To Build or Not to Build

*If that is the question, this may help.*

By Gary Randolph 10/07

Building a computer can be fun, educational, and cost-effective. But it’s not for everyone. If you are impatient, clumsy or the last person kids ask to put their toys together, you probably want to buy a prebuilt computer. On the other hand, if you are a curious, reasonably technical person who enjoys puzzles, then you can build a better computer than you can buy for the same money. This is a good place to state that I am not responsible for anything you do with this information.

Prebuilt computers from the major suppliers often come with bundles of preinstalled software that you do not want. That software drags down the performance of your computer and is difficult to delete entirely. On the hardware side, you know the type of processors, memory and monitor you are getting from the big manufacturers, but what do you know about the power supply, the case, internal temperatures, workmanship or expandability?

I’ll take you on a tour of my latest build so you can decide for yourself if it’s something you want to try.

**Getting Started**

Part of the fun of designing a computer involves researching the current state of processor technology. There are plenty of online resources and magazines that can help you understand how Intel and AMD are competing with each other to lead today’s technology.

http://www.newegg.com/Product/CategoryIntelligenceArticle.aspx?articleId=219#topic2
http://www.newegg.com/ProductSort/CategoryIntelligence.asp?Subcategory=343

The processor does not work by itself and must be accompanied by a compatible chipset. This chipset provides interfaces between the processor, memory, graphics, BIOS, integrated networking and more. Luckily, the chipset is already installed on the motherboard (mobo) so there is very little you need to know about these interfaces. The motherboard is the large circuit board that holds the main processor(s). It is the heart of your computer. I will let you enjoy learning about all of this and more – like northbridge, southbridge, and FSB – on your own. You need only understand the basics of these things but the more you know, the more you know.
The Components I Chose
My decisions were based on my budget and my needs. Yours may be very different. I wanted a machine that would make for a good software development environment. I’m not a big gamer, but I certainly like nice graphics. I’m not interested in lots of neon lights. I do like a quiet machine.

Processor
I chose an Intel Q6600, which is a Core 2 Quad processor. I considered Intel’s E6850, but the quad core won out since large programs like Photoshop benefit greatly from the additional cores. I also expect future programs and compilers to make better use of multiple cores. The price of the Q6600 is now reasonable, and I am happy with the result.

Motherboard (mobo)
I looked at several motherboards that support the Q6600. The following review was informative (http://www.cdrinfo.com/Sections/Reviews/Specific.aspx?ArticleId=21278&PageId=0). My initial decision was to go with the Gigabyte GA-P35C-S3 because it has slots for both DDR2 and DDR3 memory. But I finally decided that by the time DDR3 memory prices drop to a point that makes them a better value than DDR2-1066, I would probably upgrade my mobo anyway. So I finally chose a motherboard that was not reviewed in the above article. I chose Abit’s IP35 Pro. The IP35 Pro mobo does not have LPT or COM ports, which is fine by me since that is old technology. The board provides plenty of USB, Firewire, and eSATA connections for my needs. This board (Actually, the socket and P35) should allow me to upgrade to Intel’s future (45 and 32nm) processors. Here is an excellent review of the IP35 Pro mobo: http://www.xbitlabs.com/articles/mainboards/display/abit-ip35-pro.html

Case
I chose an Antec P182 case (http://www.hi-techreviews.com/reviews_2007/Antec182/P.htm). It’s an ATX mid-tower, which means it is made to hold today’s standard ATX motherboards. It has three 120mm fans. I dislike 80mm fans because of the noisy high-rpm and low volume air movement. The power supply (PSU) is placed at the bottom of this case. I like the design, but I will need a PSU with sufficiently long cables – that turns out to be no problem.

PSU
The Corsair 620 Watt power supply has sufficiently long cables. Furthermore, it provides modular cabling. Modular cabling means that I can plug into the power supply only those cables that I need. Non-modular power supplies have all cables permanently attached to the PSU, so any cables you don’t use will still take up space in the case. These unused cables often interfere with the proper air-flow needed to cool the system. The efficiency of this PSU is greater than 80%. Why do I care? Because it means that at least 80% of the energy in will be useful, while the remaining 10 to 20% is in the form of heat.

Graphics Card
The choice between Nvidia and ATI is not an easy one. At the high end, I believe ATI is the leader, but bang for the buck right now lead me to choose the EVGA GeForce 8600GTS 512MB 128bit GDDR3 PCI Express HDCP Video Card. I’m not interested (yet) in either Crossfire or Lsi, so this single-card Nvidia solution is perfect for me now.

CPU Cooler
I could have gone with the stock cooler that comes with the CPU – it’s a good one. My preference, however, was to go with a high quality copper cooler from Zalman. It works great and looks really cool with the Abit mobo. I don’t like the fact that it is heavier than what Intel wants this socket type to support, but I understand the ramifications (primarily, that I should move it gently – no problem.) I do not believe it will warp my cool-running mobo, but time will tell.
While researching the components that I eventually chose for this build, I read many articles, reviews and customer comments. About customer comments; take them with a grain of salt. The IQs of those who decide to build their own computer range from near nil to beyond genius. Weak minds tend to be very vocal. No matter what components you choose, someone has written a review stating that each of those components is an evil piece of garbage. Of course there are always valid complaints from intelligent people, so you have to decide for yourself which complaints ring true.

There are many vendors from which you can buy your components. Competition is a good thing. You can research the various vendors for yourself, but my purchases were from two very reputable companies – Newegg and ClubIT. Both did a good job packaging and shipping the correct components. I did save a bunch of money by shopping at both. ClubIT uses FedEx while Newegg uses UPS for shipping. My UPS experience is more pleasant than my FedEx experience, for what that’s worth. I would buy from either vendor again. I bought my CPU from ClubIT because they guaranteed that I would get a processor with G0 (gee-zero) stepping. Newegg said that I might get G0 stepping or B3 stepping. By the way, you don’t need to care what ‘stepping’ means – the bottom line is that B3 and G0 are versions of the same processor. G0 came after B3 and it has a better temperature specification. (It is likely that all the older B3 versions are gone by now, but who knows?)

Computer components really don’t like static electricity. If you are statically charged, they won’t like you either. Get a wrist strap and keep yourself and your components at the same electric potential. As your components begin to arrive at your home, the child in you will want to rip the package open and touch your cool new toy. I recommend opening the package so that you can read the owner’s manual, but leave the component in its packaging until you have everything in place and you are ready to build. Can’t resist? You can play with the case if you like.

Figure 1. The stapler and anything else not necessary were removed from the desk before beginning the build. As components arrived and installation progressed, I placed every receipt in this envelope. The bar codes I cut from boxes also went into this envelope. This is a very useful way to ensure you have what you need when applying for rebates!
Figure 2. Any accompanying CD/DVDs were placed in the tray at the top right of my desk. That way, I won’t step on or misplace the CD/DVDs.

Figure 3. My wrist strap is between my old-man glasses and the box containing the CPU. I will place everything except what I am working on next to the desk and then begin installing one component at a time. The cabling you see in the middle of the case connects the mobo to the front lights, audio, USB and firewire ports that come with the case. Those cables are labeled appropriately and they plug into their corresponding (labeled) pins on the mobo.
Figure 4.
I begin with installation of the PSU because I want to check the length of cables. I am removing the PSU cage as instructed by the Antec user’s manual. I prefer to use a nut-driver (1/4”) rather than a phillips-head when I can. Note the wrist strap.

Figure 5.
The cage fits perfectly snug around the PSU when the top of the cage is pressed down firmly.
Figure 6
The PSU is installed. The cables shown are permanently attached to the PSU. All other cables can be plugged into the PSU as needed. There will be no problem with cable length – that’s nice.

Figure 7.
The front lower cage is pulled out. This is where the hard drive (HDD) goes. My new SATA drive will go in here. So will the older 40G HDD from my previous computer. That makes it easy to save everything I need from my old drive to the new drive before I reformat the old one and install Linux.
Figure 8.
I love the HDD cage. The silicone grommets reduce vibration and keep everything quiet. The screw going through the grommet to the HDD came with the Antec case. I am installing the bottom screws at this point – you can tell this is the bottom because the round latch on the right falls away from its black plastic retaining latch.

Figure 9.
The top front cage is used to hold the optical drive. I carefully punched out the lower slot cover – actually, I rotated it around its horizontal axis until it fell off.

By using the lowest slot, I will be able to use a single SATA power cable to power the optical drive and the SATA HDD that I just installed in the lower cage. Sweet!
Figure 10.
The Antec case includes mounting brackets for optical drives. I have screwed a bracket onto the side of the CD/DVD reader-writer. I initially installed these brackets backwards (silver clip at the rear of the optical drive). That’s an easy mistake to make because of the direction of similar clips in the front middle cage. (See Figure 11.)

Figure 11.
The maroon arrows point to mounting bracket locations. The red cables are the SATA data cables that come with the mobo. The yellow arrows point to standouts – threaded spacers on which the mobo will be mounted.
Figure 12.
The IP35 Pro sitting on the statically shielded bag that contained it. This is a perfect time to examine the mobo layout. The upper right aluminum boxes contain the ports/connections that will be exposed at the back of the computer. So now I know how the board will be oriented in the case.

Figure 13.
This is the socket that will hold the Core 2 Quad processor. Press down and left to free the retaining clip.
Figure 14.
I will save this protective cover plate. If I later need to send the mobo in for repair, I will remove the processor and put this plate back in place. Don’t even think about touching the delicate circuitry that is now exposed!

Figure 15.
The processor is held in a small pocket on the side of the container.
Figure 16. Carefully remove the processor by holding it by its edges or corners.

Figure 17. The processor comes with a protective plastic cover that is carefully removed from the CPU.
Figure 18. The CPU is now in its socket. It is critical that you ensure the CPU is inserted with proper orientation. Read the owner’s manual!

Figure 19. The retaining clip in its final (original) closed position.
The copper Zalman cooling fan has been correctly installed on the CPU.
The most important thing to remember when installing a CPU cooler is to use a minimum amount of thermal paste between the CPU and the cooler.

The case already had the proper standouts in place (Figure 12), so installing the mobo was just a matter of replacing the case’s I/O shield with the one that came with the mobo, and then screwing the mobo into place with the screws that came with the case (they don’t come with the mobo). I don’t know why case manufacturers supply an I/O shield – nobody uses it. BTW, the I/O shield is that thin piece of aluminum that is stamped out to fit the I/O ports of the mobo. Its purpose is to electrically bond the surfaces of the ports to the case.

The graphics card has also been inserted into the correct PCI-E slot (yellow arrow).
Figure 22.
This space behind the mobo makes for much neater cable management. Several cables going through this side keep the front side of the mobo open for proper air cooling. It was not difficult to lay the cables flat against the case so that installing the cover did not pinch or press excessively on the cables. Once the cables were positioned correctly, there was no bulging of the side cover.

Figure 23.
Many builders remove this bottom fan because they worry that cables will contact fan blades. I did not find it to be a problem. The approximate plane of the fan is illustrated by the yellow line. There is just enough room at the power supply that I was able to plug in the modular cables as I needed them (and I have big hands.) The far PSU cables appear to invade the fan space, but they don’t. They are to the far side of the fan housing.
Figure 24.
The final assembly shows the cool blue light on the CPU fan (I didn’t expect that) and the POST status (FF) indicator. POST stands for Power On Self Test. You will hear people say that their system POSTed on first try. They are proud that all of the cables and connections were done right the first time, and they are happy that nothing fried. This system POSTed on first try. Note how the cables lay flat so they don’t interfere with air flow.

Figure 25.
Pressing the Del key upon power up brings you into the Abit install utility. It’s an excellent time to check temperatures and voltages. These are the temperatures after the case is completely assembled and the system has been running for two hours. Note that the readings are well below the warning/shutdown temps – and that’s with all of the fans set to low.
Figure 26.
All of the voltages are nice and tight. Don’t be cheap when it comes to the PSU. Quality matters.

Figure 27.
To the right of the CPU cooler you can see the 4G of Corsair DDR2 800 memory. (Previous pictures just showed 2G because the other 2G were shipped FedEx overnight, but arrived a day late.) All’s well that ends well.
Another feature I like about the Antec case is removable air filters. Just push on the right side of the vent inlet and it pops open to let you remove the filter.

The filters are washable.
Finally, I installed a 64-bit version of Windows Vista Ultimate. I had to press the ‘enter’ key a couple of times, but that’s it. The install took care of itself. I didn’t have to hunt down any 64-bit drivers. I did insert the video card CD after Vista was up and running so the video card could get what it needed. My Vista performance numbers are 5.9 (the top end of the scale) except for a 5.6 for the graphics, HDD, and memory speeds. That’s just what I expected – the 10-15K RPM HDD, DDR3, and dual graphics cards that would produce a 5.9 in those categories are not worth the price (to me).

Figure 32.
My Vista desktop after a clean OEM install. Startup and shutdown are significantly quicker than they were with my XP system – perhaps because I don’t have any of the extraneous software that comes preinstalled by the major manufacturers.
There was only one minor glitch (me). Since the default drivers provided by Vista worked so well, I didn’t bother installing the drivers that came with the mobo. Well, it turns out that the uGuru utility needs those drivers. uGuru (microGuru) is an Abit utility that monitors and allows adjustment of fans, overclocking, voltages and temperatures. I really like it. (If you have used Speedfan before, this is a polished version of that.)

Total cost of system: $1300.
Fun derived from building my own computer: priceless.

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