

The Build Your Own Computer Saga

by Len Nasman, September, 2011

A number of people have asked about the process of building your own computer. To keep up to date with both hardware and software (Windows 7), Daryl Fourman and I decided it was time to collect parts and assemble two new machines, one for Daryl, and the other to serve as the BVCC multimedia editing station.



The first step is to gather the necessary parts. We started by selecting a processor (or CPU). There are basically two lines of processors to choose from, Intel and AMD. (Computer geeks like to argue the relative merits of the two companies.) In this case, an AMD 6 core 64 bit processor was selected. The demands of computer software, especially when graphics, sound, and video editing are involved, require more CPU power.

Once the processor has been determined, a motherboard has to be selected. Since motherboards have specific sockets for mounting the CPU, you have to be careful to get a motherboard that supports the selected processor.

Motherboards come with a variety of options. In this case, one was selected that had built in Ethernet, sound, and graphics. Some motherboards require the addition of separate add-on cards for sound, or video/graphics, or Ethernet connections. Many external devices require USB ports, so the more USB ports the better. Also, there are now different versions of USB devices so it is worth checking what level of USB a motherboard supports. For many years hard drives (called EDIE or PATA drives) were connected with 40 wire ribbon cables. However the current standard is SATA drives that use a different style of cable. Other motherboard considerations are the type, amount, and speed of RAM (Random Access Memory) the board is designed for. Also, hard drives can transmit data at different speeds and it is desirable to match the motherboard SATA connector and hard drive speeds. For this project, a transfer speed of 6GB/sec was selected.



Of course these parts have to be installed in a case. a mid-tower case was selected that has room for lots of disk drives. Every case manufacture seems to try and come up with their own unique system for mounting drives. For a long time most cases required that drives be mounted with screws, The case selected for this project uses a screw-less twist-lock system. Other case selection considerations include the number and locations of external connectors, and options for mounting cooling fans.



Computer cases usually come with several bags of hardware for mounting the motherboard and other components. There is quite a bit of variety in case selection. Consideration

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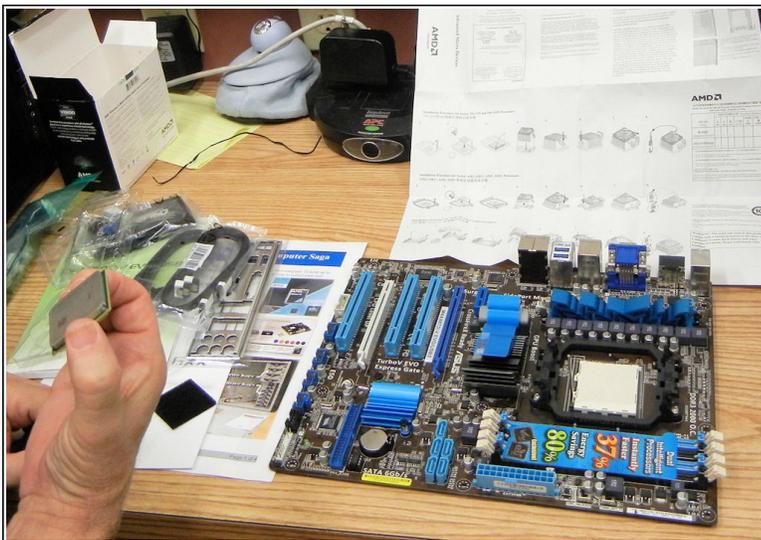
needs to be given to how many external and internal drives the case can hold, and whether there will be adequate cooling. Another consideration is the availability of front USB and audio connections. Some cases may come with connectors for memory cards (from digital cameras) but add-on memory card connectors are relatively inexpensive.

In the case photo here, you can see a main case fan on the rear of the case. The hole in the back of this case shows that it came without a power supply. Some cases include a power supply, however, there are a lot of sizes and varieties of power supplies to choose from so some prefer to choose their own power supply.



The assembly project starts with mounting the processor onto the motherboard. Installing the processor is a delicate step since dozens of tiny wires have to be aligned properly with the socket. Once the processor is in the socket, a clamping lever (part of the socket assembly) is adjusted to lock the processor contacts to the motherboard. Next, the cooling fan assembly is placed on the processor. A thin coating of contact grease is placed between the processor and fan assembly to assure that heat from the processor is conducted to the cooling fins.

A locking lever on the fan assembly insures a good thermal connection between the CPU and the heat sink. This is a tricky step. The locking lever has a loops that have to be aligned over tabs on both sides of the assembly before the locking lever can be pushed into place. If the heat sink does not maintain good contact with the CPU surface, it will overheat and possibly burn up.



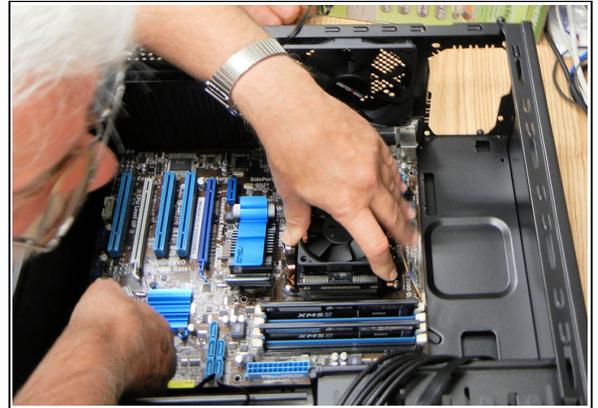
Installing the processor on the motherboard.

The computer memory strips on the motherboard shown (RAM) fit into the green connectors (behind the fan in the picture on the right). This particular motherboard has 4 RAM connectors,

two green and two black. If not all connectors are used, the board instructions show which connectors to use first. RAM chips come in different speeds and sizes. In this project it was decided to use 2 - 4GB RAM strips for a total of 8GB.

The case hardware includes threaded brass posts that are installed to match the hole pattern in the motherboard. These posts provide space between the motherboard and the case and prevent any unwanted electrical connections (or short circuits) between the metal case and motherboard components.

Since different motherboards have different mounting hole arrangements, the board is checked to insure the posts are properly positioned. Also, the rear of the motherboard has a number of connectors for video, sound, Ethernet, and more. Motherboards come with custom cover plates for the case to accommodate these connectors.



Once the posts and connector cover are in place, the motherboard can be installed.

In this project 2 DVD drives and a memory card reader were added to the computer. (Two DVD drives provide for faster DVD copying.) These are exposed on the front of the case. The DVD drives fit into 5 inch drive slot and the card reader can fit into a 3.5 inch slot, or can be adapted to fit in a 5 inch slots. Computer cases come with knock-out covers that can be removed to allow for installing components that will stick through the front case cover.



This case has extra USB and audio ports near the top front of the case. These connectors are located in different places on different cases, and are a consideration when selecting a case.

The power supply is installed, followed by the internal hard drives.

At this point, there are a lot of wires to connect. Large connectors carry power to the motherboard. There are a number of wires from the front of the case to the motherboard. These are for the power switch, hard drive light, reset switch, and front USB and audio connectors.

There are additional wires for the front card reader. Some of this wiring is a bit tricky. The best systems will have easy to read labels and connection diagrams. Getting connectors on to the proper pins requires a bit of manual dexterity. This might be the hardest part of the assembly.

Each SATA drive (both DVD and hard drives) has cables for power and data.

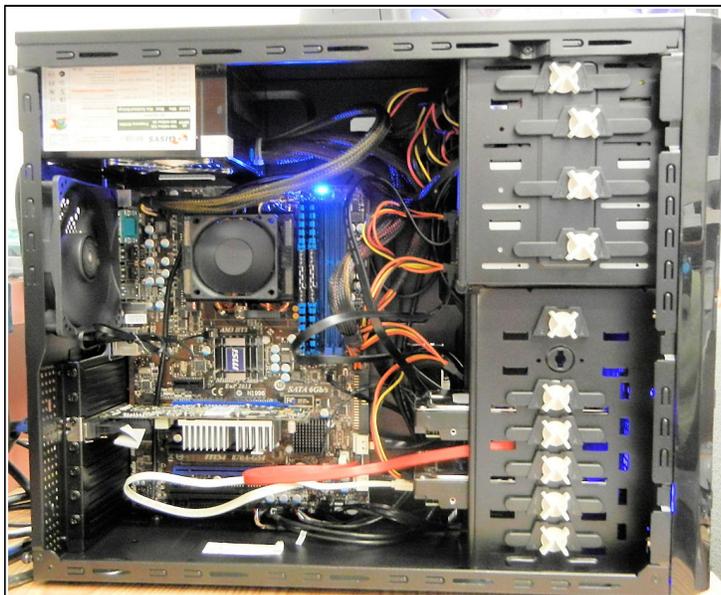


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This particular installation has 4 fans. There is one built-in to the power supply. There is a fan on the CPU that has a special power connector on the motherboard. There is a fan on the back of the case and one on the front of the case that also have connectors on the motherboard.

Once all of the connections have been made and double checked, the computer is ready for installing software.

The external computer connections to the monitor, keyboard, mouse, Ethernet, sound, and power. At this point, there is no software on the hard drive. Windows 7 is to be installed, but it lives on a DVD.



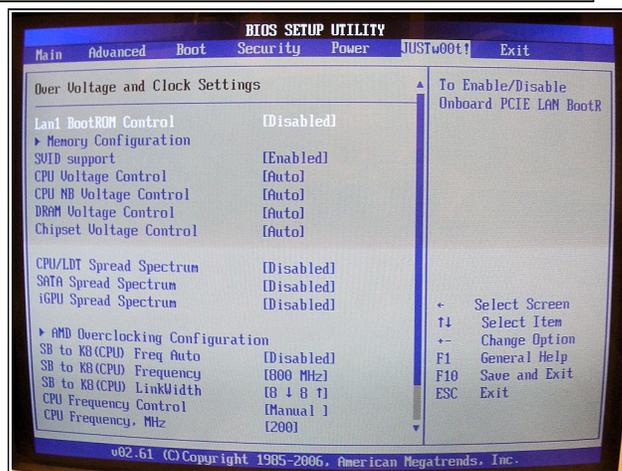
The trick is to have the computer boot (start) first from the DVD before it goes to the hard drive. This requires a setting in BIOS (Basic Input Output System).

Oops! Murphy was an optimist. Daryl and I had two nearly identical computers to build, and his was first. When we turned on the power, nothing happened. We checked and double and triple checked all of the connectors. After a bit of hair pulling, we decided to try the second motherboard to see if that was the problem. The motherboards were switched and the computer started right up. The first motherboard was set aside for return to the store. (BTW, I have installed a couple of dozen different motherboards and this is the first DOA board I have had.)

If you look at the monitor when a computer is first turned on, you will see a message that reads something like 'press Del for setup.' (Sometimes the F2 key or another key is used.)

The power switch was turned on and the appropriate key was pressed to enter the BIOS setup.

The BIOS setup utility has a row of menu options that are accessed using the keyboard cursor control keys. The boot menu in BIOS has options for setting the boot device order. The right side of this BIOS display typically has instructions on how to set the different options.



Once the boot order has been set to boot first from the DVD drive, and after an original Windows 7 disk is in the drive, the BIOS **Exit and save changes** option is selected. Now the computer will automatically start the Windows 7 install routine. At that point, the system will prompt the user for the desired Windows settings such as region, language, time zone etc.

After Windows installs itself on the hard drive, the DVD is removed and the system is restarted from the hard drive. In many cases, Windows will automatically detect the system components and automatically install the required device drivers. (Drivers are little computer programs that run during start up process and teach the system how to use devices.) In most cases, the motherboard supplier will provide installation discs that have to be used to install required software.

Here comes Murphy again. The Daryl machine ran, but did not run faithfully. When it was restarted sometimes Windows would go through some kind of restore routine. So, the troubleshooting process was begun. We tried changing out the processor. (Remember, we had two nearly identical sets of computer parts.) No improvement. We tried swapping RAM modules. No improvement. Since we had to return the first motherboard to the store, we decided to replace both motherboards with a different brand.

At first, the new motherboard seemed to work OK. But as additional software and devices were installed, the intermittent trouble returned. There were 4 possible suspects... motherboard, memory, processor, and power supply. Everything was tried except the power supply. A new power supply was installed and all was well.



Once everything is working properly, the case covers can be installed and the assembly project is complete. But... we're not quite done. The first step is to run the Windows update program. Even though Windows 7 is a fairly new operating system, there have been changes and additions since the DVD was made. Some of these updates are for removing malicious software and should not be ignored.

Once Windows has been updated, the desired applications software (like LibreOffice, Acrobat Reader, and other software) can be installed. Then we can sit back, explore Windows 7 features, and enjoy the newer faster machine.

