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The Computer Builder's Guide, Part I

- Picking Parts -

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Here it is - Part I of the Tech Buyer's Guru Step-by-Step PC Builder's Guide! We're not just going to tell you how to build your own computer, we're going to show you.

We purchased an entire system's worth of parts just to illustrate for our readers all the steps and potential pitfalls that come with building a system. By letting you in on our thinking every step of the way, we believe you'll learn a lot about building your own system. Part I of this guide focuses on how to select the right parts to meet your needs while ensuring that they'll work perfectly together.

We're basing this system off of our most recent $500 Home Office PC Builder's Guide, with a few tweaks thrown in just for fun (and a challenge!). The parts list and our explanation for each part is shown below. We're providing links to the manufacturer websites, so you can see the specifications, download drivers, or review support information, and we're also providing links to the stores where we purchased the items. Note that we waited for all the best deals (which is what we recommend you do), so it's unlikely all of the prices listed below are current.

Once you've read how we picked all our parts, head over to Part II of the article, where we step through the building process.

Step 1 - Determing Your Budget

The first thing you need to do as a computer builder is determine the budget within which you are operating. Just as if when you are buying a car, a TV, or a bucket of paint, there are alternatives available at a wide variety of price points, so rather than get overwhelmed with an open-ended budget, it's best to have in mind a general sense of what you want to spend overall. When building a computer, there's a lot of room to tweak certain component choices to meet your particular needs, so even within a given budget, there are a number of different systems we can build.

When selecting the components for this article, we decided we wanted as functional a computer as possible while staying within a $500 budget.

Step 2 - Assessing Your Needs

A computer can allow you to do a lot of things. First there are the basic tasks: surfing the web, checking e-mail, writing a document, or editing photos in a basic photo editor. For these tasks, just about any computer will do, although the user experience will be slightly different, of course, depending on the speed of the system. If you want to do sophisticated photo/video editing or want to play the latest video games, you'll quickly run up against the limits of a system in the $500 range. Thus, you may have to return to Step 1 if you realize you just can't do what you want within your original budget. Maybe that means waiting a few months until you have a bit more money saved up or until prices drop. Keep in mind, though, that prices rarely drop more than about 25% a year for full systems of equivalent performance. So you could be waiting a while if you want a system that will do everything under the sun for $500!

We decided to target this sample build at a user who just wants a basic home office computer that can also serve Home Theater PC duty. We also want something that's quiet, looks good, doesn't take up too much space, and will offer a little room to grow. Read on to find out what we came up with!

Step 3 - Buying the Parts

What you'll see below are the parts we decided on based on a $500 budget and our intended usage pattern. In some cases, the choices were as plain as day, while in other cases, it honestly took us a few days of reviewing specifications and looking at professional and user reviews, when available, to pick the parts we ended up with. This is the same process you might go through (although hopefully you'll use our many Builder's Guides as a reference!), and we think letting you in on our thought process will help you consider your own computing needs.

Processor (CPU):

Intel i3-3220 - purchased at TigerDirect for $99 plus $4 shipping

We wanted a CPU that could run basic tasks very quickly, but that would also have enough horsepower to allow for watching HD videos, running multiple tasks in the background, and maybe even a bit of gaming. At the same time, we wanted something very efficient, because for the average user, power bills may be just as important as raw speed.

For the tasks listed above, we believe Intel has the best solutions right now. While we like some of AMD's budget offerings for midrange gaming machines, we don't think AMD CPUs have the right combination of speed and energy efficiency in everyday tasks. So then it came down to an Intel vs. Intel battle. Interestingly, Intel keeps a pretty strict division between its various processor classes. Dual-cores start around $50, dual-cores with the ability to emulate quad-cores in some tasks usually start at $120, and true quad-cores typically sell for $180 and up. We knew $180 was going to eat through too much of our budget, but we also knew that operating systems and applications are getting better and better at using multiple cores, so we wanted something that wouldn't feel obsolete next year.

We came to the conclusion that there isn't a better all-around CPU for your money right now than the Intel i3-3220. That will change sooner or later, but with a $500 budget, this is the CPU you want. It features two CPU cores running at a fast 3.3GHz, along with Intel's proprietary Hyperthreading technology, which allows each core to work on two threads simultaneously, emulating a quad-core. This allows the i3-3220, to outperform much more power-hungry quad-core CPUs in some cases. It also includes a built-in Intel HD2500 graphics core, allowing it to display all manner of video without issue. It can even play many games comfortably, although for newer games, an add-on graphics card, which we aren't including in the budget, would really be necessary. All this, and it just sips power, using a maximum of 55 Watts under full load. Because it runs so efficiently, the small included Intel heatsink and fan assembly will be just fine for this system.

Motherboard:

ASRock B75 Pro3-M - purchased at Newegg for $70 plus $8 shipping

The three most common size classes for motherboards, from largest to smallest, are ATX (7-slot), Micro ATX (4-slot), and Mini-ITX (1-slot). We knew we wanted a Micro ATX (mATX) motherboard, because it would allow for the use of a slightly smaller case without cutting too much functionality. In fact, there are mATX motherboards that offer just about everything you can get in an ATX board, other than the 3 expansion slots that obviously cannot fit. Overall, mATX is a great compromise.

The ASRock motherboard we chose has a lot of great features for the price, but that doesn't mean it was an easy decision. We considered other great options, like this MSI B75MA-G43 board and this Biostar B75MU3+ board, but when it came down to it, the ASRock B75 Pro3-M was the clear winner in the $70 and under club. It also happens to be ASRock's highest-end B75 board. So what were we looking for, and what did we lose by not going to the slightly pricier H77 line, which is a step up in Intel's chipset hierarchy?

First, we wanted four RAM slots. There's no quicker way to go obsolete than to run out of memory, and knowing that we were going to equip the system with 4GB of RAM, we wanted an easy upgrade path (i.e., one that didn't require throwing 4GB of perfectly good RAM out). Second, we wanted at least six rear USB ports (including two USB 3.0 ports), because the four ports that many budget board come equipped with will run out fast. Finally, we wanted HDMI out. While most boards come with DVI, which provides an equivalent digital signal, for home theater PC use, there simply is no alternative to the incredible ease of use of HDMI, which carries both audio and video signals.

What did we lose by not going with the H77 motherboard line, which starts at about the same price as this B75 model? Not much that was going to matter here. H77 provides a potential for ten rather than eight total USB 2.0 ports (although no boards would use them all anyway), two SATA 6Gps ports rather than one, and both Intel RAID and Intel SSD caching, which are advanced hard drive options that weren't relevant here. ASRock actually one ups most H77 boards with the B75 Pro3-M by adding two additional SATA 6Gps ports, but we assume they aren't quite as fast as the Intel-provided variety. This B75 board, however, also beats all the H77 boards in its price range with its four RAM slots. Note that we didn't seriously consider the Intel Z77 chipset, which is the highest-end consumer-oriented Intel chipset currently available. Its only real advantage is the ability to overclock Intel's >$200 quad-core processors, and we aren't using one of those, so it really came down to B75 versus H77.

ASRock actually goes and does something a little unexpected with the Pro3-M: it equips it with not only a PCIe 3.0 x16 port, which is the latest video card interface, but also an older PCIe 2.0 x4 port, which is an older, slower video card interface, meaning that the board can in theory support dual AMD graphics cards using AMD's Crossfire technology. Don't get your hopes up too high, though - the slower second slot will bottleneck newer cards, and because it's the last slot on the motherboard, most graphics cards would overhang the board, and in turn not fit in a mATX case. You'd need a larger ATX card to mount a dual-slot graphics card (which most Crossfire-capable cards are).

Note that as with most motherboards, several SATA cables are included. This board comes with two, which happens to be just the number we need for a single hard drive and a single optical drive. Keep in mind that more expensive motherboards tend to include more SATA cables, but you should always check to see whether you'll need to buy extras.

Memory (RAM):

G.Skill Ripjaws Series 2x2GB DDR3-1866 - purchased at Newegg for $38 shipped*

Ok, we admit, we actually bought this RAM a while ago, and used it in a previous system. But that's the beauty of building your own computer - you really can re-use some of your parts, giving them a much longer lifespan than they'd have in a pre-built system that has proprietary components or that can't be disassembled easily.

This particular RAM set has an aggressive operating frequency of DDR3-1866. Luckily, it will be more than capable of running at the DDR3-1600 level that we view as ideal for this system, but we'll also see if we can run it at the full DDR3-1866 speed.

With two 2GB sticks, totaling 4GB, this kit is more than sufficient for most common desktop computer activities, and while we'd ideally have 8GB, the recent increase in RAM prices means it's not quite as obvious a choice. To avoid "planned obsolescence," we picked a motherboard with four memory slots to allow easy upgrades, as mentioned above, which cost perhaps an extra $5. Well worth it in our book.

*Note that because the particular RAM kit used for this build is no longer available, we are providing a link to a very similar kit currently available for purchase.

Hard Drive:

Samsung Spinpoint F3 HD502HJ - purchased at Newegg for $50 shipped

Here's another component salvaged from one of our previous systems, but like the RAM, this is a fantastic product - in fact, many users lamented Samsung's exit from the hard drive market, as Samsung's drives really dominated the price-performance curve for a long time. This 500GB model has a single platter, meaning it only has one spinning disk inside. That means it's relatively quick (due to its high data-density), incredibly quiet (fewer moving parts), and above all, runs extremely cool (for the same reason). It spins at 7200RPM, as do most midrange performance drives, but only has 16MB of cache, which is a bit lower than the best drives out there. That may affect its responsiveness ever so slightly. For reference, a comparable drive would be Seagate's 500GB Barracuda.

Now, given that we're targeting the $500 build pricepoint, we have decided to forgo a solid-state drive (SSD). An SSD would dramatically decrease boot and application load times, but it would also increase our budget by about 20%, while adding a bit of complexity to the hardware and software setup. To learn more about SSDs installation and usage, see our SSD Guide.

Of note, the current sweet spot for capacity per dollar is at the 1000GB (1TB) level, but for most users, that amount of space just isn't necessary, so we save a few dollars by going with 500GB.

Case:

Zalman ZM-T2 Micro ATX Mini Tower - purchased at Newegg for $40 shipped - $10 rebate

We actually think picking a computer case is the most difficult step in selecting the components for a system. It's the part you'll see everyday, which needs to both fit your style and serve your particular needs, and there are *a lot* of choices out there.

So we looked long and hard for the right case for this build. The case we eventually chose, the Zalman ZM-T2, was so new that when we found it on Newegg, it was listed incorrectly as a full-size ATX case. And that's an important point, because plenty of buyers could have purchased it and then found that their ATX motherboards wouldn't fit! Pitfall #1: vendor error! We helped Newegg out by letting them know that the ZM-T2 is in fact a Micro ATX case. It always pays to do a bit of research before buying!

Back on point, we think for 99% of users out there, the mATX form factor is ideal. Four expansion slots is plenty, and mATX allows computer builders to use much smaller cases, since by design, they should be at least 2.4" shorter. That's because the mATX form factor has a maximum motherboard size of 9.6" tall and 9.6" wide, while ATX is 12" tall and 9.6" wide. Knowing that mATX users probably don't have a need to install a large number of internal components, the case manufacturers ideally can cut space elsewhere. In addition, because mATX motherboards are less complicated than ATX motherboards, they usually don't even extend to the full 9.6" width specification. Note, however, that every case manufacturer offering a mATX case should design its cases to accommodate the full 9.6" x 9.6" specification for mATX motherboards, and to test that, we've purchased just such a motherboard. You'll soon see how that worked out!

So, why did we choose the Zalman ZM-T2? It came down to the following reasons:

(1) *Price* - at $30 after rebate, you simply won't find many mATX cases from a name brand for less. Zalman is a highly-respected manufacturer of PC cooling components, so they know computers.
(2) *Size* - this is where we wanted to avoid another potential pitfall - mATX cases that aren't much smaller than ATX cases. What's the point in buying smaller or fewer components if the case is still a monostrosity on your desk? At 16.73" tall by 13.7" deep by 6.65" wide, this case has an incredibly small footprint. While its height is just a few inches shy of the typical ATX case, it's footprint is similar to some Mini-ITX shoebox-style cases. We like that! In most desktop environments, it's the width and depth that cause the most space constraint issues.
(3) *Style and Features* - we wanted a cheap case, but we didn't want it to look cheap. Zalman's slightly cheaper ZM-T1 just didn't look that snazzy, although it had all the same features. The ZM-T2, with its smooth, glossy front fascia, seemed like it might have the right look for our build. That and the front and top fan mounts were what sold us. Decide for yourself how we did when you see the finished system pictures!
(4) *Ease of Use* - it seemed that Zalman put a lot of effort into making the ZM-T2 easy to build and use, particularly with its unusual hard drive mount and cutout for video cards. You'll soon see if our hunch was correct!

That doesn't mean the ZM-T2 has it all. Here's what we knew that we were giving up from the start:

(1) *Front USB 3.0 Ports* - at this price point, it's really hard to get USB 3.0 ports, and knowing that our motherboard would still have rear USB 3.0 ports, we passed on spending more to get them. USB 3.0 is honestly 5x as fast as USB 2.0 based on our in-house testing, but for most uses of front USB ports (plugging in a camera, thumb drive, or smartphones), those transfer speeds just aren't necessary, particularly considering most devices are still using the USB 2.0 protocol.
(2) *An Even Smaller Form Factor* - there are some cases that really make a game of pushing mATX to its smallest extremes. That's cool, but it usually comes with two drawbacks: cost and ease of use.

Did we give up anything else? You'll see in Part II of this builder's guide!

Power Supply:

Corsair CX430M - purchased at Newegg for $50 shipped - $20 rebate

When this model became available, we knew we had to have it. Modular power supplies, like this one, allow the user to remove unused power cables, make building a system so much easier. There's nothing more frustrating that a mess of cables in your system (well, other than a bluescreen, maybe!). But modular power supplies have historically been much more expensive than their non-modular cousins. Enter Corsair, which is selling the Corsair CX430M, with an ample 430W of power and removable cables, for under $50. That's a clear win in our book. With enough power to support midrange graphics cards for gaming, four SATA drives, as well as older peripherals, it was a perfect fit for our system.

The beauty of the design is that you, the user, get to pick which cables you need. Corsair supplies more cables than you can actually connect to the unit, but that's just fine with us - many of the cables are based on older tech, and you don't need those cables hogging up space in your system.

Welcome to low-cost power supply Nirvana...or so we think!

Optical Drive: **LG 24x DVD Burner Model GH24NS95 - purchased at Newegg for $15 shipped**

DVD burners are a dime a dozen (well, practically), and we have to admit that we bought this LG model because it was the cheapest available at the time. It didn't hurt that it had stellar user reviews on Newegg, though. Generally, we tend to prefer LG, Samsung, or Lite-On drives, so we were comfortable getting this inexpensive drive. As a bonus, it offers something called M-Disc, which uses media that purportedly is more durable. We have no idea if that's true, and honestly, we aren't going to test it!

Note that while most users don't use optical drives every day, we think that they are immensely useful once in a while - to install drivers, burn or rip music CDs, or to share photos with friends and family. Since they're so cheap, we see no reason to risk not having one when you need it, unless you're building a really small computer, which we aren't here.

Operating System (OS): **Windows 8 64-Bit Full Version (OEM) - purchased at Newegg for $80 shipped**

Windows 8 isn't perfect. Many people might actually like to stick with the more familiar (and time-tested) Windows 7. But time marches on, and Windows 8 is the more modern operating system. It's a bit quicker, a bit more secure, and it even uses a bit less power to run. While the touch-inspired interface design doesn't translate perfectly to a desktop using an old-fashioned keyboard and mouse, the concept of a desktop that actually has something on it other than a recycling bin makes a lot of sense!

Financial data suggests Windows 8 sales have been a bit of a bust for Microsoft, and rumor has it that Windows 8.1 is just around the corner. Coincidence? Whatever the reason, Windows 8.1 will offer some refinements meant to bring the desktop user experience back to the level of Windows 7, while keeping the great features of Windows 8. So jumping on the Windows 8 bandwagon now probably makes sense.

Total Cost: $454 - $30 in rebates

Note that while the prices for the components above were slightly below average market prices, overall, a system similar to the one here should cost less than $500.

To see how this build turned out, check out Part II!

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