BENEFITS OF INSTALLING A SOLID STATE DRIVE IN YOUR COMPUTER

AND HOW TO DO IT

Advantages and Disadvantages

Both SSDs and HDDs do the same job: They boot your system, store your applications, and store your personal files. But each type of storage has its own unique feature set. The question is, what's the difference, and why would a user get one over the other? Here is a breakdown:

Price: To put it bluntly, SSDs are very expensive in terms of dollar per GB. For the same capacity and form factor 1TB internal 2.5-inch drive, you'll pay about $75 for an HDD, but as of this writing, an SSD is about $500. That translates into eight-cents-per-GB for the HDD and 50 cents per GB for the SSD. Other capacities are more affordable (250 to 256GB: $150 SSD, $50 HDD), but you get the idea. Since HDDs are older, more established technologies, they will remain less expensive for the near future. Prices for SSDs are coming down and if you decide to take the plunge shop around, prices do vary between vendors and "specials" pop up regularly on Amazon and other on line vendors.

Maximum and Common Capacity: Readily available SSD units top out at 1TB, you're more likely to find 128GB to 500GB units as primary drives in systems. You'd be hard pressed to find a 128GB HDD in a PC these days, as 500GB is considered a "base" system in 2014. Multimedia users will require even more, with 1TB to 4TB drives common in high-end systems. Basically, the more storage capacity, the more stuff (photos, music, videos, etc.) you can hold on your PC. While the (Internet) cloud may be a good place to share these files between your phone, tablet, and PC, local storage is less expensive, and you only have to buy it once.

Speed: This is where SSDs shine. An SSD-equipped PC will boot in seconds, certainly under a minute. A hard drive requires time to speed up to operating specs, and will continue to be slower than an SSD during normal operation. A PC or Mac with an SSD boots faster, launches apps faster, and has higher overall performance. Witness the higher PCMark scores on laptops and desktops with SSD drives, plus the much higher scores and transfer times for external SSDs vs. HDDs. The illustration on the right shows the boot time for my laptop after installing an SSD.

Fragmentation: Because of their rotary recording surfaces,

HDD surfaces work best with larger files that are laid down in contiguous blocks. That way, the drive head can start and end its read in one continuous motion. When hard drives start to fill up, large files can become scattered around the disk platter, which is otherwise known as fragmentation. While read/write algorithms have improved (where the effect in minimized), the fact of the matter is that HDDs can become fragmented, SSDs don't care where the data is stored on its chips, since there's no physical read head. SSDs are inherently faster.

Durability: An SSD has no moving parts, so it is more likely to keep your data safe in the event that you drop your laptop bag or your system is shaken about by an earthquake while operating. Most hard drives park their read/write heads when the system is off, but they are flying over the drive platter at hundreds of miles an hour when they are in operation. Besides, even parking brakes have limits. If you're rough on your equipment, a SSD is recommended.

Availability: Hard drives are simply more plentiful. Look at the product lists from Western Digital, Toshiba, Seagate, Samsung, and Hitachi, and you'll see many more HDD model numbers than SSDs. For PCs and Macs, HDDs won't be going away completely, at least for the next few years. You'll also see many more HDD choices than SSDs from different manufacturers for the same capacities. SSD model lines are growing in number, but HDDs are still the majority for storage devices in PCs.

Form Factors: Because HDDs rely on spinning platters, there is a limit to how small they can be manufactured. There was an initiative to make smaller 1.8-inch spinning hard drives, but that's stalled at about 320GB, since the MP3 player and smartphone manufacturers have settled on flash memory for their primary storage. SSDs have no such limitation, so they can continue to shrink as time goes on. SSDs are available in 2.5-inch laptop drive-sized boxes, but that's only for convenience, as stated above. As laptops become slimmer and tablets take over as primary Web surfing platforms, you'll start to see the adoption of SSDs skyrocket and probably getting smaller.

Noise: Even the quietest HDD will emit a bit of noise when it is in use from the drive spinning or the read arm moving back and forth, particularly if it's in a system that's been banged about or in an all-metal system where it's been shoddily installed. Faster hard drives will make more noise than slower ones. SSDs make virtually no noise at all, since they're non-mechanical.

Overall: HDDs win on price, capacity, and availability. SSDs work best if speed, ruggedness, form factor, noise, or fragmentation (technically part of speed) are important factors to you. If it weren't for the price and capacity issues, SSDs would be the winner hands down.

As far as longevity goes, while it is true that SSDs wear out over time (each cell in a flash memory bank has a limited number of times it can be written and erased), thanks to TRIM technology built into SSDs that dynamically optimizes these read/write cycles, you're more

likely to discard the system for obsolescence before you start running into read/write errors. The possible exceptions are high-end multimedia users like video editors who read and write data constantly, but those users will need the larger capacities of hard drives anyway. Hard drives will eventually wear out from constant use as well, since they use physical recording methods. Longevity is a wash when it's separated from travel and ruggedness concerns.

Let's now take a look at laptops and whether it would be worthwhile upgrading to an SSD. Obviously if you still have a machine more than three years old it might be difficult to justify spending money on an upgrade but I would suggest that if your unit has the following specs it might be a candidate for it.

- Windows 7 or 8
- Intel i3, i5 or i7 processor running at 2 + Ghz or an AMD equivalent
- At least 4GB RAM (if there is room for expansion use it)

This also presumes the overall condition is good, no screen damage, corners broken etc.!

Most laptops of this vintage came with HDDs of between 250 GB and 1 TB with the majority being around the 500 to 750 GB capacity. The first thing to decide is whether to do a clean install or clone the existing drive onto a new SSD.

If your computer is reasonably new and you have the operating system DVD (Windows 7 or 8) then a clean install is an attractive possibility. This will allow you to install the new drive and boot up the computer with the disc and have a brand new installation.

For older machines check how much data you have on your drive against the capacity of the new SSD you are considering. If you are looking at installing a 500 GB SSD and you have less than that on your drive then it isn't a problem to clone the drive onto your new SSD. If it is more than it will be necessary to transfer some of the data onto an external drive to bring the used space below the capacity of the new drive before cloning. I think if you check the space your operating system and programs occupy on your "C" drive it will not be more than 200GB and the rest is taken up with documents pictures etc. which can easily be transferred to an external drive. On my laptop I have Windows 8.1 update, Windows Media Center, Microsoft Office 2010, Adobe CS5 (Photoshop, Dreamweaver, Flash, Illustrator, etc.), Photoshop Elements 10,11, and 12 plus numerous other software programs and they take less than 200 GB.

I replaced the 500 GB HDD on this laptop with a 250 GB SSD using a clean install as I had the operating system disc (Windows 8) available and I wanted to start fresh. I had previously upgraded the memory from 4 GB to 8 GB (the maximum the machine will accept) and originally (December 2010) this machine had Windows 7 but I upgraded in August 2012 to Windows 8 and updated to Windows 8.1 (Update) in April this year.

This is an Acer Aspire 5745 series laptop with a typical construction and layout.

If you are planning on cloning your drive to a new SSD you first must download the free version of "Easus Todo Backup Free" and load the software. When you open the software you will see the option "clone".
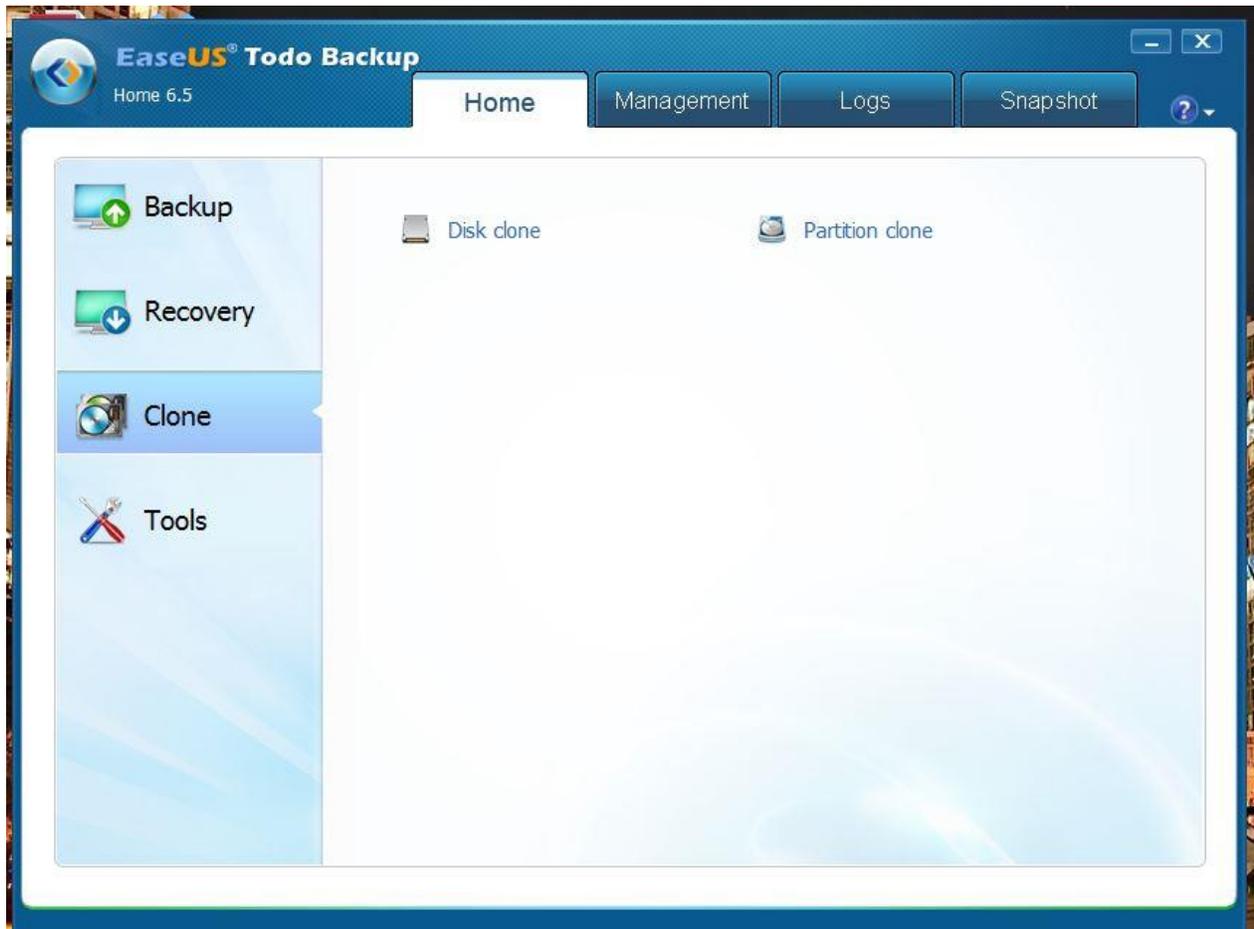
Connect the new SSD to a suitable USB port on the laptop with a USB to SSD connection cable as shown below.

Once the transfer of the files from the internal HDD to the new SSD is complete it is time to open up the laptop and install the new drive. If you are doing a clean install using your operating system disc then this is where you would start.

First **REMOVE THE BATTERY!** Removal varies between manufacturers so follow the makers' instructions. It helps if you have a clean, flat, well lit workspace where you can sit comfortably. I usually spread a light-colored tablecloth out (it cushions anything you might drop and prevents screws etc. from bouncing off the table!) and have a suitable receptacle for the screws you remove. I use an eggcup, it works fine and you can easily see what it contains. It also might be prudent to invest in a computer toolkit, I have a couple of examples here, the older one (from CompUSA) I bought probably 15 years ago and probably outdated. The latest kit I bought is much better and cost around $20. It comes with some spare screws (trust me they are very easy to lose!) plus I have a "laptop screw kit" just in case which costs around $5.

Remove the screws on the bottom of the unit and remove the cover.

Laptop manufacturers all have slightly different access panels but it should be easy to figure out which screws to remove.

The existing hard drive will be apparent and is usually secured by a retaining plate across the body.

Take out the retaining plate and the drive can be slid out of the contact area towards the outer edge of the case. You can then remove the drive and set it aside, we will be using it again later.

Now it is time to install the new drive.

Carefully check the contact arrangement in the computer and on the drive and line up them up correctly. Place the drive in the space and carefully slide the drive into the connection. It should smoothly mate together and if there is any resistance do make sure the connections are correct. Depending on your computer there may be a difference in thickness between the platter drive that was removed and the new drive. This is small probably less than a couple of millimeters and should not affect performance. Most SSD's come with an adaptor which sits below the drive and provides a cushion but if the new drive fits snugly and without any discernable vertical movement then the adaptor should not be necessary.

Here you can see the drive is in place and ready for securing.

The new drive will be held in place with the same securing plate that held the platter drive and should be installed at this time.

The two screw holes you see here at the end of the drive are for the screws that hold the case


in place and the retaining plate fits into a slot between them and the drive base to keep the drive securely in place.

Now it is just a matter of replacing the cover, sliding the battery back into place and booting up.

During boot up bring up the BIOS (basic in and out system) to check on the boot order. Depending on the manufacturer this could be repeatedly clicking F2, the DEL key, the ESC key or whatever is applicable, check with your instruction book or on the company website prior to beginning the upgrade.
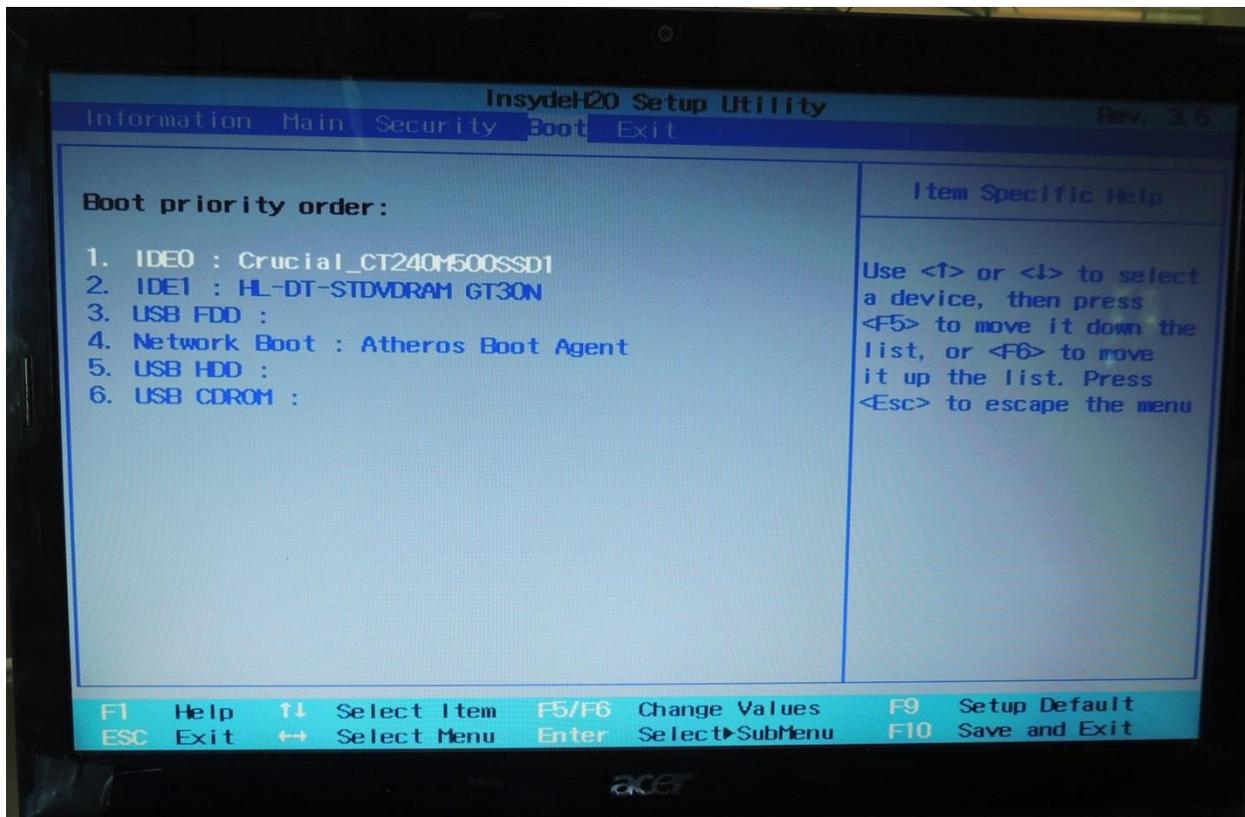
After the BIOS opens navigate to the "BOOT" page and make sure the SSD is listed as #1 in the boot priority order. This can be set by using arrows to select the device and then move it up or down the list using the keys shown on the directions. In most cases you will not need to do any changes and in fact you can probably forget about this step unless you have a problem booting after changing the drive.

Finally a nice bonus for installing the SSD in your laptop. You now have a platter drive that can easily be converted into a useful external drive. In my case I bought an enclosure for a 2.5" HD at Fry's on sale for $6.50 (checked today and they are asking ($9) and slipped the drive in side. It is held in place with tiny screws but it plugs into my computer and I have a very good 450 GB drive to augment my internal drive.

Installing an SSD in a desktop machine takes a little more work and planning but can be accomplished by most of you with a little research and time. I installed an SSD in my desktop, once again a 250 GB model to augment the 2 TB unit I already have installed. Fortunately I had partitioned this drive and had the operating system (Windows 7) plus all the programs in one partition which made it easy to transfer these to an SSD. FYI I have a lot of software on the SSD together with the operating system (I'm talking heavyweights such as Adobe Creative Suite, Microsoft Office, three versions of Photoshop Elements and numerous others) and I still have nearly 100 GB free space on the 250 GB SSD.

For those of you who just want a solid state drive for storage inside a desktop computer there is now a PCI (Peripheral Component Interconnect) Express version which will install as easily as a new set of USB sockets!

For those of you who have an SSD installed or those of you who are considering one here are some very good tips I put together for optimizing the drive. I have some copies of this available for people who haven't downloaded this list.

FINE TUNE YOUR SSD

Most SSD's today are SATA 3 compatible so before you buy ensure your MOBO has an open SATA 3 port. Most do and many have 2 or 3 open. Case in point my desktop has 4 ports open. Also check the BIOS and make sure the disk is running in AHCI mode rather than IDE, If you have open SATA 3 ports this is most likely by default.

SSD's do not need many of the tasks that Windows performs by default and they need to be turned off. First disable drive indexing: from My Computer right click on the drive and select Properties. At the bottom is a check box "allow files on this drive to have contents indexed". Uncheck and hit "Ignore All" on the error message and then wait for the process to complete. This could take a few minutes depending on the contents of your drive. Still in the Properties window select the Tools tab and hit the "defrag now" button. We aren't going to defrag (now or ever again, SSD's don't need it) instead select the Defragment Schedule and uncheck any schedules shown.

Now we need to disable the prefetch and superfetch processes which are designed to speed up search results on a platter drive but only cause distress on a SSD. Go to the Start search box and type in regedit and when the registry editor opens find the following path: HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\SessionManager\MemoryManagement\PrefetchParameters.

Now right-click both Superfetch and Prefetch to bring up their modify windows and change their values to 0. You will need to do a restart for these to take effect. After this type services.msc in the Start search box and find both Superfetch and Windows Search and use the dropdown menus to set them to disabled.

Finally we can boost the start up time. Type msconfig in the Start search box and in the boot tab tick "No GUI boot" to disable the Windows graphic which will cut a few seconds from your boot time. Also uncheck any unwanted programs in the Startup tab as well.

Now you can brag about the boot speed of your computer!