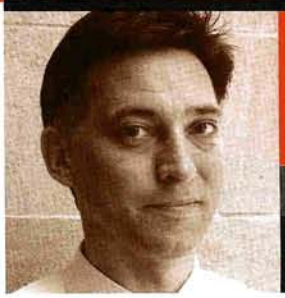
Technology Profile



DVD Audio VS. Super Audio CD:

Will Either Predominate Over Internet Downloaded Music?

By Ted Sabety,
Esq. Principal, Sabety +associates, www.sabety.net

Introduction

The record industry has used the CD format to sell copies of its products for more than 20 years. Introduced in the early 1980s, the format was highly successful, first for mass distribution of digitally encoded music (called "Redbook CD") and then as a format for computer data storage. But Redbook CD has a major vulnerability: Its valuable digital audio data is not stored in encrypted form or protected with any kind of copyright protection. Recent attempts to retrofit copyright protection onto Redbook CD have been plagued with technical problems and do not encrypt the audio data.

Two formats have been introduced that are intended to replace Redbook CD. The first, DVD-Audio, was developed by the DVD Forum. The second, Super Audio-CD (SA-CD), was developed by Phillips and Sony. Both formats feature multichannel surround sound, but only DVD-Audio has the capability to include video clips and stills. Besides competing with each other, both formats compete with music downloaded from the Internet.

Encoding and Audio Quality

DVD-Audio encodes analog audio into a stream of digital data using Pulse Code Modulation (PCM). Although Redbook CD also uses PCM, DVD-Audio is an improvement in two ways: The audio data sampling rate is substantially higher, and each data sample is more accurate. SA-CD encodes analog audio in a radically different way, called Direct Stream Digital (DSD). With this method, each audio data sample comprises only one bit, but the sampling rate is extraordinarily high: 2.82 Megahertz, or 32 times the sample rate of a DVD-Audio disk. However, DSD requires more specialized hardware than PCM to process sound.

Audiophiles still argue over which digital audio coding scheme sounds better. Some proponents of SA-CD contend that it offers even more improvement in high-frequency response than DVD-Audio, while critics note that DSD coding introduces other kinds of inaccuracies into audio output. The widespread acceptance of MP3 data compression in digital audio appliances, which is known to be detrimental to audio quality, would indicate that both DVD-Audio and SA-CD formats offer sufficient sound quality for the average consumer. In addition, it is likely that any difference in quality between the digital audio formats would be masked by the relative quality of the electronics that convert the digital audio data back to analog form. Nonetheless, the surround sound capabilities of both DVD-Audio and SA-CD, and their improved high frequency response, provide a striking improvement over Redbook CD.

Copyright Protection

DVD-Audio and SA-CD apply data encryption to the digital audio data stored on the disk. At first, the DVD-Audio standard used the same CSS encryption that is applied to DVD videodisks. After CSS was cracked and a "hack" called "De-CSS" became widely available, the DVD-Audio standard was amended to incorporate Content Protection for Prerecorded Media (CPPM). In addition, the DVD-Audio format uses an analog "watermark" in the audio signal so that copy-protected audio can be detected even if copied from the analog output of the DVD-Audio player.

SA-CD applies a data encryption scheme called "pit signal processing" (PSP), which, it is claimed, cannot be copied by any known piracy process. This system stores part of a decryption key using variation in the width of the pits engraved on the SA-CD disk itself. The licensed SA-CD hardware contains the rest of the decryption key. In addition, there is an optical watermark applied to the SA-CD disk.

Both DVD-Audio and SA-CD appear to use a "shared secret" architecture for the encryption protocol, which, in its simplest form, has the same vulnerability as CSS. However,

The outstanding question is whether DVD-Audio, SA-CD, or both together will displace the demand for MP3 files

CPPM, in contrast to PSP, improves on the shared secret protocol by adding the capability to revoke any decryption key's authority if it is compromised. This means that DVD-Audio provides a mechanism to mitigate the risk that a hacker could reverse-engineer the shared secret key in a manner similar to de-CSS. In contrast, it appears that SA-CD does not have a key revocation feature.

Player and Disk Compatibility

Consumer groups have raised concerns about the compatibility between DVD-Audio and SA-CD formats, and old CD players and disks. These concerns will probably fade, for three reasons: First, some DVD-Audio players and SA-CD players already on the market are capable of playing Redbook CDs, meaning that consumers would not be required to abandon their CD collections. Second, there are players on the market that can play both DVD-Audio and SA-CD. Third, the need for backward compatibility, that is, for DVD-Audio or SA-CD disks to play on old CD's will probably be unnecessary.

In order to permit new releases in SA-CD to be played on old CD players, the developers of DVD-Audio and SA-CD came up with a version of the formats called a "Hybrid". This version of both formats adds an area with Redbook CD data to each disk. When placed in a traditional CD player, the Redbook CD data is played and the DVD-Audio or SA-CD data is ignored. It is of critical importance to note that, although Hybrid SA-CD and Hybrid DVD-Audio solve the backward compatibility problem, they do so at a cost: There is no encryption applied to the Redbook CD audio data present on either Hybrid. And it is likely that these formats will be unnecessary in the long run: Price competition in the consumer electronics sector will rapidly erode the price of DVD-Audio and SA-CD players.

Analysis

The outstanding question is whether DVD-Audio, SA-CD, or both together will displace the demand for MP3 files, which suffer from inferior sound quality and do not offer multi-channel sound or other digital audio file formats like Windows Media or Real. In spite of these drawbacks, however, the widespread popularity of portable MP3 players that store hours of music in a palm-sized device, and the success of the Apple iTunes service, indicate a strong consumer need for highly compact, portable and convenient storage of music. In addition, the recent introduction of home entertainment digital audio library appliances will reinforce the demand for the storage convenience of digital audio files rather than individual disks.

Furthermore, this writer is not aware of any product that provides DVD-Audio or SA-CD with a "tethered ripping" capability—that is, a functionality that permits legitimate consumer copying into digital audio devices using digital rights management technology. Therefore, consumers will continue to seek sources of MP3 files (or other digital audio formats) from download sites on the Internet. In conclusion, it is likely that the consumer decision to purchase a DVD-Audio or SA-CD disk will either be reserved for specific sound recordings of particular interest, or limited to a small percentage of audiophiles. In any case, neither format will likely displace the demand for digital audio downloaded from the Internet. ■

Sabety+associates is a technology and electronic media law practice based in New York City.