4 Kb increments and thus have slack space at their end.

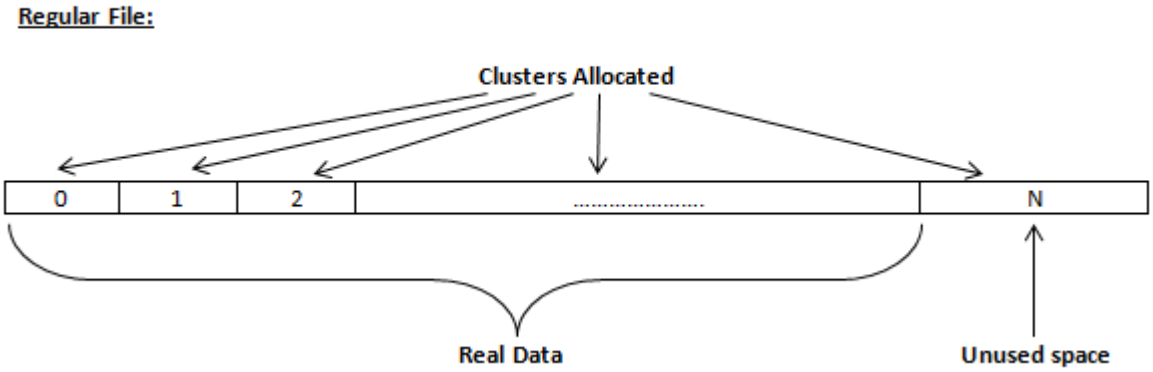


Figure 49: File Slack Space and Allocated Clusters

Specifics of Wiping Microsoft NTFS File System

NTFS Compressed Files

Wiping free space inside a file: The algorithm NTFS uses to "compress" a file operates by separating the file into compressed blocks (usually 64 Kb long). After it is processed, each of these blocks has been allocated a certain amount of space on the volume. If the compressed information takes up less space than the source file, then the rest of the space is labeled as sparse space and no space on the volume is allocated to it. Because the compressed data often doesn't have a size exactly that of the cluster, the end of each of these blocks stays as unusable space of significant size. Our algorithm goes through each of these blocks in a compressed file and wipes the unusable space, erasing previously deleted information that was kept in those areas.

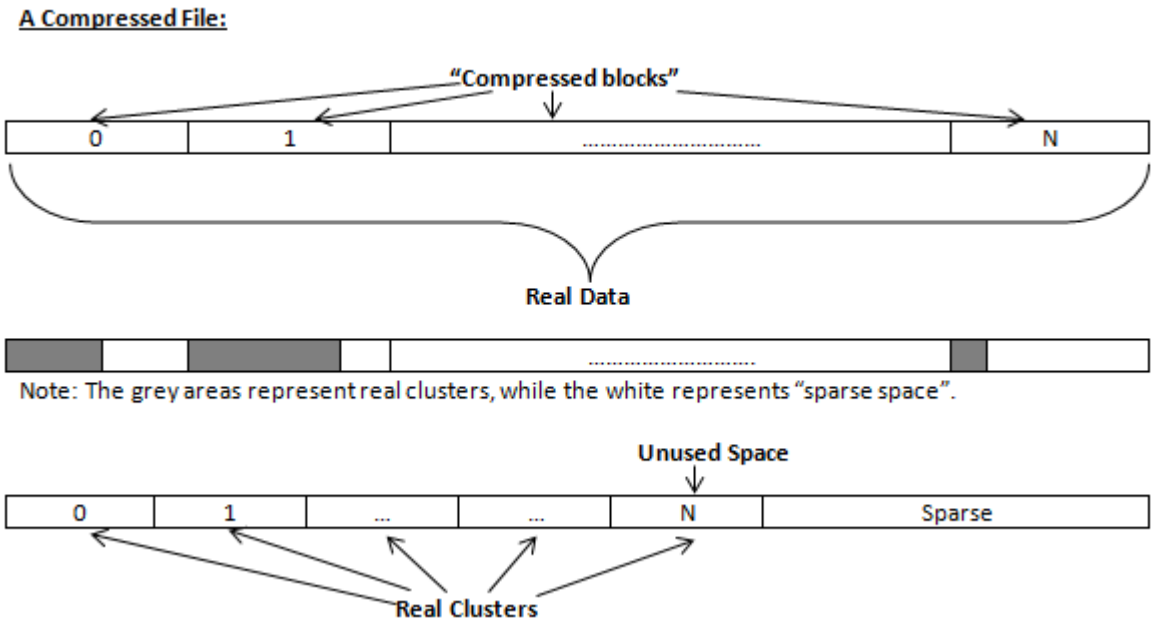


Figure 50: Compressed File Structure

The MFT (Master File Table) Area

Wiping the system information:

The MFT file contains records, describing every file on the volume. During the deletion of these files, the records of their deletion are left untouched - they are simply recorded as "deleted". Therefore file recovery software can use this information to recover anything from the name of the file and the structure of the deleted directories down to files smaller than 1Kb that are able to be saved in the MFT directly. The algorithm used by **KillDisk** wipes all of the unused information out of the MFT records and wipes the unusable space, making a recovery process impossible.

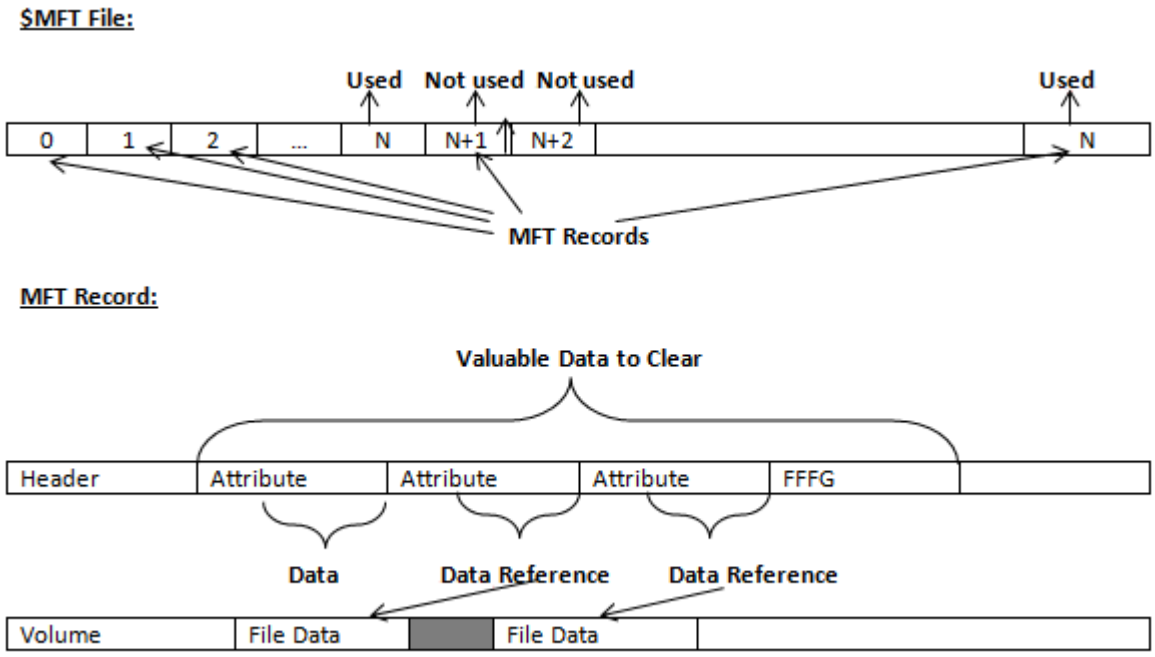


Figure 51: MFT Structure

Specifics of Wiping Microsoft FAT File System

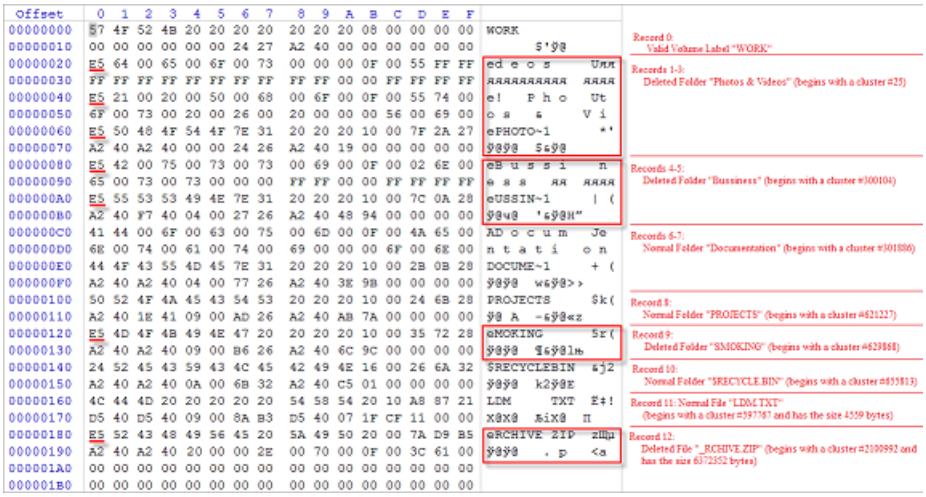
Wiping Directory Areas

Each directory on a FAT/FAT32 or an exFAT volume can be considered as a specific file, describing the contents of the directory. Inside this descriptor there are many 32-byte records, describing every file and other inner folders.

When you delete files this data is not being fully erased. It is just marked as deleted (hex symbol 0xE5). That's why data recovery software can detect and use these records to restore file names and full directory structures.

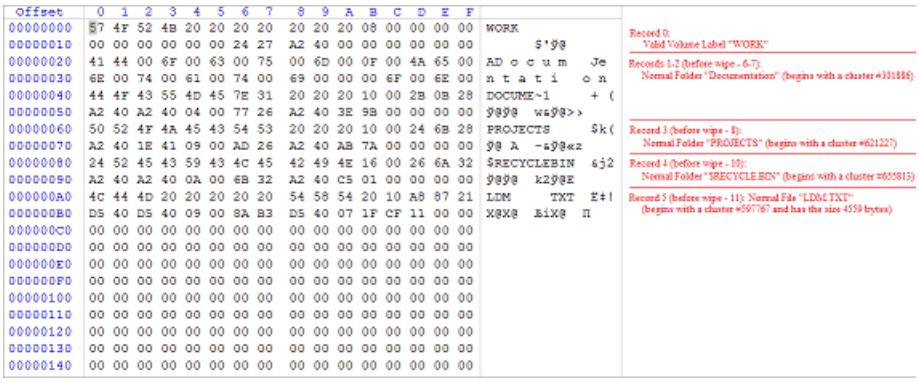
In some cases dependent on whether a space where item located has been overwritten yet or not, files and folders can be fully or partially recovered..

KillDisk makes data recovery impossible by using an algorithm that wipes out all unused information from directory descriptors. **KillDisk** not only removes unused information, but also defragments Directory Areas, thus speeding up directory access.



In this example red rectangles display deleted records.

Figure 52: FAT Directory before Wipe



In this example all deleted records removed and root folder defragmented.

Figure 53: FAT Directory after Wipe

Specifics of Wiping Apple HFS+ File System

HFS+ B-tree

A B-tree file is divided up into fixed-size nodes, each of which contains records consisting of a key and some data.

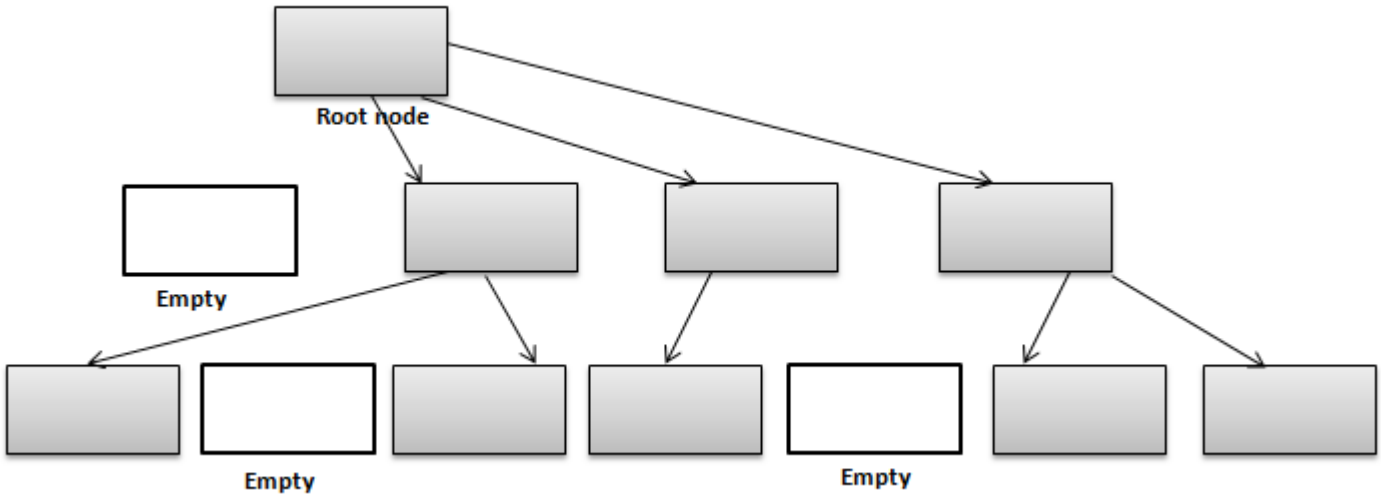


Figure 54: B-tree Structure

In the event of the deletion of a file or folder, there is a possibility of recovering the metadata of the file, (such as its name and attributes), as well as the actual data that the file consists of. **KillDisk**'s Wipe method clears out all of this free space in the system files.

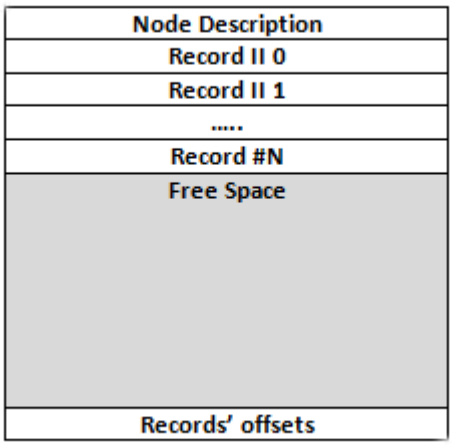


Figure 55: HFS+ System Table

Specifics of Wiping Linux Ext2/Ext3/Ext4 File Systems

A Linux Ext file system (Ext2/Ext3/Ext4) volume has a global descriptors table. Descriptors table records are called group descriptors and describe each blocks group. Each blocks group has an equal number of data blocks.

A data block is the smallest allocation unit: size vary from 1024 bytes to 4096 bytes. Each group descriptor has a blocks allocation bitmap. Each bit of the bitmap shows whether the block is allocated (1) or available (0). **KillDisk** software enumerates all groups, and for each and every block within the group on the volume checks the related bitmap to define its availability. If the Block is available, **KillDisk** wipes it using the method supplied by the user.

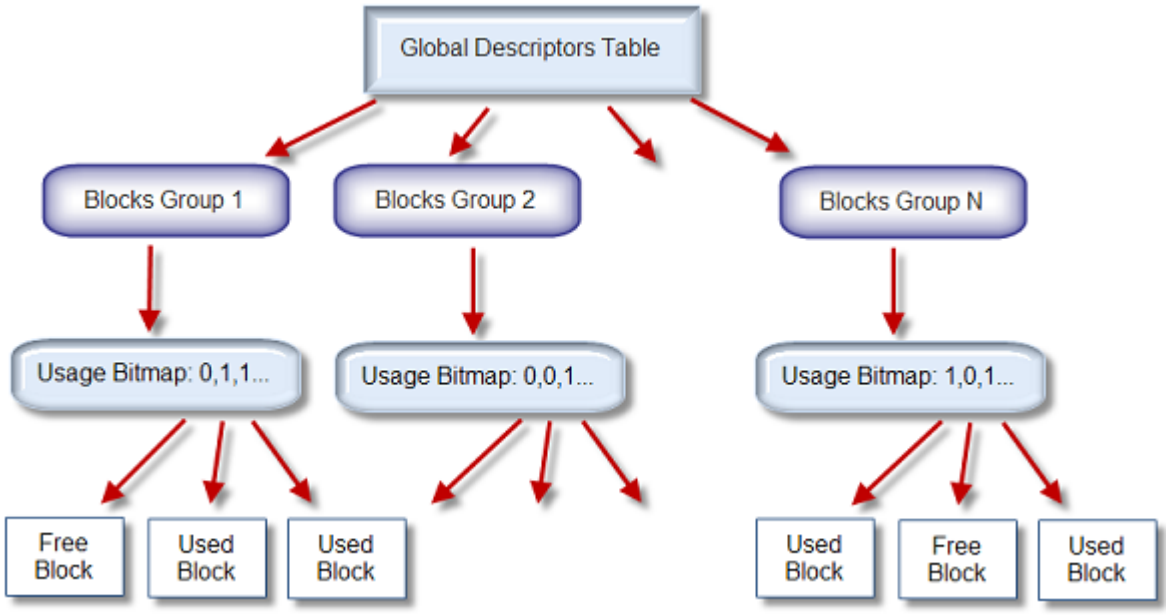


Figure 56: Ext2/Ext3/Ext4 Descriptors Table

Erase Methods

One Pass Zeros or One Pass Random

When using One Pass Zeros or One Pass Random standard, the number of passes is fixed and cannot be changed. When the write head passes through a sector, it writes only zeros or a series of random characters.

US DoD 5220.22-M

The write head passes over each sector three times. The first time with zeros 0x00, second time with 0xFF and the third time with random characters. There is one final pass to verify random characters by reading.

Canadian CSEC ITSG-06

The write head passes over each sector, writing a random character. On the next pass, writes the compliment of previously written character. Final pass is random, proceeded by a verify.

Canadian OPS-II

The write head passes over each sector seven times (0x00, 0xFF, 0x00, 0xFF, 0x00, 0xFF, random). There is one final pass to verify random characters by reading.

British HMG IS5 Baseline

Baseline method overwrites disk's surface with just zeros 0x00. There is one final pass to verify random characters by reading.

British HMG IS5 Enhanced

Enhanced method - the write head passes over each sector three times. The first time with zeros 0x00, second time with 0xFF and the third time with random characters. There is one final pass to verify random characters by reading.

Russian GOST p50739-95

The write head passes over each sector two times: 0x00, Random. There is one final pass to verify random characters by reading.

US Army AR380-19

The write head passes over each sector three times. The first time with 0xFF, second time with zeros 0x00 and the third time with random characters. There is one final pass to verify random characters by reading.

US Air Force 5020

The write head passes over each sector three times. The first time with random characters, second time with zeros 0x00 and the third time with 0xFF. There is one final pass to verify random characters by reading.

NAVSO P-5329-26 RL

RL method - the write head passes over each sector three times: 0x01, 0x27FFFFFF, Random. There is one final pass to verify random characters by reading.

NCSC-TG-025

The write head passes over each sector three times: 0x00, 0xFF, Random. There is one final pass to verify random characters by reading.

NSA 130-2

The write head passes over each sector two times: Random, Random. There is one final pass to verify random characters by reading.

NIST 800-88

Supported three NIST 800-88 media sanitation standards:

- 1. The write head passes over each sector one time (0x00).
- 2. The write head passes over each sector one time (Random).
- 3. The write head passes over each sector three times (0x00, 0xFF, Random).

For details about this,the most secure data clearing standard, you can read the original article at the link below: http://csrc.nist.gov/publications/nistpubs/800-88/NISTSP800-88_with-errata.pdf

German VSITR

The write head passes over each sector seven times.

Bruce Schneier

The write head passes over each sector seven times: 0xFF, 0x00, Random, Random, Random, Random, Random. There is one final pass to verify random characters by reading.

Peter Gutmann

The write head passes over each sector 35 times. For details about this, the most secure data clearing standard, you can read the original article: http://www.cs.auckland.ac.nz/%7Epgut001/pubs/se%0Acure_del.html

Australian ISM-6.2.93

The write head passes over each sector once with random characters. There is one final pass to verify random characters by reading.

IEEE Std 2883-2022

IEEE Std 2883-2022 clear sanitization method consists of at least two passes of writes, to include a pattern in the first pass and its complement in the second pass. (0x00 in the first pass and 0xFF in the second). Verification step selects random locations on the storage media that represent at least 5% of the addressable space.

Secure Erase (ANSI ATA, SE)

According to National Institute of Standards and Technology (NIST) Special Publication 800-88: Guidelines for Media Sanitation, *Secure Erase* is "*An overwrite technology using firmware based process to overwrite a hard drive. Is a drive command defined in the ANSI ATA and SCSI disk drive interface specifications, which runs inside drive hardware. It completes in about 1/8 the time of 5220 block erasure.*" The guidelines also state that "*degaussing and executing the firmware Secure Erase command (for ATA drives only) are acceptable methods for purging.*" ATA Secure Erase (SE) is designed for SSD controllers. The SSD controller resets all memory cells making them empty. In fact, this method restores the SSD to the factory state, not only deleting data but also returning the original performance. When implemented correctly, this standard processes all memory, including service areas and protected sectors.

User Defined

User indicates the number of times the write head passes over each sector. Each overwriting pass is performed with a buffer containing user-defined or random characters. User Defined method allows to define any kind of new erase algorithms based on user requirements.

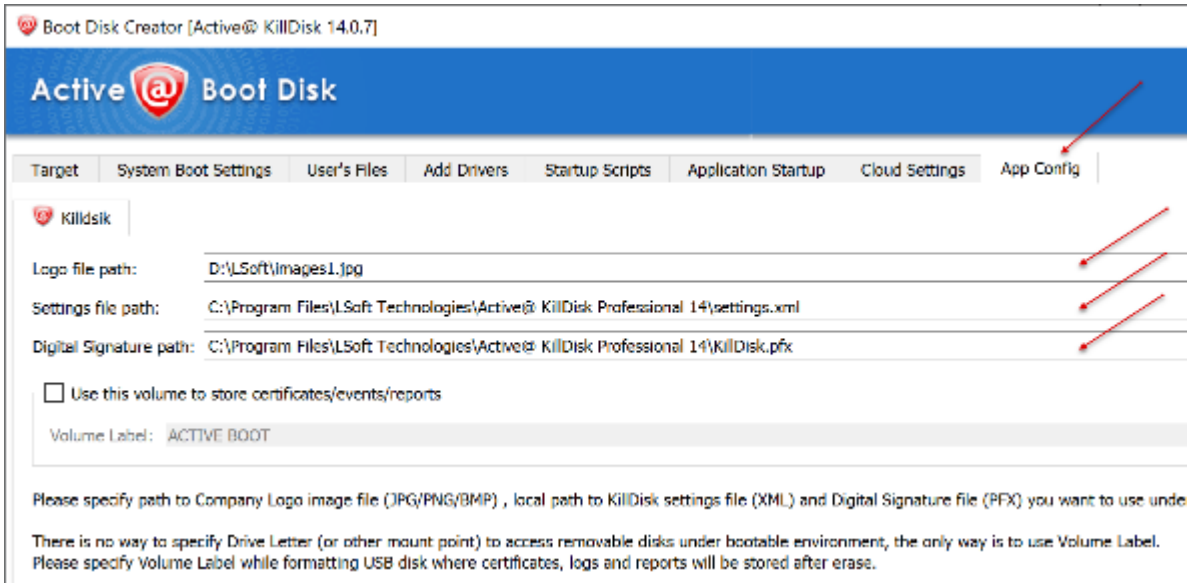
KillDisk and PXE

How to place a registered Active@ KillDisk into a WinPE image for use in a network PXE boot environment

Note:

To modify WinPE image (WIM) you need to have Windows ADK installed.

1. Start the **Boot Disk Creator** form Windows Start menu and prepare a bootable media. For KillDisk settings fill in the data on App Config page.

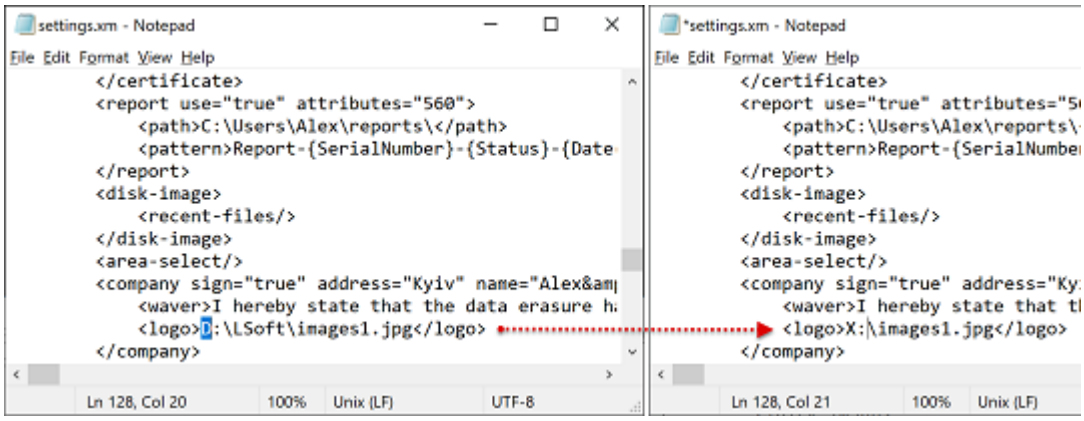


   Let's assume that the **Boot Disk** media has an F: letter in our environment.
2. Run **Command Prompt** as an Administrator.
3. Create an empty directory C:\MOUNT and mount BOOT.WIM file using the DISM tool:

```
Command: Dism /mount-image /imagefile:F:\sources\boot.wim /index:1 /mountdir:C:\mount
```

4. Replace BOOTDISK.KEY in C:\MOUNT directory with BOOTDISK.KEY located at the root of **Boot Disk** media (F:\ BOOTDISK.KEY). This file is required and contains user's registration information.
5. Copy your company logo file from Boot Disk media (located F:_kd\images1.jpg) to C:\MOUNT directory.

6. Open **settings.xml** file on Boot Disk media (F:_kd\settings.xml) for edit using Notepad. Change path for your company logo file to X:\



Copy modified **settings.xml** to C:\MOUNT\PROGRAM FILES\BOOTDISK\.

7. Create folder **BootDisk_Scripts** in C:\MOUNT\PROGRAM FILES\BOOTDISK\. In any text editor (Notepad) create script file and copy it to the newly created folder BootDisk_Scripts. For example:

```
cd x:\program files\bootdisk\
call killdisk.exe -em=0 -p=1 -v=11 -eh=5 -id -fp -bp
```

8. Dismount the BOOT.WIM image and commit the changes you applied:

```
Command: Dism /Unmount-Image /MountDir:C:\mount /commit
```

9. Use prepared F:\SOURCES\BOOT.WIM as a network PXE boot environment.

How to load Active@ KillDisk over the network via PXE environment on Windows Server platform

1. Add roles Windows Deployment Services.
2. Configure the WDS server, but don't add images in WDS Configuration Wizard.
3. Add Windows PE image with **Active@ KillDisk** software Boot.wim in Boot Images on WDS server.
4. In properties of WDS server in Boot tab add our image as default boot image for x64 architecture.
5. Configure the DHCP server for work with WDS server.

For more detailed instructions, read Microsoft TechNet official documentation.

How to load Active@ KillDisk over the network via PXE environment on a Windows 10 computer

There are several steps required to do this: configuring the WinPE WIM, Boot Manager and PXE Server.

For the configuration steps, let's assume that inserted **Boot Disk** has a F: letter in our configuration environment.

Step 1: Copy WinPE Source Files onto the PXE Server

- Map a network connection to the root TFTP directory on the PXE/TFTP server and create a \BOOT folder there. We will assign this network drive the Y: letter.

  Note:

  You can the **'Easy access'** feature in the **Windows Explorer** to do this. Make sure to enable read/write permissions in the sharing and folder options.

- Copy the PXE boot files from the mounted \BOOT folder of the **Active@ Boot Disk** boot.wim to the \BOOT folder on PXE/TFTP server. For example:

```
Command: copy C:\mount\windows\boot\pxe\*.* y:\boot
```

  Note:

To mount/dismount the boot.wim file, see section "How to place a registered Active@ KillDisk into a Windows PE image for use in a network PXE boot environment".

- After dismounting the boot.wim, copy the bootable Windows PE image (F:\ Sources\boot.wim) to the \BOOT folder on PXE/TFTP server.
- Copy the file boot.sdi (F:\Boot\boot.sdi) to the \BOOT folder on PXE/TFTP server.

Step 2: Configure boot configuration

- On a Windows 10 computer or in a Windows PE environment, create a BCD store using the **BCDEdit** tool.
- In the BCD store, configure the RAMDISK, BOOTMGR and OS Loader settings for the Windows PE image.
- Copy the BCD file to the \BOOT folder on PXE/TFTP server.
- Configure your PXE/TFTP server and DHCP server to point PXE clients to download PXEBoot.com or PXEBoot.n12.

These are a few of the files that were copied over to the server in Step 1

For more details, see "Creating a BCD file for PXE boot" below.

Step 3: Deployment process

Boot the client machine through PXE, connected to the network. After pressing initializing the PXE boot, the system should handle the rest. Here's what will happen:

- The client is directed (by using DHCP Options or the PXE Server response) to download PXEBoot.com.
- PXEBoot.com downloads Bootmgr.exe and the BCD store. The BCD store must reside in a \BOOT directory in the TFTP root folder. Additionally, the BCD store must be called BCD.
- Bootmgr.exe reads the BCD operating system entries and downloads boot.sdi and the Windows PE image.
- Bootmgr.exe begins booting Windows PE by running Winload.exe within the Windows PE image.

For more detailed instructions, read the Microsoft TechNet official documentation.

Configuring a PXE Server

Configuring a TFTP server is made simple with a tool called **Serva**. You can download it here.

This tool is an "Automated PXE Server Solution Accelerator" that supports a variety of server protocols. The ones we will be configuring are TFTP and DHCP.

- Click the logo in the top left to access the Settings.

- Configure your DHCP settings. You may copy the ones below, just make sure the address it binds to is a static IP address from your router. Under IP Pool 1st addr, input the first available IP address in your routers IP pool settings.

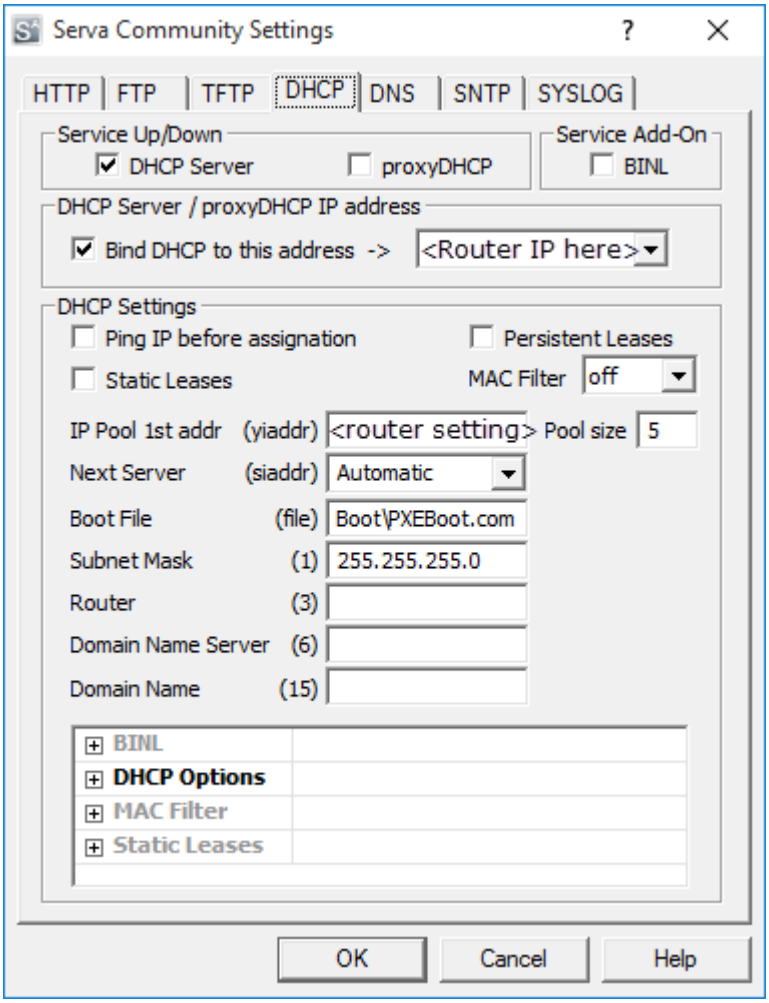


Figure 57: DHCP Configuration

- Configure your TFTP settings. You may also copy the setting below. Again, make sure the IP address is your router's static IP and the TFTP server root directory is the one you configured in Step 1.

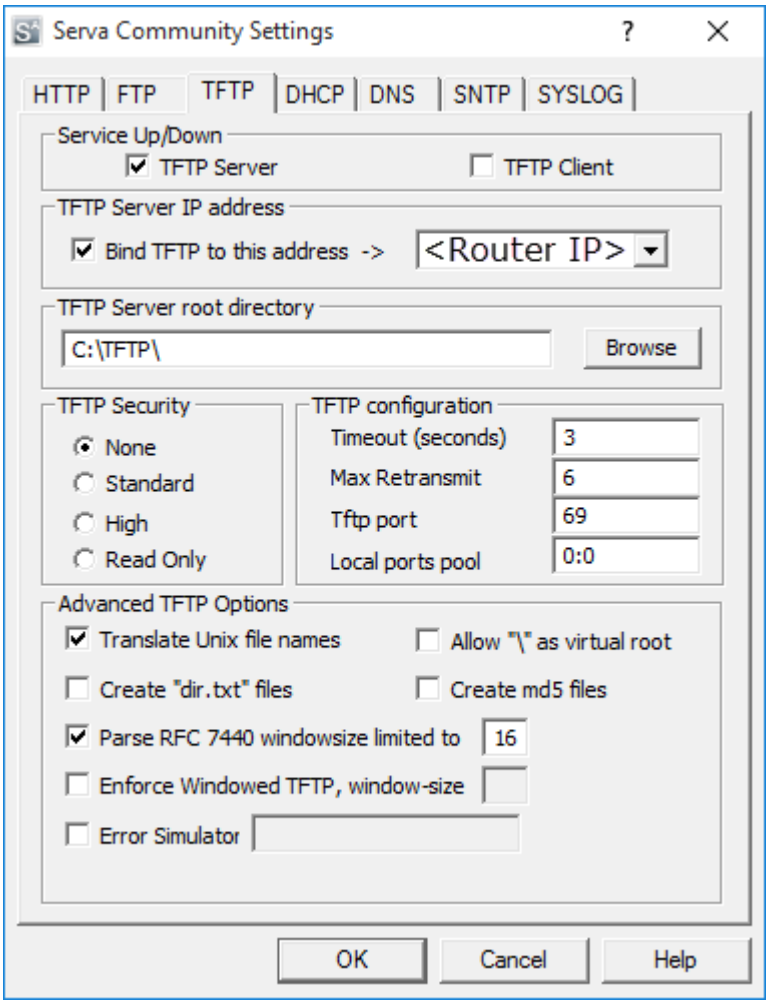


Figure 58: TFTP Configuration

Once the settings are configured, reset the application and your PXE server should be fully operational!

Creating a BCD file for PXE boot:

This entire process is done in **Command Prompt**. Be sure to run it as Administrator.

1. Create a BCD store using **bcdedit.exe**:

```
bcdedit /createstore c:\BCD
```

2. Configure RAMDISK settings:

```
bcdedit /store c:\BCD /create {ramdiskoptions} /d "Ramdisk options"
bcdedit /store c:\BCD /set {ramdiskoptions} ramdisksdidevice boot
bcdedit /store c:\BCD /set {ramdiskoptions} ramdisksdipath \boot\boot.sdi
bcdedit /store c:\BCD /create /d "winpe boot image" /application osloader
```

   The last command will return a GUID, for example:

   *The entry **{ bb254249-93e9-11e7-84cb-6c71d9da760e }** was successfully created.*

   Copy this GUID for use in the next set of commands. In each command shown, replace "GUID1" with your GUID.

3. Create a new boot application entry for the Windows PE image:

```
bcdedit /store c:\BCD /set {bb254249-93e9-11e7-84cb-6c71d9da760e} device ramdisk=[boot]\Boot\boot.wim,{ramdiskoptions}
bcdedit /store c:\BCD /set {bb254249-93e9-11e7-84cb-6c71d9da760e} path \windows\system32\winload.exe
bcdedit /store c:\BCD /set {bb254249-93e9-11e7-84cb-6c71d9da760e} osdevice ramdisk=[boot]\Boot\boot.wim,{ramdiskoptions}
bcdedit /store c:\BCD /set {bb254249-93e9-11e7-84cb-6c71d9da760e} systemroot \windows
```

```
bcdedit /store c:\BCD /set {bb254249-93e9-11e7-84cb-6c71d9da760e} detecthal Yes
bcdedit /store c:\BCD /set {bb254249-93e9-11e7-84cb-6c71d9da760e} winpe Yes
```

4. Configure BOOTMGR settings (remember to replace GUID1 in the third command with your GUID):

```
bcdedit /store c:\BCD /create {bootmgr} /d "boot manager"
bcdedit /store c:\BCD /set {bootmgr} timeout 30
bcdedit /store c:\BCD -displayorder {bb254249-93e9-11e7-84cb-6c71d9da760e} -addlast
```

5. Copy the BCD file to your TFTP server:

```
copy c:\BCD \\PXE-1\TFTP\Boot\BCD
```

6. Your PXE/TFTP server is now configured. You can view the BCD settings that have been configured using the command:

```
bcdedit /store <BCD file location> /enum all
```

Example of BCD settings:

```
C:\>bcdedit /store C:\BCD /enum all
Windows Boot Manager
--------------------
identifier              {bootmgr}
description             boot manager
displayorder            {bb254249-93e9-11e7-84cb-6c71d9da760e}
timeout                 30

Windows Boot Loader
-------------------
identifier              {bb254249-93e9-11e7-84cb-6c71d9da760e}
device                  ramdisk=[boot]\boot\boot.wim,{ramdiskoptions}
description             winpe boot image
osdevice                ramdisk=[boot]\boot\boot.wim,{ramdiskoptions}
systemroot              \Windows
detecthal               Yes
winpe                   Yes

Setup Ramdisk Options
---------------------
identifier              {ramdiskoptions}
description             ramdisk options
ramdisksdidevice        boot
ramdisksdipath          \boot\boot.sdi
```

Note:

Your GUID will be different than the one shown above.

Config File KILLDISK.INI

KILLDISK.INI is a text file with the list of parameter names and values. All KillDisk settings are stored in the [General] section. The latest version of KillDisk still supports settings stored by previous versions. However, on first run KillDisk exports all settings to SETTINGS.XML file and works with this file thereafter. Structure of SETTINGS.XML file is similar to KILLDISK.INI file, however advanced XML file format being used.

When **KillDisk** changes its settings (erase method, certificate options, etc...) all the current values are saved to the SETTINGS.XML file (older versions support KILLDISK.INI only) at the location where KillDisk executable resides. These settings used as default values when KillDisk runs the next time.

For the parameter storage the syntax being used:

```
Parameter=value
```

Here is an example of an INI file:

```
[General]

excludeSystemDisk=false

initHD=true

initRD=true

initCD=false

initFD=false
```

```
defaultSerialDetectionMethod=2
clearLog=false
logPath=C:\\Program Files\\LSoft Technologies\\Active@ KillDisk\\
logName=killdisk.log
logging=0
shutDown=false
saveToRemovable=false
showCert=true
killMethod=0
killVerification=false
killVerificationPercent=10
initDevice=true
fingerPrint=false
autoEject=false
skipConfirmation=false
wipeMethod=0
wipeVerification=false
wipeVerificationPercent=10
wipeUnusedCluster=true
wipeUnusedBlocks=false
wipeFileSlackSpace=false
wipeInHex=false
wipeUserPattern=Erased by Active@ KillDisk
wipeUserPasses=3
eraseInHex=false
killUserPattern=Erased by Active@ KillDisk
killUserPasses=3
accessDeniedCount=10
retryAtt=3
ignoreErrors=true
saveCert=true
certPath=C:\\Users\\UserName\\certificates\\
hideDefaultLogo=false
computerIDSource=0
showLogo=false
logoFile=
clientName=
companyName=
```

```
companyAddress=

companyPhone=

logComments=I hereby state that the data erasure has been carried out in
accordance with the instructions given by software provider.

technicianName=Technician

sendSMTP=false

attachCert=true

useDefaultAccount=true

fromSMTP=

toSMTP=

nameSMTP=

portSMTP=2525

authorizeSMTP=false

usernameSMTP= password

SMTP=

mapName=

mapPath=

mapUser=

mapPass=
```

When **KillDisk** is running in interactive mode all these parameters can be configured in Preferences on page 60 accessed by clicking the **Preferences** menu item from **Tools** menu or by pressing **F2** shortcut. Settings can be changed manually by editing the SETTINGS.XML (or KILLDISK.INI) file in any text editor (such as Notepad etc).

Here is an explanation of all settings supported:

Parameter	Default	Options
defaultSerialDetectionMethod=	2	1 - use operating system's DeviceIOControl method
		2 - use S.M.A.R.T. information, if device supports it
		3 – use Windows Management Instrumentation (WMI), if operating system supports it
showCert=	true	true/false – option of displaying the Erase/Wipe Certificate for printing after completion
saveCert=	false	true/false – option of saving the Erase/Wipe Certificate after completion
certPath=		Full path to the location where Erase/Wipe Certificate will be saved. This is a directory name
logPath=		Full path to the location where log file will be saved. This is a directory name
logName=		Name of the log file where event log will be saved to
skipConfirmation=	false	true/false – whether to display or skip Erase/Wipe confirmation dialog

Parameter	Default	Options
ignoreErrors=	false	true/false – whether to display disk writing errors (bad sectors), or ignore them (just place them to the log file)
clearLog=	false	true/false – whether to truncate log file content before writing new sessions or not (append to existing content)
initDevice=	true	true/false – whether to initialize disks after erasing complete or no
fingerPrint=	false	true/false – whether to initialize disk(s) and write fingerprint to the disk's first sector or no
hideDefaultLogo	false	true/false – whether to hide default KillDisk logo at the top-left corner of the certificate or no
computerIDSource=	0	0 - Disables showing the computer ID on the certificate
		1 - Shows BIOS ID in the certificate
		2 - Shows Motherboard ID in the certificate
shutDown=	false	true/false – whether to shutdown PC after Erase/Wipe execution complete or no
sendSMTP=	false	true/false – to send e-mail report by email via SMTP
attachCert=	false	true/false – to attach a PDF certificate to e-mail report being sent
useDefaultAccount=	true	true/false – use pre-defined Free SMTP account for sending e-mail reports
fromSMTP=		E-mail address you'll get a report from, for example: reports@killdisk.com
toSMTP=		E-mail address the report will be sent to
nameSMTP=		SMTP server (relay service) being used for sending e-mail reports, for example: www.smtp-server.com
portSMTP=	25	TCP/IP port SMTP service will be connected on. The standard SMTP port is 25. Some internet providers block it on a firewall
authorizeSMTP=	false	true/false – use SMTP authorization for sending e-mail reports (Username and Password must be defined as well)
usernameSMTP=		In case if SMTP service requires authorization, this is SMTP Username
passwordSMTP=		In case if SMTP service requires authorization, this is SMTP Password
showLogo=	false	true/false – whether to display custom Logo (image) on a Certificate or no
logoFile=		Full path to the file location where Logo image is stored
clientName=		Client Name - custom text to be displayed on a Certificate
technicianName=		Technician Name - custom text to be displayed on a Certificate
companyName=		Company Name - custom text to be displayed on a Certificate

Parameter	Default	Options
companyAddress=		Company Address - custom text to be displayed on a Certificate
companyPhone=		Company Phone - custom text to be displayed on a Certificate
logComments=		Any Comments - custom text to be displayed on a Certificate
killMethod=	2	[0-23] – Erase method to use for disk/volume erasing. See table of Erase Methods available. DoD 5220.22-M by default
killVerification=	true	true/false – whether to use data verification after erase or no
killVerificationPercent=	10	[1-100] – verification percent, in case if data verification is used
killUserPattern=		ASCII text to be used for User Defined erase method as a custom pattern
killUserPasses=		[1-99] – number of overwrites to be used for User Defined erase method
wipeMethod=	2	[0-23] – Wipe method to use for volume wiping. See table of Erase Methods available. DoD 5220.22-M by default
wipeVerification=	true	true/false – whether to use data verification after wipe or no
wipeVerificationPercent=	10	[1-100] – verification percent, in case if data verification is used
wipeUserPattern=		ASCII text to be used for User Defined wipe method as a custom pattern
wipeUserPasses=		[1-99] – number of overwrites to be used for User Defined wipe method
wipeUnusedCluster=	True	true/false – whether to wipe out all unused clusters on a volume or no
wipeUnusedBlocks=	False	rue/false – whether to wipe out all unused blocks in system records or no
wipeFileSlackSpace=	False	true/false – whether to wipe out all file slack space (in last file cluster) or no

When you start KillDisk with or without command line parameters its execution behavior depends on either command line settings (highest priority), settings configured in interactive mode and stored in the settings file (lower priority) or default values (lowest priority).

Default value means that if the settings file is absent or exists, but contains no required parameter, the predefined (default) value is used.

Related information

Preferences on page 60

Customizing Boot Disk

Note:

To customize Boot Disk image file you need basic skills in Command Line Scripts writing.

Example below shows how to customize a Boot Disk (WinPE image) containing **KillDisk** to change a default Erase Method and to add a Company Logo.

1. Create settings file

   Create custom KILLDISK.INI file using documented parameters (Application Settings).

   Here is an example of an INI file which uses **US DoD 5220.22-M (ECE)** erase method with 10% verification, stores logs, reports and certificates to X:\\ location (X: virtual drive is the only known drive with guaranteed letter when boot disks starts), specifies Company Name and Logo Image file:

```
[General]
killMethod=3
killVerification=true
killVerificationPercent=10
logName=X:\\killdisk.log
showCert=true
saveCert=true
certPath=X:\\
showLogo=true
logoFile=X:\\MyCompanyLogo.png
companyName=LSoft.NET
```

2. Create start up script

   Create KillDisk start up script which uses Command Line parameters.

   Here is an example of an CMD file which enumerates all drive letters, searches KILLDISK.INI file in **User_Files** folder, defines Drive Letter where Settings and Logo stored, copies Company Logo image file to known location and starts KillDisk with custom KILLDISK.INI file:

```
@ECHO OFF
FOR %%i IN (c d e f g h i j k l m n o p q r s t u v w y z) DO (IF EXIST %%i:\user_files\KILLDISK.INI ( SET
 CDROM=%%i:&& GOTO END ))
:END
copy %CDROM%\user_files\MyCompanyLogo.png X:\
KillDisk.exe -ip="%CDROM%\user_files"
```

3. Configure Boot Disk start up settings

Start Active@ Boot Disk Creator to configure Boot Disk start up settings:

Start Active@ Boot Disk Creator

Click Windows Start menu and launch **Active@ Boot Disk Creator** from KillDisk folder.

Select a Target

Select a media for Boot Disk to be created on (CD/DVD/BD ROM, ISO image or USB drive) and click **Next**.

Select Windows-based Boot Disk

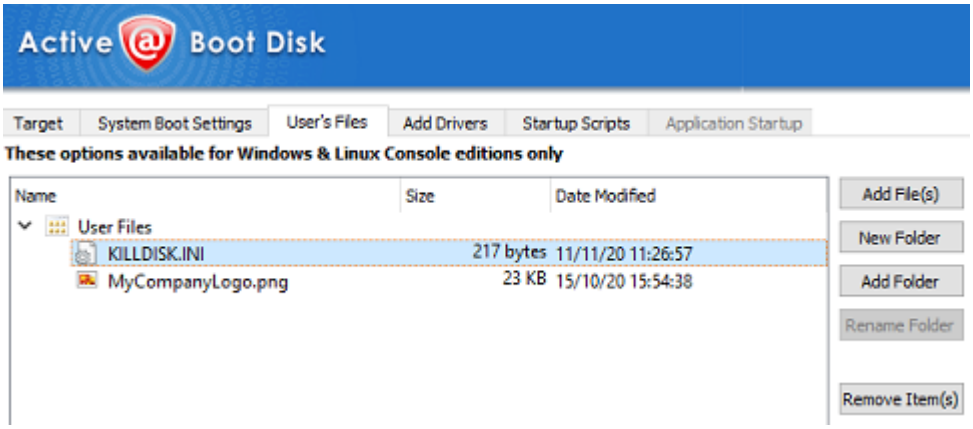
Make sure **Windows-based Boot Disk** check box is selected on a Target tab.

Disable Default Application Auto-start

Switch to System Boot Settings tab and select **OFF** for **Default Application Start** option.

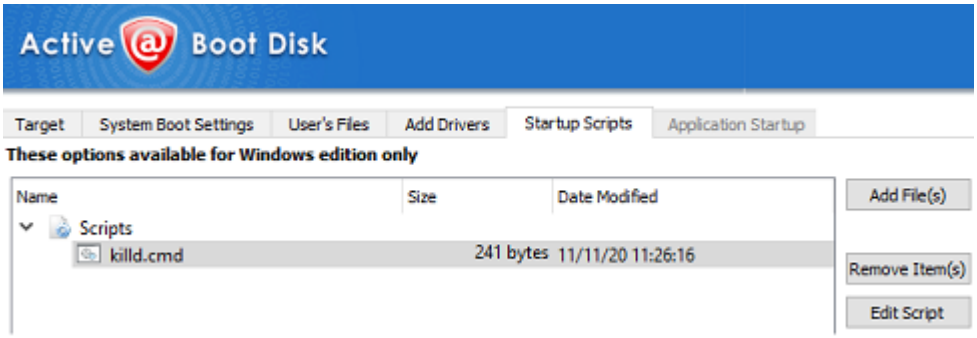
Add KILLDISK.INI file and Company Logo

Switch to User's Files tab and click **Add File(s)** button to add your custom settings file KILLDISK.INI and Company Logo Image file (JPG, PNG, BMP formats). After files being added, application should look like:



Add Custom Start up Script

Switch to Startup Scripts tab and click **Add File(s)** button to add your custom script (CMD file) where you launch **KillDisk** with custom Command Line parameters. After file being added, application should look like:



Click **Next** button to complete Boot Disk creation.

Finalize Boot Disk

Click **Create** button to burn CD/DVD/BD, or store Boot Disk to ISO file, or write Boot Disk to USB disk, depending on Target option selected on the first step.

Related tasks

Create a Boot Disk on page 21

Related information

Config File KILLDISK.INI on page 104
Command Line Mode on page 52

Name Tags

Name Tags Idea

Name tags used in different scenarios to form meaningful File Names, Label or Barcode data and more. Predefined constant value in brackets, for example **{SerialNumber}**, will be replaced with actual disk's Serial Number when Label or Barcode is formed and printed out.

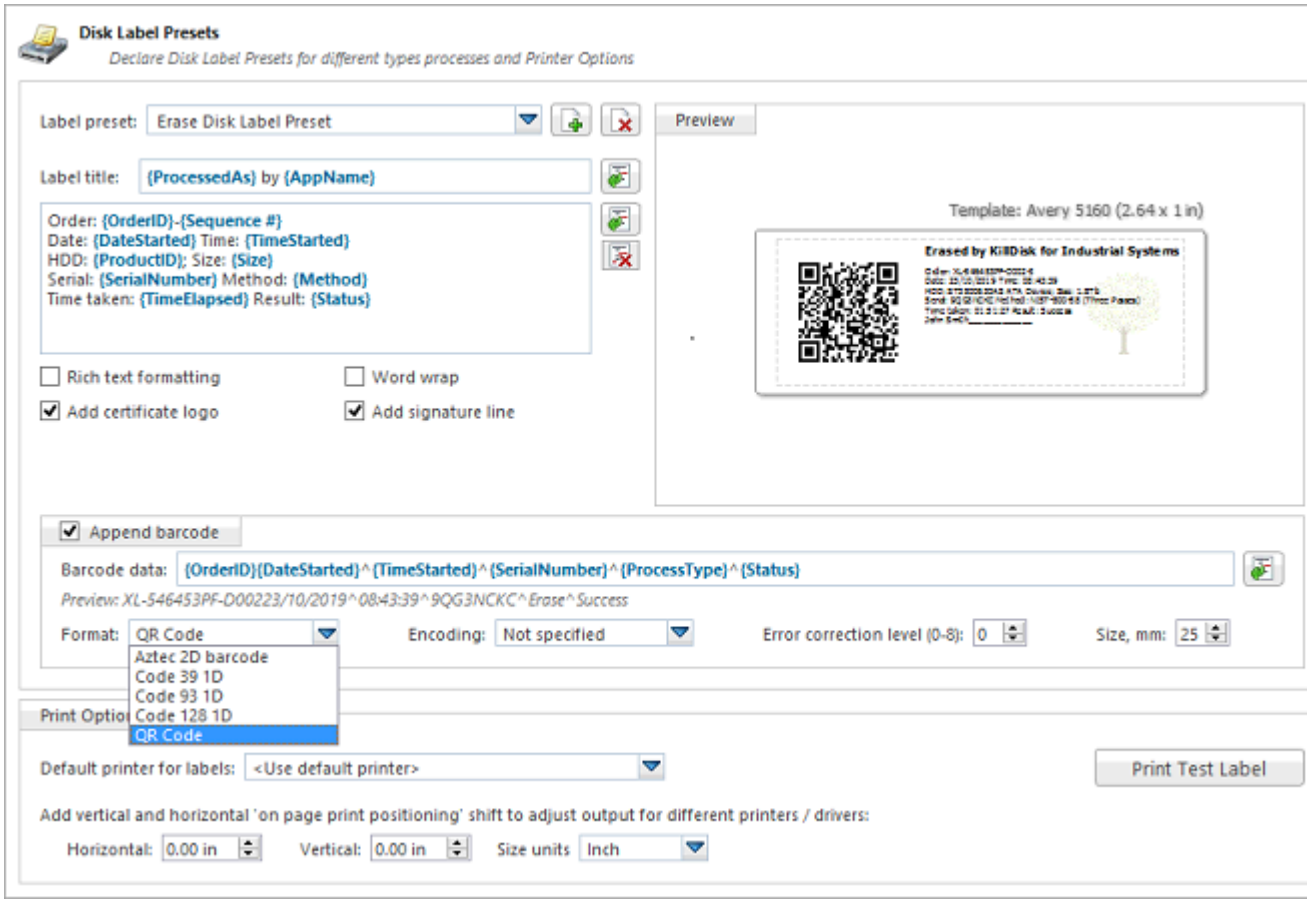


Figure 59: Name Tags in Labels and Barcodes

Below is description of different Name Tags grouped by sections.

General

{Computer ID}
Workstation (computer) ID

{OS}
Operating System name
{AppName}
Application name
{AppVersion}
Application full version
{KernelVersion}
Kernel version
{UniqueID}
Generated unique 8 symbols ID

Date & Time

Tags to represent current date in different formats:

{Date(YYYYMMDD)}
Complete date in full form without delimiters
{Date(YYYY-MM-DD)}
Complete date in full form with delimiters
{Date(YYMMDD)}
Complete date in short form without delimiters
{Date(YYYY)}
Year in full form
{Date(YY)}
Year in short form
{Date(Month)}
Full month name as literal
{Date(MM)}
Month as digital with leading zero
{Date(DD)}
Day of month with leading zero
{Time(HHmmss)}
Time with hours, minutes and seconds without delimiters
{Time(HH-mm-ss)}
Time with hours, minutes and seconds with delimiters
{Time(HH)}
Hours with leading zero
{Time(mm)}
Minutes with leading zero
{Time(ss)}
Seconds with leading zero

Disk

Values for these name tags retrieved from the context device:

{Serial ID}
Disk serial number, retrieved from OS or from S.M.A.R.T. attributes
{Platform ID}
Disk platform identification (may be vary due to OS format)
{Product ID}
Disk manufacturer Id
{Model}
Disk model name (if available)
{Size}
Disk size in gigabytes
{Sectors}
Disk size in sectors

Processing attributes

Disk processing attributes based on execution conditions:

{Method}
Erase method
{Passes}
Erases passes description
{Verified}
Verification attribute
{DateStarted}
Process start date
{TimeStarted}
Process start time
{TimeElapsed}
Process elapsed time
{Status}
Overall completion status for group processing or separate disk processing status.
{StatusCode}
Overall process result digital code

Item processing attributes

Item processing attributes based on execution conditions:

{ProcessType}
Process type name
{ProcessedAs}
Process short name
{Range}
Processed disk range

Virtual Disks

KillDisk provides full support for Virtual Disks - dynamic disks created and managed by:

- **Logical Disk Manager** (LDM on Windows)
- **Logical Volume Manager** (LVM on Linux)
- **Windows Storage Spaces** (WSS on Windows)

Virtual Disks are virtual devices which look like regular physical disks to all applications. These virtual devices are stored on one or more physical disks and emulate different types of volumes and RAID disk arrays not on a hardware level (inside disk controller), but on Operating System level (software emulation). Virtual devices are fully supported by the **KillDisk**. These disks will appear in **Local Devices** view like any other regular disks. When you launch an erase for the virtual disk, the progress is displayed in the same color on all components of the composite virtual drive.

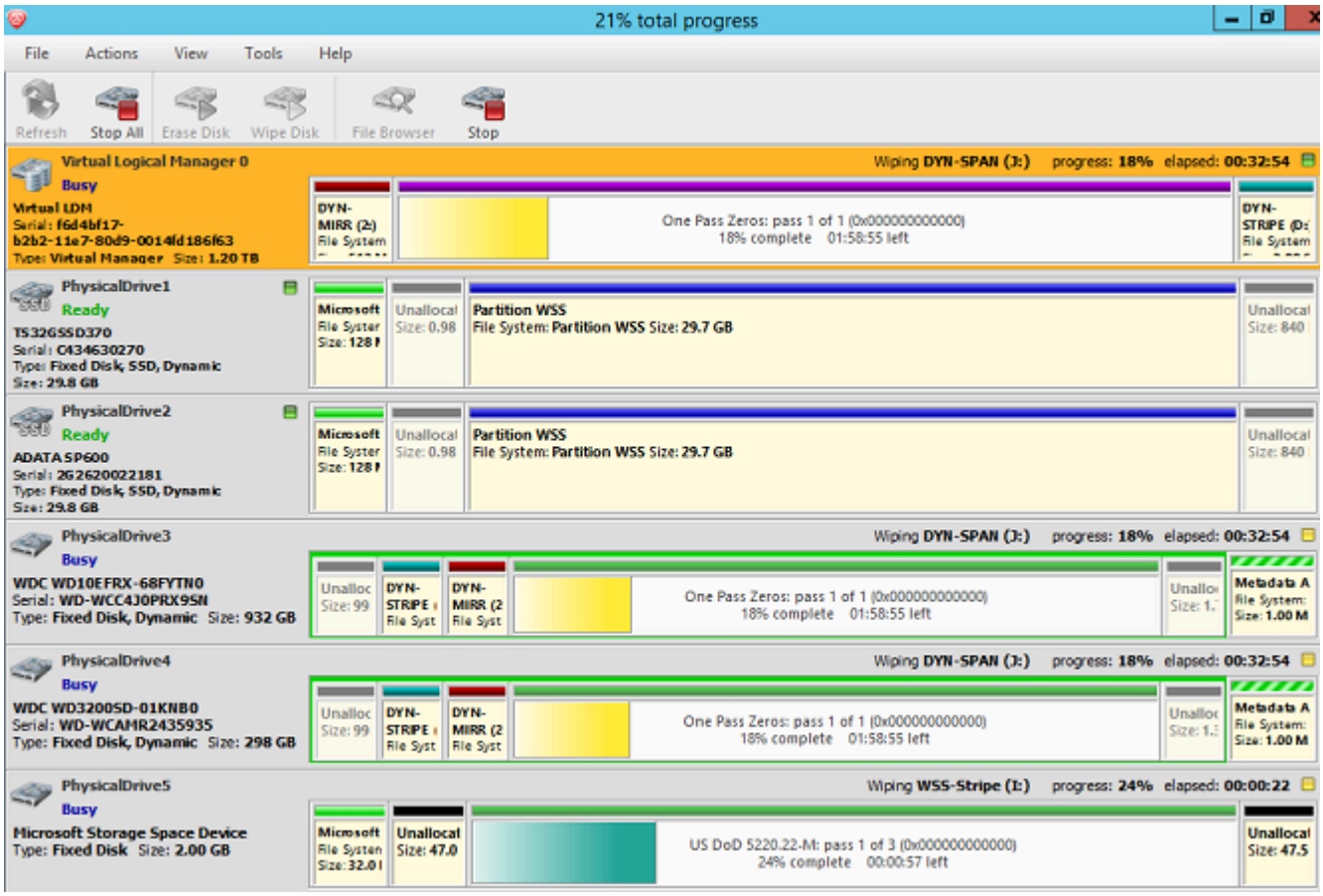


Figure 60: Erasing a Virtual Drive (Striped Disk Array)

Note: By default Virtual Disks are not being displayed in the list of devices. To display Virtual Disks go to **Preferences** > **General Settings** and turn on **Initialize virtual disks** option.

Disk Hidden Zones

KillDisk is able to detect and reset Disk's Hidden Zones: HPA and DCO.

HPA - Host Protected Area

The Host Protected Area (HPA) is an area of a hard drive or solid-state drive that is not normally visible to an operating system. It was first introduced in the ATA-4 standard CXV (T13) in 2001.

How it works:

The IDE controller has registers that contain data that can be queried using ATA commands. The data returned gives information about the drive attached to the controller. There are three ATA commands involved in creating and using a host protected area. The commands are:

- IDENTIFY DEVICE
- SET MAX ADDRESS
- READ NATIVE MAX ADDRESS

Operating systems use the IDENTIFY DEVICE command to find out the addressable space of a hard drive. The IDENTIFY DEVICE command queries a particular register on the IDE controller to establish the size of a drive.

This register however can be changed using the SET MAX ADDRESS ATA command. If the value in the register is set to less than the actual hard drive size then effectively a host protected area is created. It is protected because the OS will work with only the value in the register that is returned by the IDENTIFY DEVICE command and thus will normally be unable to address the parts of the drive that lie within the HPA.

The HPA is useful only if other software or firmware (e.g. BIOS) is able to use it. Software and firmware that are able to use the HPA are referred to as 'HPA aware'. The ATA command that these entities use is called READ NATIVE MAX ADDRESS. This command accesses a register that contains the true size of the hard drive. To use the area, the controlling HPA-aware program changes the value of the register read by IDENTIFY DEVICE to that found in the register read by READ NATIVE MAX ADDRESS. When its operations are complete, the register read by IDENTIFY DEVICE is returned to its original fake value.

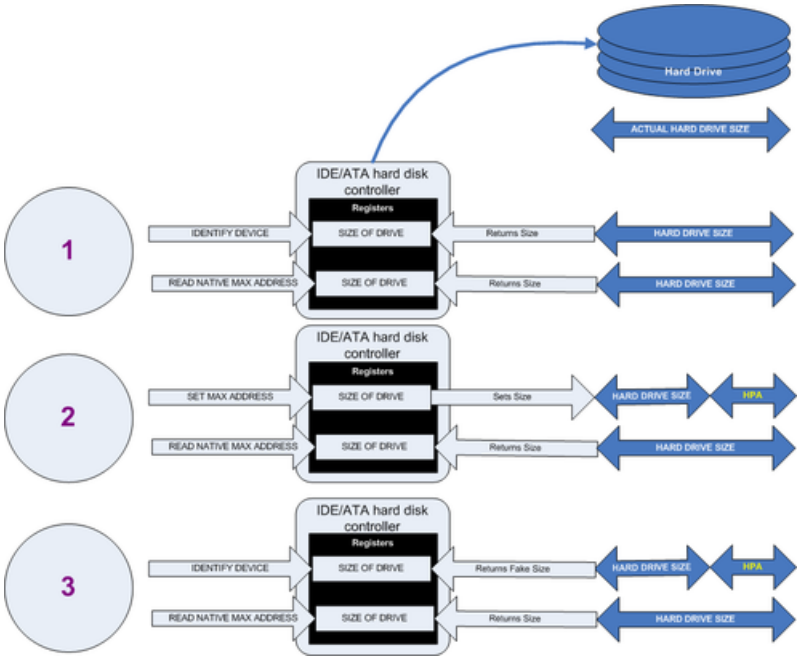


Figure 61: Creation of an HPA

The diagram shows how a host protected area (HPA) is created:

1. IDENTIFY DEVICE returns the true size of the hard drive. READ NATIVE MAX ADDRESS returns the true size of the hard drive.
2. SET MAX ADDRESS reduces the reported size of the hard drive. READ NATIVE MAX ADDRESS returns the true size of the hard drive. An HPA has been created.
3. IDENTIFY DEVICE returns the now fake size of the hard drive. READ NATIVE MAX ADDRESS returns the true size of the hard drive, the HPA is in existence.

Usage:

- At the time HPA was first implemented on hard-disk firmware, some BIOS had difficulty booting with large hard disks. An initial HPA could then be set (by some jumpers on the hard disk) to limit the number of cylinder to 4095 or 4096 so that older BIOS would start. It was then the job of the boot loader to reset the HPA so that the operating system would see the full hard-disk storage space.
- HPA can be used by various booting and diagnostic utilities, normally in conjunction with the BIOS. An example of this implementation is the Phoenix First BIOS, which uses Boot Engineering Extension Record (BEER) and Protected Area Run Time Interface Extension Services (PARTIES). Another example is the Gujin installer which can install the bootloader in BEER, naming that pseudo-partition /dev/hda0 or /dev/sdb0; then only cold boots (from power-down) will succeed because warm boots (from Ctrl-Alt-Delete) will not be able to read the HPA.

- Computer manufacturers may use the area to contain a preloaded OS for install and recovery purposes (instead of providing DVD or CD media).
- Dell notebooks hide Dell MediaDirect utility in HPA. IBM ThinkPad and LG notebooks hide system restore software in HPA.
- HPA is also used by various theft recovery and monitoring service vendors. For example, the laptop security firm Computrace use the HPA to load software that reports to their servers whenever the machine is booted on a network. HPA is useful to them because even when a stolen laptop has its hard drive formatted the HPA remains untouched.
- HPA can also be used to store data that is deemed illegal and is thus of interest to government and police.
- Some vendor-specific external drive enclosures (Maxtor) are known to use HPA to limit the capacity of unknown replacement hard drives installed into the enclosure. When this occurs, the drive may appear to be limited in size (e.g. 128 GB), which can look like a BIOS or dynamic drive overlay (DDO) problem. In this case, one must use software utilities (see below) that use READ NATIVE MAX ADDRESS and SET MAX ADDRESS to change the drive's reported size back to its native size, and avoid using the external enclosure again with the affected drive.
- Some rootkits hide in the HPA to avoid being detected by anti-rootkit and antivirus software.
- Some NSA exploits use the HPA for application persistence.

DCO - Device Configuration Overlay

Device Configuration Overlay (DCO) is a hidden area on many of today's hard disk drives (HDDs). Usually when information is stored in either the DCO or host protected area (HPA), it is not accessible by the BIOS, OS, or the user. However, certain tools can be used to modify the HPA or DCO. The system uses the IDENTIFY_DEVICE command to determine the supported features of a given hard drive, but the DCO can report to this command that supported features are nonexistent or that the drive is smaller than it actually is. To determine the actual size and features of a disk, the DEVICE_CONFIGURATION_IDENTIFY command is used, and the output of this command can be compared to the output of IDENTIFY_DEVICE to see if a DCO is present on a given hard drive. Most major tools will remove the DCO in order to fully image a hard drive, using the DEVICE_CONFIGURATION_RESET command. This permanently alters the disk, unlike with the (HPA), which can be temporarily removed for a power cycle.

Usage:

The Device Configuration Overlay (DCO), which was first introduced in the ATA-6 standard, "allows system vendors to purchase HDDs from different manufacturers with potentially different sizes, and then configure all HDDs to have the same number of sectors. An example of this would be using DCO to make an 80-gigabyte HDD appear as a 60-gigabyte HDD to both the (OS) and the BIOS.... Given the potential to place data in these hidden areas, this is an area of concern for computer forensics investigators. An additional issue for forensic investigators is imaging the HDD that has the HPA and/or DCO on it. While certain vendors claim that their tools are able to both properly detect and image the HPA, they are either silent on the handling of the DCO or indicate that this is beyond the capabilities of their tool.

Glossary

BIOS Settings

Basic **I**nput **O**utput **S**ubsystem is the program a personal computer's microprocessor uses to get the computer system started after you turn it on. It also manages data flow between the computer's operating system and attached devices such as the hard disk, video adapter, keyboard, mouse and printer. A typical method to access the BIOS settings screen is to press **Delete** / **F1** / **F2** / **F8** / **F10** or **Esc** during the boot sequence.

BCD

Boot **C**onfiguration **D**ata. Firmware-independent database for boot-time configuration data. It is used by Microsoft's new Windows Boot Manager and replaces the **boot.ini** that was used by NTLDR.

Boot Priority

BIOS settings allow you to run a boot sequence from a floppy drive, a hard drive, a CD/DVD/BD drive or a USB device. You may configure the order that your computer searches these physical devices for the boot sequence. The first device in the order list has the first boot priority. For example, to boot from a CD/DVD/BD drive instead of a hard drive, place the CD/DVD/BD drive ahead of the hard drive in priority.

Boot Record

See MBR for **M**aster **B**oot **R**ecord - located in the physical disk's first sector. Each volume on the disk has its own Boot Record called Volume or Partition Boot Sector, the content is file system specific.

Boot Sector

The boot sector continues the process of loading the operating system into computer memory. It can be either the MBR or the Partition Boot Sector.

Compressed Cluster

When you set a file or folder property to compress data, the file or folder uses less disk space. While the size of the file is smaller, it must use a whole cluster in order to exist on the hard drive. As a result, compressed clusters contain file slack space. This space may contain residual confidential data from the file that previously occupied this space. **KillDisk** can wipe out the residual data without touching the existing data.

CSV File

A comma-separated values (**CSV**) file is a delimited text file that uses a comma to separate values. Each line of the file is a data record. Each record consists of one or more fields, separated by commas. The use of the comma as a field separator is the source of the name for this file format. A CSV-file typically stores tabular data (numbers and text) in plain text, in which case each line will have the same number of fields.

Data Cluster

A cluster or allocation unit is a unit of disk space allocation for files and directories. To reduce the overhead of managing on-disk data structures, the file system does not allocate individual disk sectors by default, but contiguous groups of sectors, called clusters. A cluster is the smallest logical amount of disk space that can be allocated to hold a file. Storing small files on a file system with large clusters will therefore waste disk space; such wasted disk space is called slack space. For cluster sizes which are small versus the average file size, the wasted space per file will be statistically about half of the cluster size; for large cluster sizes, the wasted space will become greater. However, a larger cluster size reduces bookkeeping overhead and fragmentation, which may improve reading and writing speed overall. Typical cluster sizes range from 1 sector (512 B) to 128 sectors (64 Kb). The operating system keeps track of clusters in the hard disk's root records or MFT records, see Lost Cluster.

Device Node

Device node in the Local System Devices list is a physical device containing logical drives. The first physical device on older versions of Operating Systems is named 80h, now more typical name is PhysicalDrive0.

Exclusive Access

Lock is applied to a partition for exclusive writing access. For example, while recovering deleted or damaged files or folders, the recovery application must have exclusive access to the target partition while recovering files. If another application or the operating system are using the target partition - the processes could interfere, so user/process must close all applications or system processes that may be using the target partition before locking it.

FAT

File **A**llocation **T**able. Area that contains the records of every other file and directory in a FAT-formatted disk drive. The operating system needs this information to access the files. There are FAT32, FAT16 and exFAT versions. FAT file systems are still commonly found on flash disks and other memory cards and modules (including USB flash drives), as well as many portable and embedded devices. FAT is the standard file system for digital cameras per the DCF specification.

FTP

File **T**ransfer **P**rotocol. This is a standard network protocol used for the transfer of computer files between a Client and Server on a computer network. FTP is built on a client-server model architecture using separate control and data connections between the client and the server. FTP users may authenticate themselves with a clear-text sign-in protocol, normally in the form of a username and password, but can connect anonymously if the server is configured to allow it. For secure transmission that protects the username and password, and encrypts the content, FTP is often secured with SSL/TLS (FTPS) or replaced with SSH File Transfer Protocol (SFTP). The first FTP client applications were command-line programs developed before operating systems had graphical user interfaces, and are still shipped with most Windows, Unix, and Linux operating systems. Many FTP clients and automation utilities have since been developed for desktops, servers, mobile devices, and hardware, and FTP has been incorporated into productivity applications, such as HTML editors.

File Slack Space

The smallest file (and even an empty folder) takes up an entire cluster. A 10-byte file will take up 2,048 bytes if that is the cluster size. File slack space is the unused portion of a cluster. This space may contain residual confidential data from the file that previously occupied this space. **KillDisk** can wipe out the residual data without touching the existing data.

Free Cluster

A cluster that is not occupied by a file. This space may contain residual confidential data from the file that previously occupied this space. **KillDisk** can wipe out the residual data.

FreeDOS

A free operating system for PC compatible computers. It intends to provide a complete DOS-compatible environment for running legacy software and supporting embedded systems. FreeDOS can be booted from a floppy disk or USB flash drive. It is designed to run well under virtualization or x86 emulation. Unlike most versions of MS-DOS, FreeDOS is composed of free and open-source software, licensed under the terms of the GNU General Public License.

Deleted Boot Records

All disks and partitions start with a boot sector. For a damaged disk and volumes (where the location of the boot records known) the partition table can be reconstructed. The boot record contains a file system identifier.

iSCSI

Internet **S**mall **C**omputer **S**ystems **I**nterface. iSCSI is a transport layer protocol that works on top of the Transport Control Protocol (TCP). It enables block-level SCSI data transport between the iSCSI initiator and the storage target over TCP/IP networks.

ISO

An International Organization for Standardization ISO-9660 file system is a standard CD-ROM file system that allows you to read the same CD-ROM whether you're on a PC, Mac, or other major computer platform. Disk images of ISO-9660 file systems (ISO images) are a common way to electronically transfer the contents of CD-ROMs. They often have the file name extension .ISO (though not necessarily), and are commonly referred to as "ISO".

Logical Drive

A partition is a logical drive because it does not affect the physical hard disk other than the defined space that it occupies, yet it behaves like a separate disk drive.

Lost Cluster

A cluster that has an assigned number in the file allocation table, even though it is not assigned to any file. You can free up disk space by reassigning lost clusters. In DOS and Windows you can find lost clusters with the ScanDisk utility.

MBR

Master **B**oot **R**ecord. All physical disks start with MBR. When you start the computer, the code in the MBR executes before the operating system is started. The location of the MBR is always track (cylinder) 0, side (head) 0, and sector 1. The MBR contains a partition table with file system identifiers.

MFT Records

Master **F**ile **T**able. A file that contains the records of every other file and directory in the NTFS-formatted volume. The operating system needs this information to access the files.

Named Streams

NTFS supports multiple data streams where the stream name identifies a new data attribute on the file. A handle can be opened to each data stream. A data stream, then, is a unique set of file attributes. Streams have separate opportunistic locks, file locks, and sizes, but common permissions.

NTFS

New **T**echnology **F**ile **S**ystem (developed by Microsoft) is the file system that the Windows NT operating system uses for storing and retrieving files on a hard disk. NTFS is the Windows NT equivalent of the Windows 95 file allocation table (FAT) and the OS/2 High Performance File System (HPFS). All the latest Windows Operating Systems (Windows Vista, Windows 7, Windows 10) still use NTFS as a default file system.

NTLDR

Aka NT loader is the boot loader for all releases of Windows NT operating system up to and including Windows XP and Windows Server 2003. NTLDR is typically run from the primary hard disk drive, but it can also run from portable storage devices such as a CD/DVD or USB flash drive.

OpenSUSE

A Linux distribution. It is widely used throughout the world. The focus of its development is creating usable open-source tools for software developers and system administrators, while providing a user-friendly desktop and feature-rich server environment.

Partition

A section of the hard disk isolated for a specific purpose. Each partition can behave like a separate disk drive .

Partition Boot Sector

On NTFS or FAT file systems, the partition boot sector is a small program that is executed when the operating system tries to access a particular partition. On personal computers, the Master Boot Record uses the partition boot sector on the system partition to determine file system type, cluster size, etc., and to load the operating system kernel files. Partition boot sector is usually the first sector of the partition.

Physical Device

A piece of hardware that is attached to your computer by screws or wires. A hard disk drive is a physical device. It is also referred to as a physical drive.

RAID

RAID ("**R**edundant **A**rray of **I**nexpensive **D**isks" or "**R**edundant **A**rray of **I**ndependent **D**isks") is a data storage virtualization technology that combines multiple physical disk drive components into one or more logical units for the purposes of data redundancy, performance improvement, or both. Data is distributed across the drives in one of several ways, referred to as RAID levels, depending on the required level of redundancy and performance. The different schemes, or data distribution layouts, are named by the word "RAID" followed by a number, for example RAID ***0*** or RAID ***1***. Each scheme, or *RAID* level, provides a different balance among the key goals: reliability, availability, performance, and capacity. RAID levels greater than RAID 0 provide protection against unrecoverable sector read errors, as well as against failures of whole physical drives.

RAID 0

RAID 0 consists of striping, but no mirroring or parity. Compared to a spanned volume, the capacity of a RAID 0 volume is the same; it is the sum of the capacities of the drives in the set. But because striping distributes the contents of each file among all drives in the set, the failure of any drive causes the entire RAID 0 volume and all files to be lost. In comparison, a spanned volume preserves the files on the unfailing drives. The benefit of RAID 0 is that the throughput of read and write operations to any file is multiplied by the number of drives because, unlike spanned volumes, reads and writes are done concurrently. The cost is increased vulnerability to drive failures—since any drive in a RAID 0 setup failing causes the entire volume to be lost, the average failure rate of the volume rises with the number of attached drives.

RAID 1

RAID 1 consists of data mirroring, without parity or striping. Data is written identically to two or more drives, thereby producing a "mirrored set" of drives. Thus, any read request can be serviced by any drive in the set. If a request is broadcast to every drive in the set, it can be serviced by the drive that accesses the data first (depending on its seek time and rotational latency), improving performance. Sustained read throughput, if the controller or software is optimized for it, approaches the sum of throughputs of every drive in the set, just as for RAID 0. Actual read throughput of most RAID 1 implementations is slower than the fastest drive. Write throughput is always slower because every drive must be updated, and the slowest drive limits the write performance. The array continues to operate as long as at least one drive is functioning.

RAID 2

RAID 2 consists of bit-level striping with dedicated Hamming-code parity. All disk spindle rotation is synchronized and data is striped such that each sequential bit is on a different drive. Hamming-code parity is calculated across corresponding bits and stored on at least one parity drive. This level is of historical significance only; although it was used on some early machines (for example, the Thinking Machines CM-2), as of 2014 it is not used by any commercially available system.

RAID 3

RAID 3 consists of byte-level striping with dedicated parity. All disk spindle rotation is synchronized and data is striped such that each sequential byte is on a different drive. Parity is calculated across corresponding bytes and stored on a dedicated parity drive. Although implementations exist, RAID 3 is not commonly used in practice.

RAID 4

RAID 4 consists of block-level striping with dedicated parity. This level was previously used by NetApp, but has now been largely replaced by a proprietary implementation of RAID 4 with two parity disks, called RAID-DP. The main advantage of RAID 4 over RAID 2 and 3 is I/O parallelism: in RAID 2 and 3, a single read I/O operation requires reading the whole group of data drives, while in RAID 4 one I/O read operation does not have to spread across all data drives. As a result, more I/O operations can be executed in parallel, improving the performance of small transfers.

RAID 5

RAID 5 consists of block-level striping with distributed parity. Unlike RAID 4, parity information is distributed among the drives, requiring all drives but one to be present to operate. Upon failure of a single drive, subsequent reads can be calculated from the distributed parity such that no data is lost. RAID 5 requires at least three disks. Like all single-parity concepts, large RAID 5 implementations are susceptible to system failures because of trends regarding array rebuild time and the chance of drive failure during rebuild. Rebuilding an array requires reading all data from all disks, opening a chance for a second drive failure and the loss of the entire array.

RAID 6

RAID 6 consists of block-level striping with double distributed parity. Double parity provides fault tolerance up to two failed drives. This makes larger RAID groups more practical, especially for high-availability systems, as large-capacity drives take longer to restore. RAID 6 requires a minimum of four disks. As with RAID 5, a single drive failure results in reduced performance of the entire array until the failed drive has been replaced. With a RAID 6 array, using drives from multiple sources and manufacturers, it is possible to mitigate most of the problems associated with RAID 5. The larger the drive capacities and the larger the array size, the more important it becomes to choose RAID 6 instead of RAID 5. RAID 10 (see Nested RAID levels) also minimizes these problems

PXE

Preboot E**X**ecution **E**nvironment. In computing the Preboot Execution Environment specification describes a standardized client-server environment that boots a software assembly, retrieved from a network, on PXE-enabled clients. On the client side it requires only a PXE-capable network interface controller, and uses a small set of industry-standard network protocols such as DHCP and TFTP.

RAS

Remote **A**ccess **S**ervice. Is any combination of hardware and software to enable the remote access tools or information that typically reside on a network of IT devices. A remote access service connects a client to a host computer, known as a remote access server. The most common approach to this service is remote control of a computer by using another device which needs internet or any other network connection.

Registry Hive

Highest level of organization in the Windows registry. It is a logical group of keys, subkeys, and values in the registry that has a set of supporting files loaded into memory when Windows is started or an user logs in.

Root Records

Used in FAT file system. A table that contains the records of every other file and directory in a FAT-formatted hard disk drive. The operating system needs this information to access the files. There are FAT32, FAT16 and FAT versions.

SAM

Security **A**ccount **M**anager. Database file that stores users' passwords in a hashed format. Since a hash function is one-way, this provides some measure of security for the storage of the passwords. It can be used to authenticate local and remote users. Beginning with Windows 2000 SP4, Active Directory authenticates remote users.

Sector

The smallest unit that can be accessed on a disk. Typically sector size is 512 or 4096 bytes.

SCSI

Small **C**omputer **S**ystem **I**nterface. A set of standards for physically connecting and transferring data between computers and peripheral devices. The SCSI standards define commands, protocols, electrical, optical and logical interfaces. SCSI is most commonly used for hard disk drives and tape drives, but it can connect a wide range of other devices, including scanners and CD drives, although not all controllers can handle all devices. The SCSI standard defines command sets for specific peripheral device types; the presence of "unknown" as one of these types means that in theory it can be used as an interface to almost any device, but the standard is highly pragmatic and addressed toward commercial requirements.

Secure Erase (SSD)

The ATA Secure Erase command is designed to remove all user data from a drive. With an SSD without integrated encryption, this command will put the drive back to its original out-of-box state. This will initially restore its performance to the highest possible level and the best (lowest number) possible write amplification, but as soon as the drive starts garbage collecting again the performance and write amplification will start returning to the former levels. Drives which encrypt all writes on the fly can implement ATA Secure Erase in another way. They simply zeroize and generate a new random encryption key each time a secure erase is done. In this way the old data cannot be read anymore, as it cannot be decrypted. Some drives with an integrated encryption will physically clear all blocks after that as well, while other drives may require a TRIM command to be sent to the drive to put the drive back to its original out-of-box state (as otherwise their performance may not be maximized).

Secure Erase (Frozen State)

SSD disk is blocked (frozen) by BIOS. The reasons can differ. Modern ATA hard drives and SSDs offer security options that help user to control access and reliably destroy data if necessary. Brand new HDD or SSD from a store have all the security features initially disabled... BIOS of many motherboards run the SECURITY_FREEZE_LOCK ATA command when booting to provide protection against manipulation.

Signature Files

File types are recognized by specific patterns that may serve as a reference for file recovery. When a file header is damaged, the type of file may be determined by examining patterns in the damaged file and comparing these patterns to known file type templates.

Span Array

A series of dynamic drives linked together to make one contiguous spanned volume.

S.M.A.R.T.

S.M.A.R.T. (Self-Monitoring, Analysis and Reporting Technology; often written as SMART) is a monitoring system included in computer hard disk drives (HDDs), solid-state drives (SSDs) and embedded MultiMediaCards (eMMC) drives. Its primary function is to detect and report various indicators of drive reliability with the intent of anticipating imminent hardware failures. When SMART data indicates a possible imminent drive failure, software running on the host system may notify the user so preventative action can be taken to prevent data loss and the failing drive can be replaced and data integrity maintained.

Templates (Patterns)

File types are recognized by specific patterns that may serve as a reference for file recovery. When a file header is damaged, the type of file may be determined by examining patterns in the damaged file and comparing these patterns to known file type templates. This same pattern-matching process can be applied to deleted or damaged partitions. Using FAT or NTFS templates, recovery software can assume that a particular sector is a FAT or NTFS boot sector because parts of it match a known pattern.

Tiny Core Linux

A minimal Linux kernel based operating system focusing on providing a base system functionality. The distribution is notable for its small size (11 to 16 MB) and minimalism; additional functions are provided by extensions. Tiny Core Linux is free and open source software and is licensed under the GNU General Public License version 2.

Track

Tracks are concentric circles around the disk and the sectors are segments within each circle.

Unallocated Space

Space on a hard disk where no partition exists. A partition may have been deleted or damaged or a partition may not have been created.

UEFI

Unified **E**xtensible **F**irmware **I**nterface is a specification for a software program that connects a computer's firmware to its operating system (OS). UEFI is expected to eventually replace BIOS. Like BIOS, UEFI is installed at the time of manufacturing and is the first program that runs when a computer is turned on.

Unused Space in MFT-records

Applicable to NTFS file system on Windows. The performance of the computer system depends a lot on the performance of the MFT. When you delete files, the MFT entry for that file is not deleted, it is marked as deleted. This is called unused space in the MFT. If unused space is not removed from the MFT, the size of the table could grow to a point where it becomes fragmented, affecting the performance of the MFT and possibly the performance of the computer. This space may also contain residual confidential data (file names, file attributes, resident file data) from the files that previously occupied these spaces. **KillDisk** can wipe out the residual data without touching the existing data.

Volume

A fixed amount of storage on a hard disk. A physical device may contain a number of volumes. It is also possible for a single volume to span to a number of physical devices.

Volume Shadow Copy

Shadow Copy (also known as Volume Snapshot Service, Volume Shadow Copy Service or VSS) is a technology included in Microsoft Windows that can create backup copies or snapshots of computer files or volumes, even when they are in use. It is implemented as a Windows service called the Volume Shadow Copy service.

Windows System Caching

Windows reserves a specified amount of volatile memory for file system operations. This is done in RAM because it is the quickest way to do these repetitive tasks.

Windows System Records

The Windows logs keeps track of almost everything that happens in Windows OS. This enhances performance of the computer when doing repetitive tasks. Over time, these records can take up a lot of space.

WinPE

WinPE is a compact Windows-based operating system used as a recovery environment to install, deploy, and repair Windows Desktop Editions, Windows Server, and other Windows operating systems. After boot to WinPE, user can:

- Set up a hard drive before installing Windows.
- Install Windows by using apps or scripts from a network or a local drive.

- Capture and apply Windows images.
- Modify the Windows operating system while it's not running.
- Set up automatic recovery tools.
- Recover data from unbootable devices.
- Add a custom shell or GUI to automate these kinds of tasks.

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