**WHAT IS SSD?**

These days, whether you're buying a new computer or upgrading an old computer, you'll want to buy a solid-state drive (SSD) instead of a traditional hard disk drive (HDD). Indeed, switching from HDD to SSD is one of the best PC performance upgrades you can make.

To understand how SSDs work and why they're so useful, we have to first understand how computer memory works. A computer's memory architecture is broken down into three aspects: the cache, the memory, the data drive.

Each of these aspects serves an important function that determines how they operate. The cache is the innermost memory unit. When running, your computer uses the cache as a sort of playground for data calculations and procedures. The electrical pathways to the cache are the shortest, making data access almost instantaneous. However, the cache is very small so its data is constantly being overwritten.

The memory is the middle ground. You may know it as RAM (Random Access Memory). This is where your computer stores data related to the programs and processes that are actively running. Access to RAM is slower than access to the cache, but only negligibly so.

The data drive is where everything else is stored for permanence. It's where all of your programs, configuration files, documents, music files, movie files, and everything else is kept. When you want to access a file or run a program, the computer needs to load it from the data drive and into RAM.

The important thing to know is that there's a vast speed difference between the three. While cache and RAM operate at speeds in nanoseconds, a traditional hard disk drive operates at speeds in milliseconds.

In essence, the data drive is the bottleneck: no matter how fast everything else is, a computer can only load and save data as fast as the data drive can handle it. This is where SSDs step in. While traditional HDDs are orders of magnitude slower than cache and RAM, SSDs are much faster. This can significantly cut the amount of time it takes to load various programs and processes, and will make your computer feel much faster.

SSDs serve the same purpose as HDDs: they store data and files for long-term use. The difference is that SSDs use a type of memory called "flash memory," which is similar to RAM---but unlike RAM, which clears its data whenever the computer powers down, the data on an SSD persists even when it loses power.

If you took apart a typical HDD, you'd see a stack of magnetic plates with a reading needle---kind of like a vinyl record player. Before the needle can read or write data, the plates have to spin around to the right location.

On the other hand, SSDs use a grid of electrical cells to quickly send and receive data. These grids are separated into sections called "pages," and these pages are where data is stored. Pages are clumped together to form "blocks." SSDs are called "solid-state" because they have no moving parts.

Why is this necessary to know? Because SSDs can only write to empty pages in a block. In HDDs, data can be written to any location on the plate at any time, and that means that data can be easily overwritten. SSDs can't directly overwrite data in individual pages. They can only write data to empty pages in a block. So then how do SSDs handle data deletion? When enough pages in a block are marked as unused, the SSD commits the entire block's worth of data to memory, erases the entire block, then re-commits the data from memory back to the block while leaving the unused pages blank. Note that erasing a block doesn't necessarily mean the data is fully gone.

When you have a fresh SSD, it's loaded entirely with blocks full of blank pages. When you write new data to the SSD, it can immediately write to those blank pages with blazing speeds. However, as more and more data gets written, the blank pages run out and you're left with random unused pages scattered throughout the blocks.

Since an SSD can't directly overwrite an individual page, every time you want to write new data from that point on, the SSD needs to:

1.Find a block with enough pages marked "unused".

2.Record which pages in that block are still necessary.

3.Reset every page in that block to blank.

4.Rewrite the necessary pages into the freshly reset block.

5.Fill the remaining pages with the new data.

So in essence, once you've gone through all of the blank pages from a new SSD purchase, your drive will have to go through this process whenever it wants to write new data. This is how most flash memory works. That said, it's still much faster than a traditional HDD, and the speed gains are absolutely worth the purchase of an SSD over an HDD.

Link to internet source: <https://www.makeuseof.com/tag/solidstate-drives-work-makeuseof-explains/>

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TRANSLATE

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Архитектура памяти компьютера разбита на три аспекта: кэш, память и диск с данными.

Каждый из этих аспектов выполняет важную функцию, определяющую их работу. Кэш - это самая внутренняя единица памяти. Во время работы ваш компьютер использует кэш как своего рода площадку для вычислений данных и процедур. Электрические пути к кэш-памяти самые короткие, что делает доступ к данным практически мгновенным. Однако кэш очень мал, поэтому его данные постоянно перезаписываются.

В то время как кэш и оперативная память работают со скоростью в наносекунды, традиционный жесткий диск работает со скоростью в миллисекунды.

По сути, диск с данными является узким местом: независимо от того, насколько быстро все остальное, компьютер может загружать и сохранять данные только с той скоростью, с которой диск данных может их обработать. Здесь на помощь приходят твердотельные накопители.

Твердотельные накопители служат той же цели, что и жесткие диски: они хранят данные и файлы для долгосрочного использования. Разница в том, что твердотельные накопители используют тип памяти, называемый «флэш-памятью», которая похожа на оперативную память, но в отличие от ОЗУ, которая очищает свои данные при выключении компьютера, данные на твердотельном накопителе сохраняются, даже когда он теряет питание.

Твердотельные накопители используют сетку электрических ячеек для быстрой отправки и получения данных. Эти сетки разделены на разделы, называемые «страницами», и на этих страницах хранятся данные. Страницы сгруппированы в «блоки». SSD-диски называются «твердотельными», потому что у них нет движущихся частей.

SSD не могут напрямую перезаписывать данные на отдельных страницах. Они могут записывать данные только на пустые страницы в блоке. Итак, как твердотельные накопители обрабатывают удаление данных? Когда достаточное количество страниц в блоке помечено как неиспользуемое, SSD фиксирует данные всего блока в памяти, стирает весь блок, затем повторно фиксирует данные из памяти обратно в блок, оставляя неиспользуемые страницы пустыми.

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SUMMARY

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The data drive is the bottleneck: no matter how fast everything else, the computer can only load and save data as fast as the data drive can process it. This is where solid state drives come to the rescue. Solid state drives serve the same purpose as hard drives: they store data and files for long-term use. The difference is that SSDs use a type of memory called "flash memory," which is similar to RAM, but unlike RAM, which clears its data when the computer is turned off, the data on the SSD is retained even when it loses power. Solid state drives use a grid of electrical cells to send and receive data quickly. These grids are divided into sections called "pages" and these pages store data. Pages are grouped into "blocks". SSDs are called "solid state" drives because they have no moving parts.