

New Tools for the Digital Age

A/V Professional Launches Systems to the Next Level of Performance

Tailoring a Custom Solution

Disc drives are a lot like automobiles. Both provide tremendous levels of utility to users and are seemingly indispensable parts of many people's lives. Disc drives and automobiles also share the attribute of being very adaptable; they can be used for a variety of purposes and applications. A sports car may be the best design for a racing situation while a van or truck might serve better in a cargo transport application. While all vehicles in use today share certain common attributes-tires, an engine, a steering wheel, a gear box, a chassis-the combination, integration, and development of each of those components varies depending upon the intended use of the vehicle.

The same is true of disc drives. Seagate's 2.5-inch form factor disc drives are ideally suited for mobile applications, such as portable and laptop computer systems. Ultra ATA models in a 3.5-inch form factor are furnished to best fit the needs of typical desktop PC users in home and office environments. UltraSCSI and FC-AL models deliver leading-edge performance demanded by the most rigorous computing applications, often serving the needs of many users simultaneously. Such drives cover a wide base of applications ranging from network server operations to data warehousing and audio/video systems.

Professional audio/video systems, which place unique demands on disc drives, require a special type of storage product. In traditional high-performance applications, a pause of several hundreds or tenths of a second will not even be noticed by users. Such occasional allotments of time are easily afforded to disc drives to complete such operations as data read/write retries and drive event logging. But in the A/V industry, missing even a third of a second of data can mean missing as much as ten frames of a film-an effect that would be very much noticed by both the producer and the moviegoer.

As an early leader in the development of disc drives for use in digital A/V storage, Seagate responded proactively to the heightened needs of A/V professionals for storage products that can consistently, reliably deliver images and sound at established quality levels. In 1995, Seagate debuted its A/V Professional program, providing Seagate customers who work closest with A/V professionals the necessary tools to further tailor the performance characteristics of disc drives to each specific user's needs. Today, Seagate is taking the next step in industry leadership and customer support with enhancements to its A/V Professional program. These improvements take into account advancements in disc drive technology over the past two years, while also delivering more robust features for distributors to choose from when adding value to Seagate disc drives in the professional audio/video marketplace.

Making the Best Even Better

It has been said that many-a-car race has been won by the minute changes of a master mechanic in the pit. This model is true in many

fields; often, the most subtle changes in the right areas can yield some of the greatest results. Such is certainly the case in the professional A/V disc drive marketplace. Just as mechanics make exacting changes to car configurations for specific racetracks, so do disc drives require particular modifications for various A/V applications. When the industry first identified users' needs for enhanced disc drive performance in A/V applications, the thought was that one specific disc drive configuration would be able to serve the needs of all forms of A/V applications. But the way a non-linear video editing system utilizes a disc drive is dramatically different from that of a video-on-demand server. To propose a single drive configuration solution to fit all A/V users' needs would not be the ideal solution.

Seagate's newly-revised A/V Professional toolkit provides resources for customers with demonstrated technical expertise to custom configure each individual Seagate drive to operate at its peak in a user's environment. Authorized VARs and distributors utilizing Seagate's A/V Professional toolkit are able to identify the features and configurations that would most benefit and enhance drive performance. With that information at hand, Seagate resellers then modify Seagate Cheetah, Barracuda, and Elite disc drives to take advantage of the most optimal configuration settings.

A Sense for the Extraordinary

These configuration changes are input into the heart of the disc drive in an area referred to as the Mode Sense Pages. The Mode Sense Pages contain a number of variables that define the characteristics of how a disc drive acts when presented with various situations. As mentioned earlier, a critical element to the design of a successful A/V Professional disc drive is its ability to effectively manage pauses in read/write activity while completing regular internal functions. For example, one variable in a Mode Sense Page may instruct the drive to continuously attempt several seconds' worth of read retries if a particular drive sector isn't responding immediately. In a conventional business application, this kind of response from the disc drive would be very much expected; missing a single number on a huge corporate spreadsheet could have a huge impact.

When used in an audio/video situation, however, properly reading a single bit of data amongst millions of others may be much less important. Suppose the image a producer is working on is at a typical resolution of 1,024 pixels across by 768 pixels down. If a single pixel is misread out of an entire frame, only 1/786,432nd of the entire image is affected. Combined with the fact that the typical frame is displayed for only around 0.03 seconds, the loss of a single pixel within a frame is considered an acceptable loss.

Unfortunately, if a conventional drive used in a business application encountered the same kind of issue, the drive may spend several seconds trying to determine the characteristics of that single pixel, thus causing the entire audio and video stream to come crashing to a halt during that time. Therefore, through manipulation of the Mode Sense Pages, the drive can be directed to spend, say, a maximum of 0.02 seconds attempting to retry reading the pixel, at which point the drive would move on and continue in reading the video stream and in enough time to complete the transfer of the single image before frames become

'dropped.'

While read/write retry management is one important aspect of defining the characteristics of an A/V Professional disc drive, there are many other areas equally important. These include:

Flaw Management

Typically, a disc drive will automatically re-allocate sectors on-the-fly if a potential error appears to be manifesting within an isolated area of the disc drive. In an A/V environment, however, this would cause problems, since sector reallocation can take several seconds of time, which can result in the meantime with frames potentially being 'dropped.' So, this feature is often de-activated on A/V drives, allowing for controlled sector re-allocation during times when continuous data streams aren't being read or written.

ECC Correction

Certain algorithms are built into disc drives for read/write operations in order to maintain high data integrity. Sometimes, the time used by these algorithms to ensure data reliability can begin to affect overall drive performance. Special configurations in this area of the Mode Sense Pages by a Seagate A/V Professional-authorized reseller or distributor can fine tune these settings so as to not detrimentally affect drive performance while still continuing to offer superior data integrity.

Error Reporting

Seagate Cheetah, Barracuda, and Elite disc drives are so advanced that they are able to provide specific reports to the host system regarding any potential errors that are encountered. While this is often critical in a business application, it can create too long a delay to both the drive and the system in a professional A/V environment. Depending on the specific user application, many A/V Professional disc drives tend to disable this feature.

Read/Write Retry Management

As mentioned earlier, a certain number of read/write retries is acceptable in an A/V application before frames begin to be dropped. With Seagate's A/V Professional program, the number of retries acceptable within a customer's system can be determined and assigned through this value in the Mode Sense Pages.

Recovery Time Limit

In addition to the above Read/Write Retry Management feature, a specific window of time in milliseconds can be set in which to attempt read/write retries. With this additional feature, the drive has an extra safeguard against dropped frames or corrupted audio.

Read Continuous

Some A/V applications simply demand the highest in data rate with less concern for absolute data integrity. For such applications, the read continuous feature of the Mode Sense Pages can be activated, leading the drive to forego any read/write retry activity and simply stream data to and from the disc drive at the highest data rate possible.

Buffer Full/Buffer Empty

In order to maintain a steady stream of data coming from and going to the

disc drive, the buffer full/buffer empty definitions of the disc drive can be modified, depending on the necessary data transfer rates and number of data streams in a user's specific configuration. Seagate's A/V Professional partners are able to determine an optimal setup while designing a customer's system and adjust the Buffer Full/Buffer Empty values to provide the best performance possible for a specific user's needs.

Write Caching

Typically, write caching is disabled in business applications in order to maintain the highest in data integrity should the drive lose power from the system before emptying its buffer. In professional audio/video, however, tremendous performance advantages are gained through the enabling of this feature. Typically, A/V Professional partners will enable this option on a customer's disc drive.

Cache Segmentation

Seagate's Cheetah, Barracuda, and Elite disc drives can divide their cache into various segments in order to handle various video streams simultaneously. By evaluating the application need of a specific customer, Seagate's A/V Professional partners can determine an ideal number of cache segments to best serve system needs. This, too, will benefit overall system performance by tailoring a custom-fit solution to a user's needs.

Pre-Fetch

A/V files on disc drives are notorious for their large size and the large number of sequential sectors and tracks they use on a platter. During a disc drive's read of a large A/V file, the actuator arm moves from track to adjoining track on the disc, sequentially reading all of the sectors of the file. When the arm moves to a new track, it often has to wait several milliseconds while the platter rotates before the first sector to be read is properly positioned. This waiting period is referred to as latency. Since A/V files are so large, often entire tracks within a platter contain a single file. So, while the data first encountered after a track change by the read/write head may not be immediately required, there is a very strong possibility that it will be requested within a few milliseconds. With pre-fetch enabled, the disc drive anticipates this need and begins caching all data found on a new track. This effectively reduces latency to virtually nil in many situations-and thus enhances performance-since all of the data read on a track is eventually used and no time is wasted by idly rotating the platter to its starting position on a track.

Logging

While drive event logging is a useful feature for business users, it can be time-consuming and does not offer much benefit to the A/V Professional user. Often, this feature is disabled within an A/V Professional drive's Mode Sense Pages.

S.M.A.R.T.

Like error logging, Self-Monitoring Analysis and Reporting Technology (S.M.A.R.T.) is useful to report various drive conditions back to the host system. However, these actions do require valuable time that A/V drives often do not have to spare. For that reason, many A/V Professional disc drives disable this feature.

A Word on Thermal Re-Calibration

One notable advancement in disc drive technology relating specifically to the professional audio/video marketplace is that thermal-recalibrations no longer need to be performed. A few years ago, drives utilized a head positioning technology referred to as dedicated servo. Dedicated servo technology was ideal at the time because it allowed for greater drive performance and areal densities within specific media surfaces, which was critical to the early adoption of disc drives for use in digital editing applications. However, as temperatures fluctuated within a disc drive, metal would expand and contract relative to the heat, and the positions of a head relative to the disc surface would vacillate. Drives counteracted this issue with thermal re-calibration-a time when the disc drive would take a moment to re-position all of the heads relative to their appropriate locations, thus compensating for heat variances. This action, while requiring only fractions of a second, was sometimes too long in A/V applications. So technology was developed to re-calibrate a single disc drive head at a time at opportune moments, thus alleviating the potential problem.

Today's new Cheetah, Barracuda, and Elite disc drives use a new head positioning technology referred to as embedded servo technology. Embedded servo technology weaves head positioning information amongst the data on platters, so drive heads are continuously monitoring their position relative to the track on the media and making minute changes as necessary. With embedded servo technology, thermal re-calibration is no longer an issue in A/V applications.

When You See Video, See Seagate

As a clearly-defined leader in the professional audio/video marketplace, both the computer and film industries look to Seagate to define and deliver the latest in online random-access video storage technologies. Seagate's partnership with industry-leading, technically-expert distributors and resellers guarantees that customers can expect a customized solution tailored to the specific nuances of their systems' needs. With this latest refinement in Seagate's A/V Professional standards, users that today's A/V Professional equipment will be ready for tomorrow's digital audio/video challenges.

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