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Starting From Scratch

Building a PC for DAW use from the motherboard up is easier than you think—and can be more reliable and cheaper than a pre-assembled system.

by Tony Thomas

While you can buy an off-the-shelf PC and use it as a DAW, it is a far better idea to design your DAW from the ground up. Why? You'll end up with a machine that is better suited to the task of recording and processing digital audio.

The typical name brand PCs that you'll find on the shelf at superstores and department stores are crafted for the masses. While they may look sleek and powerful in the showroom, you really have no idea about the quality of the components inside the box. As a result, it may be a great machine for gamers but a mediocre one for audio. That doesn't mean that you can't use your DAW for other tasks. In fact, it is possible to build a DAW that will work beautifully for audio production and handle routine computer tasks like word processing, managing your finances, connecting to the 'net and even blasting strange looking creatures by night.

Questions...Questions

You may ask yourself, why even bother with a DAW at all? After all, there are plenty of other tools out there for digital audio recording. While that is true, a DAW can be a totally integrated solution, encompassing digital I/O, non-destructive and non-linear editing, sample-level waveform manipulation, multitrack recording and mixing, complex audio processing, sampling and a MIDI sound source. If you add up the prices for all the components that can be easily replaced by a properly outfitted PC, you may find yourself hundreds and maybe even thousands of dollars ahead.

How about using your existing computer as a DAW? While that is certainly a possibility, you'll need to take a good, hard look at your present system. Is it of recent vintage? The newer the system, the greater the possibility that it will have the processor speed and disk subsystem necessary to keep up with the latest audio software. What kind of motherboard does it have and how expandable is it? This is an important question since many name brand systems use proprietary motherboards with built-in video cards, modems and sound cards. As a result, they are not good candidates for such an application since it is difficult and sometimes even impossible to disable these built-ins. And even if you can, there are often not enough free slots to accomodate any cards that you'll need to add to make it function as a DAW.

DAW Essentials

What kind of system do you need for a DAW? Let's start with a motherboard. The motherboard is really the heart of any computer system since it determines the maximum speed the CPU can operate at, the speed that it can communicate with system memory and peripherals plugged into it, and the expandability of the system based upon the quantity and type of expansion slots which are available. I recommend starting with a quality motherboard, one without any built-in soundcards (which seem to be popular these days for some reason). Manufacturers that I have had good experiences with include Abit, Asus, Tyan and Supermicro.

The second thing to look at is the CPU (short for central processing unit-the real brain of the computer). While you could build a pretty basic DAW with a fast 486, the latest programs generally require a 64-bit processor like the Intel Pentium or AMD K6 with a speed of 166 MHz or greater.

If you plan to use audio programs that employ Direct X plug-ins (computer programs that perform the tasks of hardware processing devices like reverbs and delays), then the faster the CPU—and just as importantly—the speed of its FPU, (floating point unit—a special processor inside the CPU that handles floating point calculations that are employed by plug-ins) the more effects you will be able to run.

A decent low-end DAW can be built with a Intel Celeron 366 MHz or AMD K6 II 400 MHz processor. The Intel CPU would have an advantage for plug-in users due to its faster FPU. A high-end system would employ a Intel Pentium III 550 MHz or an AMD K6 III 450 MHz CPU. Again, the Intel CPU would have the FPU edge.

As far as memory goes, the more you install, the better off you'll be. 64 MB is fairly standard these days and 128 MB is even better since it will allow you to run several programs at once quite easily and give open programs more "room" to work with. While you can use any amount between 32 MB and 256 MB for Windows 95 and Windows 98, 128 MB is the practical minimum if you plan on using Windows NT (though there are few audio packages that support NT at present).

The hard disk subsystem is also critical to any DAW as it will determine the number of simultaneous audio tracks your system can record. While just about any recent EIDE (short for Enhanced Integrated Drive Electronics) hard drive will probably work for DAW applications, an Ultra IDE (sometimes called Ulta DMA) drive which transfers data at twice the speed of regular EIDE is much better. A hard drive with a faster rotational speed (7200 RPM vs 5400 RPM) and lower access time (8 ms vs. 11 ms) is also indicative of a better drive for DAW work.

Look for a drive that does not perform thermal recalibration (T-Cal) while it is operating. T-Cal can produce glitches in audio track at inopportune times and should be avoided. SCSI (Small Computer System Interface) drives have been the mainstay for professional audio, video and networking systems for years and are considered by some to be the "gold standard", especially when audio/video (or A/V) rated drives are employed. The advantages of SCSI are that more drives can be supported (8 or more vs. 4 for EIDE) and that extremely large drive capacities are available. The downside is higher drive cost, the need for an expensive SCSI controller and greater installation complexity (due to the different types of SCSI drives available and the specialized cable configurations required). In contrast, EIDE and UIDE drives are more or less "plug 'n play" since the drive controller is built into the motherboard.

I recommend two hard drives in any DAW—one to hold your applications and one just for data. A 4.3 GB or smaller drive will work fine as a program drive and a 4.3 to 12 GB drive is fine as a data drive. Of course, remember you'll need about 5 MB per track-minute of audio plus room for temporary or "scratch" files generated by any audio application, so it is far better to err on the side of a larger drive.

As far as the video subsystem goes, you can get away with just about any video card that supports the resolution of your monitor. Accelerated cards are essential if you plan to do any video playback (for scoring or syncing audio to video), A/V work or plan on playing 3D games.

Build it Yourself or Build to Order?

When I build or upgrade computers, I start with something called a "bare system". In the past, a bare system included only the most basic of system components: the motherboard, CPU, cooling fan, floppy disk drive and case. These days, many computer dealers also include system memory, hard drives and video cards in their bare systems. So, all you need to complete the system is the audio card(s) and any other cards or peripherals you want to add. Of course, you can choose to have the integrator configure the entire system, but you'll have more control if you start with a bare system and select every component from the available options.

There are three important reasons for starting with a bare system. First of all, you don't have to deal with putting the motherboard and floppy in the case, installing the CPU, setting jumpers and dealing with a bunch of wires going to lights and switches. I've done all of that before and it is tedious and nerve wracking if you don't do it very often. Secondly, most reputable computer dealers will do a complete test and "burn in" of a bare system to make sure everything works properly and also to diminish the possibility that a system component may suffer from "infant mortality". You can usually get a better warranty on a bare system since it is thoroughly tested by the dealer before delivery. Thirdly, it allows me to specify every item in the bill of materials to make sure it is exactly what I want. Thus, there is little chance that I will get something that I don't want or need inside the system.

You can also buy a "build to order" system from a superstore or mail order company which offers many of the benefits of a bare system plus some advantages. They will build the system to your exact specifications and even add a monitor, software and extended warranty. The one thing that you are not likely to find with such a system is an audio card with the specs required to support a decent DAW. If you decide to go the "build to order" route, make sure you get a bill of materials specifying the list of components that will be used at the time you order your system.

Deal the Cards

A sound card is a sound card, right? Wrong! While all sound cards have improved over the past few years, there is still a line of demarcation between consumer or "gamer" cards and those suitable for use in a DAW. Many cheap cards have OK audio specs, but semi-pro and pro cards offer better specs and many features which would be attractive to DAW users. They include:

I/O: Upper level cards offer more I/O options like multiple analog inputs and outputs, balanced connections, various digital input and output options such as S/PDIF, AES/EBU, ADAT I/O and word clock. Some are even capable of hardware sample rate conversion which is invaluable if you need to convert 48K DAT recordings to the 44.1K Red Book audio standard used by CDs.

DSPs and Processing: Some of the newer cards utilize multiple DSPs (Digital Signal Processors) which can be used for hardware mixing and digital effects processing. The advantage of DSPs is that they can perform these functions without taxing the host CPU. This mean less latency (delays caused by CPU overload) and better processing quality and efficiency.

MIDI: Though cards with MIDI I/O and sound modules on them have been around for many years, the quality of the sounds available have greatly improved. While it was common for a 1MB sound ROM to be used even a few

years ago, newer cards have up to 20 MB of ROM memory available and hundreds of sound patches instead of the 128 standard General MIDI patches. In addition, some cards offer sampling, hardware synthesizer expansion capabilities and even multiple synthesis models like FM, analog, modeling, etc. Software synthesis (using the computer CPU as synth) is also possible, but this taxes the CPU and may not be compatible with some sequencing and audio applications. Today, it is possible to get away with using a computer for both audio and MIDI without any external modules or processors.

The nice thing about sound cards is that you can employ as many as your system can handle. In my DAW, I have three different sound cards that provide three sets of stereo analog ins and outs, two S/PDIF outs, a digital foldback input, hardware mixing, 10 audio processors, four synths with 25MB of combined ROM a sampler with 12 MB of RAM and three sets of MIDI I/O. Installing them these days is a breeze since the majority are PCI and plug 'n play. Just bolt the card in (being careful to gound yourself—as a precaution against static electricity), install the drivers and you are done.

Finishing Touches

Of course, you'll need a CD-ROM drive to load software. Just about anything on the market these days is 24X-32X and is similarly priced. I've had good experiences with Sony and Matsushita drives but just about anything will work. If you have a SCSI system, you'll probably want a SCSI CD-ROM.

I also recommend picking up a CD burner for your DAW. I've found mine to be extremely valuable for making archival backups and for burning audio CDs. The nice thing about mastering to CD is that your audio never has to leave the digital realm once it enters the DAW. Many programs allow you to mix down to a stereo WAV file and you can take that file and burn an audio CD from it. I also create hybrid CDs with digital audio and the archived WAV files on the same CD. And since you can find CD blanks for less than $2.00 and they hold 650 MB of data, you won't find a lower cost per megabyte for archival storage.

As far as software is concerned, there are numerous applications to choose from, including simple two-track editors, sequencing packages with digital audio, multitrack audio editing and mixing programs, synth editors, software synths and samplers and specialized software and plug ins that perform a variety of tasks. One great thing about software is that you can start with an entry-level program and move up to something better later.

Building a PC DAW doesn't have to be a frustrating experience if you take the time to carefully analyze your available choices and plan and budget accordingly. You can build a DAW for $1000 with a lower-end sound card and software or $10,000 if you have that kind of budget to work with. If you are comfortable with it, you can take on some or all of the assembly yourself, though I do recommend starting with at least a bare system. The ultimate thrill of building a DAW is hitting the power switch for the first time and, as the system boots up, realizing that you designed it from the ground up.