

Solid State Drives, the Technology Replacing the Mechanical Hard Drive

This article shows you how to:

- ✓ Why an SSD is so much faster than a hard drive
- ✓ The speed boost you could expect from an SSD
- ✓ The basic steps to add an SSD to your current PC

When you come to buy your next PC, there's a good chance it could contain a solid state drive, or SSD for short. What's that? It's the new, lightning-fast and reliable alternative to the clunky old mechanical hard drive.



But why wait? In theory at least, you could add an SSD to your current, slow PC. But is it worth doing? Are the benefits of the SSD worth the cost and trouble it would involve? And are there any disadvantages? Read on to discover all the ins and outs of the SSD.

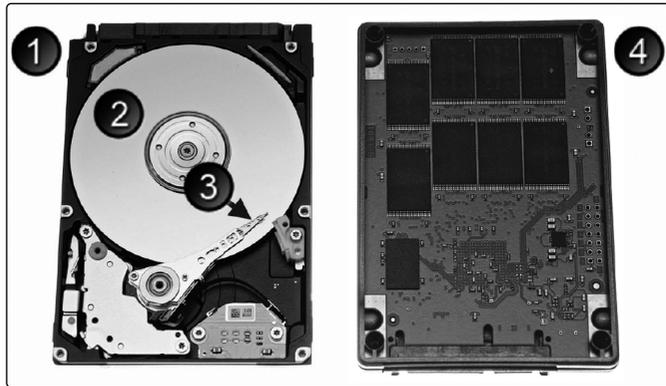
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Side by Side: SSDs and Hard Drives Compared

The SSD – a new challenger to the hard drive

The PC has been around for more than 40 years, and the hard drive has been in existence even longer, so we're talking about some very mature technology. The computing world has relied on hard drives for decades, and generally without complaint. Suddenly, however, a much faster alternative is becoming all the rage – the Solid State Drive, or SSD.

So what makes the SSD such a great improvement over the old-fashioned hard drive?



How the hard drive works

A modern hard drive (1) consists of one or more disks (2) (commonly known as 'platters') on which data is stored magnetically. A tiny motor inside the drive makes the required disk rotate very quickly, and a read/write head (3) hovers just above a platter to read data from it or to write more data to it.

A mechanical system

You could think of this arrangement as working much like dropping the stylus into the groove on an old gramophone record. The head has to be manoeuvred into exactly the right spot (on the right disk!) where the data is to be read or written. It sounds slow and clumsy, but in fact this mechanical

process takes between four and 13 milliseconds. In other words, it could potentially be repeated 250 times every second.

That's an impressive turn of speed, and it helps to explain why we've been happy with the humble hard drive for so long. But an SSD (4 in the picture opposite) can access data up to 400 times faster.

The amazing speed of an SSD is possible because there are no moving parts involved: no motors, no disks to spin, no read/write head to send hither and thither. The SSD is entirely electronic, using the same type of technology found in those little USB flash drives.

If that's the case, then why aren't USB flash drives also blindingly fast? Essentially it's because they have to be plugged into a USB socket, and the USB system isn't really designed for speed (although it's getting faster). Hard drives and SSDs connect to a different system inside your PC – one that can handle immense speeds. While the hard drive can't take full advantage of the speeds available, the SSD certainly can.

SSDs are entirely electronic



The Pros and Cons of SSDs

All the advantages of the SSD really stem from the fact that it has no mechanical parts:

SSDs have numerous advantages

| The SSD is: | Resulting advantage: |
|----------------------------|----------------------------------------------------------|
| Robust and shock-resistant | Reduced risk of damage or lost data due to shock or heat |
| Silent | More pleasant working environment |
| More energy-efficient | Saves electricity; notebook batteries last longer |

| | |
|--------------------------------------------|--------------------------------------------------------------------------------|
| Cooler | Less fan noise; reduced risk of heat-related damage to PC components |
| Much quicker in accessing and reading data | Less waiting: most (but not all) of what you do should happen far more quickly |

Windows and programs start much faster

Of all the above advantages, perhaps the most dramatic is the last one – the increased speed. Whereas you might be used to waiting two minutes for your PC to start and Windows to be ready for use, an SSD could reduce this to a mere 10–20 seconds. Likewise, large heavyweight pro-grams like Adobe Photoshop that might take half-a-minute to start from a hard drive should now appear almost instantly.

Disadvantages?

So the benefits aren't to be sniffed at, but is it all good news? Not exactly: SSDs do have their drawbacks too, although in many cases they're similar to the disadvantages of hard drives:

It won't last forever

- **Limited lifetime:** the flash cells inside the SSD eventually wear out, resulting in a gradual drop in performance and, eventually, failure. However, hard drives are reckoned to last for about five years, with any extra time regarded as a lucky bonus, and SSDs are generally rated for a much longer lifetime than a hard drive (largely because SSDs aren't sensitive to the two main weaknesses of mechanical devices: heat and movement).



The thing that causes an SSD to wear out more quickly is writing data, not reading it. Therefore, the less time spent writing data, the longer the SSD should last. A great way to decrease the amount of writing is to have plenty of memory (RAM) in your PC, since a lack of RAM causes far more data to be written to the main drive (be it a hard drive or an SSD).

- **Loss of storage space:** between two and 12 percent of the storage space is reserved for the system and not available for you to use (for example, a 256 GB SSD gives you only 230 GB for your own use). However, a portion of a hard drive's space is reserved in just the same way. **Smaller than you might expect**
- **Data recovery may be impossible:** a hard drive can fail in a variety of ways, and in many cases it's possible to recover at least some of the data from it – perhaps with the aid of a data-recovery specialist. If an SSD fails, data recovery is more difficult, and may be impossible. It would certainly involve sending the SSD to a data-recovery firm. That's an argument for ensuring you keep backups of all your personal files on a separate disk if you use an SSD (but, of course, there are already countless arguments for doing that!). **Failure is usually absolute**
- **High price:** for ease of comparison, the cost of storage is usually measured as price per gigabyte (GB). A hard drive typically costs around 3 pence per gigabyte, whereas an SSD will set you back around 15 pence per gigabyte. **Much more expensive than hard drives**
- **Lower capacity:** hard drives are available with capacities of up to 8 TB (terabytes), but the largest available SSD holds only 2 TB and (as mentioned above) it costs around five times as much as a 2 TB hard drive. **Available only in smaller capacities**

In summary, then, the advantages of SSDs are many, but they're offset by their much higher price. Those clunky mechanical hard drives remain in popular use because they're considerably cheaper and they offer far greater storage capacities.

Would You Really Benefit from an SSD?

Most of us feel our PC isn't as fast as it should be – or as fast as it used to be – and we get frustrated at having to wait

for it. The question is, will an SSD actually make any difference? While an SSD is hugely faster than a hard drive, are you sure it really is the hard drive that's slowing you down?

There are three main elements that affect a computer's speed, of which the storage medium (hard drive or SSD) is just one. The others are its processor speed and how much RAM it has.

It depends
what's slowing
it down!

If you mainly use your PC for things that don't involve intensive use of the hard drive, then it's likely that a slow processor or insufficient RAM is what's slowing things down and causing the frustration.

You can find your processor speed and amount of RAM by looking at the System section of the Control Panel – a quick way to get there is to hold the Win key and tap the Pause/Break key:

Processor speed

- **Processor:** the processor speed is measured in GHz (gigahertz). An old notebook computer might have a speed of only 1.6 GHz whereas a new PC runs over twice as fast at 3.3 GHz. If your PC is towards the lower end of this scale, it's a safe bet that the processor isn't up to par, and an SSD would do little to improve your experience.

Enough RAM

- **RAM:** insufficient RAM will certainly slow down a PC. Modern versions of Windows should have a bare minimum of 2 GB; if you have a 32-bit version of Windows (which will be noted alongside the words **System type**), your system won't be able to make use of much more than 3 GB, regardless of how much is installed, but 3 GB is far better than 2 GB. If you have a 64-bit version of Windows with less than 4 GB RAM, that's the likely bottleneck.



An effect of having too little RAM is that your PC has to supplement it using the much-slower hard drive... or

the not-so-slow SSD. So if your PC's problem really is too little RAM, an SSD may go a little way towards alleviating the problem, although a far more practical use of the money would be in adding more RAM!

Perhaps your PC isn't actually slow, though: perhaps you feel that a little extra speed wouldn't go amiss, or perhaps you're about to buy a new PC and you're wondering whether an SSD would be a worthwhile inclusion. In that case, it helps to know what aspects of PC use are actually affected by your choice. Here's where the increased speed of an SSD really comes into its own:

- Starting Windows
- Starting programs
- Copying files
- Searching for files
- Working with very large databases
- Converting and processing photos, videos and music

Other aspects of PC use certainly do involve the hard drive or SSD (in fact, pretty much everything does to some extent), but those are the areas in which you'll really notice the difference.

Is an SSD Worthwhile in Your New PC?

If you look at new PCs in the upper end of the price spectrum, you'll find that quite a few of them come with both an SSD and a traditional hard drive. (Indeed, it's the inclusion of the SSD that helps to put them at the upper end of that spectrum.) But why both?

In a nutshell, the SSD is there for speed and the hard drive is there for storage space. The SSD probably has a capacity of about 128 GB, which is comparatively small beer, but an

How an SSD's speed helps

Some new PCs have an SSD and a hard drive

One for speed, the other for capacity

Windows is installed on the SSD

SSD with a higher capacity would make that PC quite a lot more expensive.

If you were to buy one of these PCs, you'd find that Windows is installed on the SSD, as are any programs provided with it. And the SSD is also where you'll install the programs you add yourself. All your other files – your photos, documents, videos and music – you'll save and keep on the hard drive.

As a result, the SSD doesn't really need to be any larger. It has enough capacity to store Windows and your programs, and they'll all start vastly more quickly than they would on the hard drive.

Your files are stored on the hard drive

This means that when a program has instantaneously sprung into life and you want to open a file, you'll be opening it from the much-slower hard drive, but that's far less of an issue. It's just one file, and it's probably very small, so the time wasted is counted in tiny fractions of a second.



If you really do want out-and-out speed, look for a new PC with a larger SSD. They'll become more plentiful as SSD prices drop, and a 500 GB (or even 250 GB) SSD may well be sufficient without a hard drive if you don't store a lot of large files (chiefly videos, photos and music), allowing you to keep everything on the SSD. If space gets tight, you could consider adding another SSD later, when their prices have fallen still further.

Removes the one remaining bottleneck

There's no doubt that in modern PCs, with their fast processors and plentiful RAM, it's the mechanical hard drive that's the real speed-killer. The addition of an SSD therefore makes a tremendous difference, and the only question you have to consider is whether that extra burst of speed is worth an extra £150-or-so on the typical price of a PC.

The Upgrade Option: Adding an SSD to Your Current PC

What about your current PC: could you install an SSD in that and achieve a similar speed increase?

If you use Windows 10, 8.1 or 7, the answer is that you almost certainly could. For Windows Vista and XP users, I'd suggest not for two reasons: first, it's a little more complicated for these older versions of Windows, and second, the other aspects of the PC are probably not awfully speedy themselves, so it's a bit like fitting a turbocharger to a bicycle.

Not a good choice for Vista or XP

The more-recent versions of Windows are designed to know all about SSDs and they work with them as seamlessly as they work with hard drives. The SSD uses the same cables currently connecting your hard drive, so in theory the job simply entails copying all the data from your hard drive, installing the SSD and then copying all that data on to the SSD. (You can keep your hard drive installed as additional storage.)

Easy to use with Windows 10, 8.1 and 7

In practice, that's not quite as straightforward as it sounds and you'll probably need an expert to do it for you (or at least to help you with it). Here's how the process works in more detail:

The basic procedure

- **Check the interface:** the 'interface' is the type of technology used to transfer data between your hard drive and the rest of the PC. If your PC uses an interface named 'SATA III' or 'SATA II', you're fine. If it's 'SATA I' you wouldn't get the full speed benefit of the SSD but it would still be an improvement; if it's 'IDE', you'd be unlikely to notice any gain at all besides quieter operation.
- **Order the SSD:** here you have to consider the size of your current C: drive and how much you're willing to spend

How is your hard drive connected?

A large enough SSD?

on the SSD. If you have 100 GB of data on your hard drive, a 120 GB SSD would be fine; however, if you have 300–500 GB of data, are you really willing to buy an expensive 500 GB SSD? Probably not, so you'll need to buy a smaller SSD and transfer only the main system software to it (Windows and programs). The migration software supplied with the SSD may allow you to do this, but in many cases it won't: you'll probably need a program like Paragon Migrate OS (www.paragon-software.com) which allows you to pick and choose what to transfer.

Backup first
for safety!

- **Backup the hard drive:** create a 'backup image' of your hard disk using a program like the free Macrium Reflect (www.macrium.com).

Copy the data
to the SSD

- **Migrate the hard drive data to the SSD:** connect the SSD to the computer and use the migration software to copy your data from the hard drive to the SSD.

Install and set
up the SSD

- **Switch the drives:** unplug the PC, remove the battery from a notebook, and either replace the hard drive with the SSD or install it alongside the hard drive. After restarting the PC, optimise the SSD settings.



Expert help is
probably needed!

As you can tell from the brief guide above, although the basics are straightforward, there can be thorny issues of migrating the data from one drive to the other and physically installing the new device inside the PC's case. If you fancy going ahead with this, I recommend factoring in the extra cost of having an expert do it for you!