Phiston TECHNOLOGIES® INC.
Innovation, Ingenuity, Integrity

An Introduction to Various HDD Architecture and the Secure Technology to Destroy them

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A study by IDC titled Data Age 2025 predicts worldwide data creation will grow to an enormous 163 zettabytes (ZB) by 2025. That's ten times the amount of data produced in 2017.

It's a complex topic the paper addresses. The short version of "why so much more data" directly results from more devices generating more data, including images and video consumed from applications such as advertising and security, productivity-driven data such as files on servers and PCs, and massive amounts of metadata created by embedded devices.

SOME KEY FINDINGS FROM THE RESEARCH:

- The number of embedded devices, such as those found in smart buildings, and smart cars, will grow from less than one per person to **more than four** in the next 10 years.
- In just 8 years, the average person will interact with a connected device nearly **4,800 times a day**.
- By 2025, **75% of the population** will be connected, creating, and interacting with data.
- By 2025, **over 25% of data created** in the global datasphere will be real-time, and IoT real-time data will make up more than 95 percent of this.
- Data from new sources will open up new risks to private and sensitive information. By 2025, almost 90% of all data created in the global datasphere requires some level of security, but **less than half** will be secured.
- **20% of the data** in the global datasphere will have the potential to be critical to the continuity of our lives.

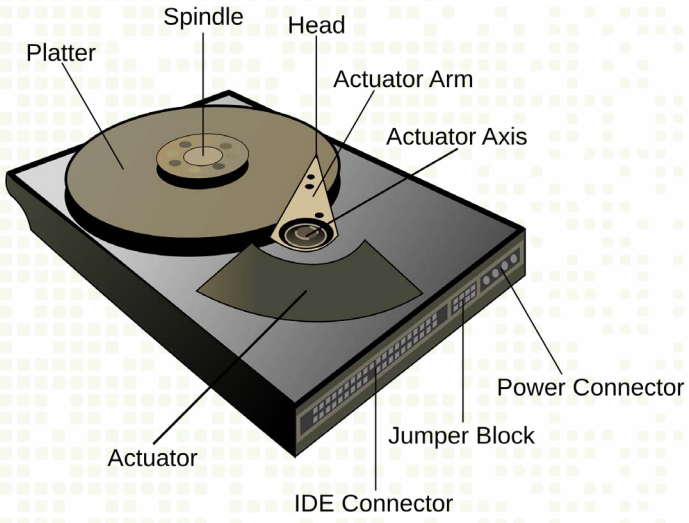
Most people don't really consider the technology behind the drives that store these massive amounts of data. They might know whether a drive is manufactured by popular brands such as Seagate, Western Digital (WD), Hewlett-Packard, or other manufacturers. Hard disk drives have come a long way since they became standard on systems units. Indeed, the common companies built a variety of hard drives, each operating to the specifications of the technology behind them. These are some different types of hard drives, some of which you might already be familiar with. However, others are cutting-edge technology in computing right now.

DIFFERENT TYPES OF HARD DISK DRIVES

HDD

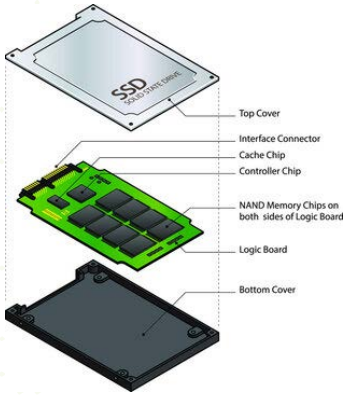
One of the most enduring types of hard drives, the Hard Disk Drive, uses a metal plate in which magnetic fields create binary code onto the metal platter by use of an arm which physically moves across the surface of the hard drive media to record and retrieve data. These hard drives are generally heavy and composed of various alloys which respond to magnetism to write the code. Throughout their use, the quality of the data degrades due to electromagnetism, corrosion, heat, physical impacts, or dust. These drives were common with SCSI chain devices, especially in early computing.

Every HDD consists of a number of magnetic platters, reading/writing heads, an electric motor, and a controller board. Since manufacturers cannot place an infinite number of platters and still maintain the same 3.5" form-factor, alternative approaches to overcome barriers in data compaction must be thought out.



SSD

Solid State Drives, unlike HDDs, contain no moving parts. They work more like a USB flash drive (only on a much larger scale). A traditional SSD consists of a spinning disk with a read/write head on a mechanical arm called an actuator. The two key components in an SSD drive are the flash controller and NAND flash memory chips.



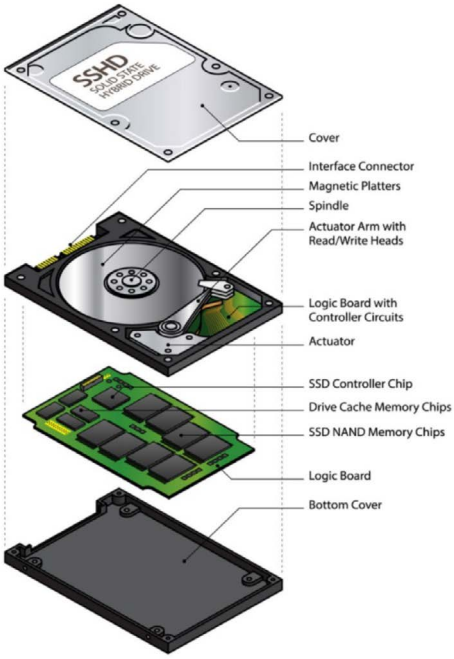
They are generally more durable, reliable, and faster than HDD and the cost reflects this. Unlike the HDD, the SSD uses digital memory. Thus, recording information digitally through a series of microchips, much like your computer's RAM. Unlike RAM, the data is not lost when the device is powered down or disconnected and can last indefinitely.

HYBRID (SSHD)

A Hybrid Hard Drive combines elements of solid-state technology and HDD technology. Mainly the storage capacity of a hard disk drive with the speed and performance of a solid state drive.

The purpose of the SSD in a hybrid drive is to act as a cache for the data stored on the HDD, improving the overall performance by keeping copies of the most frequently used data on the faster SSD drive. The downside of this is that sensitive data can be stored on the NAND flash memory, which could be vulnerable to data theft.

Typical hybrid hard drives are beneficial in terms of cost, capacity, and manageability. Hybrid drives typically cost more than hard drives but less than SSDs.



ENTERPRISE

An Enterprise HDD is a variation of the consumer HDD model with an emphasis on longer lifespans, larger storage capacities, and better reliability. On the downside, this usually comes at the cost of temperature control and noise reduction. Mainly, enterprise hard drives are engineered for servers.

Enterprise drives cost more than consumer hard drives and sometimes as much as 3x the price of a consumer model with the same capacity.

Enterprise HDDs are typically not used as a standalone drive but as part of a collective unit to operate service at a higher efficiency. These drives are built factoring into mind constant use over long periods of time.

HAMR

As the Data Age continues to evolve at an astronomical rate, so has the hunger for greater storage capacity drives. HAMR is the next major step to enabling higher-capacity hard drives.

To increase drive capacity, HAMR drives fit more data bits, or “grains,” onto each disk platter. This means an increase in the density of bits crammed into each square inch of surface space. More bits on a disk means more data can be stored. Seagate says this will allow for drives with a range of 2 to 5 Tbpsi (Terabits per square inch) density - compared with 1.3 Tbpsi used on conventional drives.

Heat-Assisted Magnetic Recording uses the same principle as HDD but incorporates heat into recording information onto the disk platter to maximize the amount of data stored without corrupting adjacent data clusters on the medium. Part of the reason hard disk drives degrade over time is magnetic and thermal instability.

HAMR has taken this to new levels. The recording diode can accurately change magnetic polarity and temperature with the help of a laser onto a media. This principle predictably and accurately packs more information into a hard drive platter. Each bit is heated and cools down in a nanosecond, so the laser has no impact on drive temperature or reliability of the overall media.

MAMR

Much like HAMR, microwave technology is incorporated to affect the media platter’s physical media accurately. This makes for smaller components recording incredible amounts of data with less energy. However, instead of using laser-powered heat like HAMR, MAMR uses 20-40 GHz frequencies to bombard the disk platter with circular microwave fields.

Further, this is great for larger hard disk storage and less heat than traditional server arrays. Less heat also means the reduction of less data corruption in adjacent packets. The idea is better reliability with microwaves than laser diodes, such as in HAMR.

LEGACY MEDIA DEVICES

Many legacy storage media devices and mediums contain valuable information as hard disk technology improves.

- **Tape drives:** Miles of magnetic tapes are still in archives from DAT to ZIP and JAZZ drives. Often, their obsolescence is considered a security feature. However, any intrepid data thief with the right equipment can retrieve information from these types of data storage.
- **Floppy disks:** Very few floppy disk drives are in operation, much like tape drives. However, that doesn't mean they no longer exist. In many cases, entire drawers and cabinets are stacked with these old storage volumes, and to the right data thief, they are ripe for the picking.
- **CD-R/DVD-R:** Though this technology is slowly becoming extinct, that isn't to say it is impossible to retrieve data from old rewritable media such as these. Phiston has dedicated many of its media destroyers to make this form of storage volume completely unusable.
- **Credit cards**: Magnetic strip cards, chipped cards, and other media are vulnerable to RFID scanners and devices. Proper disposal is essential in securing this information.

TYPES OF DATA DESTRUCTION

DEGAUSSING

In the past, many organizations looking to dispose of their electronic data on hard drives turned to degaussing. Degaussing is essentially the act of using a powerful, specialized magnet to erase data on a hard drive until it becomes completely irretrievable. The disruption of the magnetic field destroys the data.

For a long period of time, degaussing was a successful method of data erasure for hard disk drives. As technology has improved, however, degaussing has become almost entirely obsolete.

Newer hard drives no longer operate with a magnetic, spinning disk inside. Solid state drives use an electric charge to store data on integrated circuit assemblies, so degaussing an SSD will not erase the data. Degaussing a solid state drive has no effect on the media because the data is not stored magnetically. This is also the case for other FLASH NAND technology-electronic chips such as Hybrid, USB drives, and flash memory cards.

Hybrid drives with a low coercivity may potentially be able to be degaussed. The NSA/CSS policy manual 9-12 states to separate the hard disk drive case and the external circuit board. For these drives, there would need to be two separate protocols to sanitize fully; one for hard drive sanitization and a separate solid state drive process to sanitize the removed circuit board.

DEGAUSSING *(con't)*

Degaussing is also ineffective on newer drive technologies such as HAMR and MAMR. To ensure total erasure, a degausser's magnetic field strength must be four times the coercivity of the media. New drive recording technology would require a coercivity of 90,000 Oe to degauss. No such degaussers exist in the market.

With that said, it is universally accepted in the industry that even NSA-listed degaussers are insufficient to sanitize solid state drives, HAMR, MAMR, and other newer drive technologies such as Hybrid and Enterprise.

SHREDDING/DISINTEGRATING

Hard drive shredding can be an effective way to destroy a hard drive. It involves running the drive through a machine known as a shredder, which cuts it into tiny bits. Since hard drives store data on a platter, cutting it into small pieces can render the drive and any data on it useless.

Hard drive shredders are divided by speed and volume of drives they can process per hour and by the final particle size to which they reduce the hard drive.

The issue with shredding revolves around the final particle size of the destroyed media. There are many shredders in the market. Due to various reasons, the majority are incapable of shredding drives below a 20mm x 20mm particle size.

However, Phiston has solved this through its patented magnetic separation process, and our newest disintegrator destroys all media to a particle size of less than 2mm x 2 mm. Disintegrators use a conveyor system and knife mill that slices hard drives into tiny particles.

Phiston's latest innovation, the MediaDice® All Media Disintegrator, was designed to meet DIN 66399 Class 3, H7, and E7 security levels for HDDs and SSDs, exceeding all NIST SP 800-88 for extremely high protection requirements of sensitive media and NSA/CSS EPL devices designed for media sanitization.

CRUSHING

Physical data destruction is the most efficient way for organizations and businesses of all sizes to destroy data because it gives an organization the highest probability that data has been physically destroyed.

When dealing with hard disk drives, the key point is to ensure the platter is pierced and folded such that the drive is no longer accessible to read the data.

Some machines produce less than 10,000 pounds of force and limit their destructive power on small areas while potentially leaving other areas unscathed. This can leave behind smooth, flat surfaces from which forensic methods can recover data.

Phiston's MediaVise® destroyers are the only hard drive destruction system's to use a patented, corrugated, interlocking, hardened steel plated design. The 5.75-inch by 4.25-inch (146.05mm by 107.95 mm) plates attack the entire hard drive, not just select points, and will damage every component of the drive, including casing, circuit boards, read/write heads, and platters. This, however, requires a tremendous amount of force so that sufficient pressure can be applied on every point of the hard drive; otherwise, the hard drive would not be sufficiently destroyed.

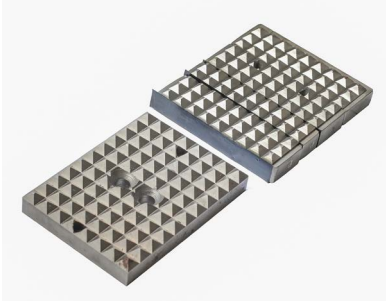
Currently, no mechanical or electrical system the size of the MediaVise® can produce enough force to employ a plate design that can attack all hard drive surfaces simultaneously and in one damaging cycle.

The MediaVise® overcomes this obstacle by using a hydraulic system that produces an unmatched 40,000 pounds (20 Tons) of crushing force.

Traditionally because of the physical differences between HDDs and SSDs, you would need two separate machines to destroy each. Physical destruction of an SSD drive requires a puncturing process. Drives are placed into machinery containing a press, which punches multiple pins into the hard drive and the chips contained with them.

The end result of the puncturing process is all memory chips are destroyed, and the drive is littered with holes.

Our line of SSD destroyers utilize a proprietary hydraulic power unit and patented crushing plates with an array of 187 interlocking razor-sharp hardened steel teeth. This delivers 20 tons of destructive forces to the SSD media, and their ceramic memory chips become punctured, crushed, serrated, and decimated on both sides in less than 30 seconds.



THE PHISTON ADVANTAGE

At Phiston Technologies, we believe in innovation, proactive product development, and secure destruction of data.

Our goal is simple: destroying your media to preserve and promote data security. We build products to ensure complete media destruction.

As data storage continues to evolve, so will the need to advance current data destruction products. Phiston will always be ready to provide security solutions to keep your organization safe and in compliance.

Phiston as a company is a leader in end-of-cycle media destruction and has various products that can handle all. Our clients include some of the largest tech companies in the world, and our devices are deployed across all 50 states and in 49 different countries.

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