Rotating storage makes the audio world go 'round

Last December and again in January of this year, I did some live-music recording, using a set of Oktava MC012 small-diaphragm condenser microphones and cardioid capsules. On the first occasion, my subject was a trio of musicians, two playing Dobros and the third on acoustic guitar, at a party thrown by friends. More recently, I captured the first set of Leftover Salmon's concert at the Alpine Meadows ski resort in Lake Tahoe, CA. Notice I said "recording," not "taping." No analog tape for this budding audio engineer, and I left my DAT (digital-audio-tape) gear at home, too.

Instead, I went to the performances straight from work with my NEC Versa UltraLite notebook PC in hand, plugged a Digigram VxPocket sound card into the PCMCIA slot, and dumped the audio directly to the hard drive using Sonic Foundry's Sound Forge version 5. Editing the result (with some performance limitations), burning it to a CD, or converting it to a lossy-compressed format for streaming is no problem; I can do it all right from the PC. And with 20 Gbytes of storage at my disposal, I can archive many hours' worth of high-quality 24-bit, 48-kHz recordings (approximately 1 Gbyte/hour). Or—if I'm at a show that lasts several days, such as this summer's High Sierra Music Festival—I can move the recordings to an even larger external hard-disk drive made by companies such as LaCie.

Another indication of how the times are changing became clear to me in early January, when I attended the Consumer Electronics Show in Las Vegas. Digital audio remains red-hot in popularity, but the most innovative and attention-catching of the latest generation of portable audio players use neither removable flash cards nor embedded solid-state memory. Instead, exemplified by Apple's iPod and Creative Labs' upcoming Nomad 3, they store music on small-form-factor, high-density hard drives. Or they employ 3-in. miniature CDs instead of traditional 4.75-in. CDs. Why the shrinking optical-disc size? You can store a lot more music with a less-than-100-kbps lossy audio codec (assuming your player supports it) than with the now seemingly dated 1.4-Mbps lossless PCM (pulse-code-modulation) approach.

COMPUTERS ARE BECOMING AN INCREASINGLY CENTRAL PIECE OF THE AUDIO PROCESS.

What's going on here? Traditional wisdom held that hard drives were too bulky, too unreliable, and too power-hungry for portable use, and that tape's far cheaper cost per minute also gave it an edge over hard-disk drives in penny-pinching applications. But both consumers' expectations and technologies' capabilities have evolved. For one thing, computers are becoming an increasingly central piece of the audio process. People no longer want to just record audio presentations or buy them prerecorded, then play them back unchanged and unduplicated. They want to make their own "best-of" collections and fine-tune the contents of those collections. They also want to quickly and easily share music with others, within the boundary conditions of copyright law, of course. (Note that all of the bands that I record allow such activity; I don't record in stealth.)

The need for removable storage diminishes when the embedded storage becomes enormous in density and when the transfer speeds between that storage and the outside world become lightning fast, thanks to standards such as USB 2.0, IEEE 1394, and IEEE 802.11. As that embedded, rotating storage becomes smaller in form factor and lighter in weight, it consumes less power and becomes more shock-tolerant. Just like basic physics tells you, force=(mass)×(acceleration). Thanks to cheap RAM and the consequently larger system buffers it enables, momentary data-transfer disruptions are hidden from the listener, and the drive can remain in low-power spin-down modes for more time. When you do need removable storage, a CD-R or DVD-R is even cheaper than tape. It's also more durable than tape and, like a hard-disk drive, enables near-instant access to any point in the recording along with high-speed lossless duplication.

If the 1990s marked the era of upstart flash memory, the 2000s are shaping up as the counterattack of optical storage and the hard-disk drive. The semiconductor vendors are, with multilevel-cell and other technologies, doing their utmost to keep pace with rotating media's plummeting cost per bit (**Reference 1**). But they're falling further and further behind, and rotating media's power and reliability improvements are eliminating semiconductors' traditional advantages here, too. Isn't innovation amazing?

Reference

1. Dipert, Brian, "Exotic memories, diverse approaches," *EDN*, April 26, 2001, pg 56.

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