10,000 RPM: Shifting the Redline on

Performance

Faster is Better

It's hard to find many computer users who complain about their hard drives operating too quickly. The demand for increased drive performance remains insatiable in virtually all aspects of computing, ranging from the nightly television feature assembled and seamlessly edited together on a computer-based non-linear video editing system to the paramedic needing rapid access to information critical to the life of a patient. More and more, information technology grows dependent on hard drives to provide real-time access to immense volumes of information at a moment's notice.

Thankfully, the hard drive industry has responded by enabling many computer applications that couldn't have possibly existed even a decade ago. Disc drives, in many ways, are like high-performance sports cars. For continued performance enhancements to be realized, various elements of the car must be refined. Each element provides a specific contribution to performance and provides distinctive characteristics to the handling of the car.

The same holds true for disc drives. While seek times and buffer space are important in measuring drive throughput, it can be argued that nothing so greatly affects the overall performance of a disc drive more than the rate of speed at which bits of data pass under the read/write head of the disc drive. This measure, in turn, is directly proportional to to the speed at which a disc drive's platters spin. And, just like a Ferrari, fast speeds are dependent on a fast motor.

Seagate has understood this concept for close to two decades. With this knowledge in mind, we have continued to pioneer newer, faster, and higher performance disc drives.

Welcome to the Next Level

Seagate's continuing legacy of performance is well established in the drive industry. The company pioneered the first 5,400-rpm spindle speed with the Elite series of disc drives. The Barracuda family introduced the world to 7,200-rpm performance. Both of these innovations enabled computer application developers to bring their dreams into the material world. Suddenly, high-performance online storage allowed a motion picture to be edited on a computer while retaining much of the film's original clarity, vibrancy, and depth. Online transaction systems became much more robust and the strain of high transaction volumes eased on both the network and the user as more rapid responses became available. Further, scientists and engineers were better able to share intricate designs with each other in a real-time format, leading to greater productivity, heightened product reliability, and lower costs.

With the debut of the Cheetah family of disc drives, Seagate once again expands the reach and possibilities of technology. Seagate introduced the world to 10,000-rpm disc drives with the Cheetah 4LP and Cheetah 9, which demonstrated unprecedented performance gains. Seagate's second generation of Cheetahs, the Cheetah 9LP and 18, introduced 3.0"

media, which substantially reduced power consumption, acoustics, and cooling requirements to near-7,200-rpm levels. Seagate's new, third generation family of Cheetahs, the Cheetah 18LP and Cheetah 36, take the next step with Just-in-Time seeking, a feature that further reduces power consumption and acoustics with no trade-off in performance.

Thanks to the 10,000-rpm spindle speed, average drive latency shrinks on the Cheetah to under 3 msec, meaning that the drive not only sends the data back to the system at a faster rate, but also that the time for the disc drive to find requested information is also greatly reduced. This leads to a one-two punch in boosted performance, with the high data transfer rate and low latency times working hand-in-hand.

Higher RPM Truly Makes a Difference

The phenomenon of higher performance with faster spindle speeds can be understood by examining the greater rotational rate of an Indy race car's tire. As the race car's tires gain greater rotational speeds on the race track, the vehicle naturally travels more distance each second. On the other hand, if the tire is displaying a lower rotational rate, this naturally leads to less distance traveled since the tire isn't pushing past as much pavement each second.

The same is true for disc drives. In essence, a 10,000-rpm disc drive is simply able to transfer its data in less time than that of a slower unit. What this means for many applications, especially those that rely on a real-time feed, is that more data can be delivered each second. For various applications, that means various things. To the film producer, that could mean that either more colors can be used to enhance the vibrancy of the picture or that less compression can be used in order to create a clearer image. To the airline reservation attendant, as well as the customer, it means retrieving and confirming a passenger's flight data in three-fourths to half the time. For the doctor, it means the ability to quickly receive computer image updates of CAT and MRI scans before a critical procedure. The benefits are quite real and tangible, and the applications now possible are revolutionary.

The Drive Ain't Latent

Latency is another important concern for high-performance applications. While an impressive sustained throughput helps large blocks of data to be transferred rapidly on a consistent basis, a low average latency time for the drive helps random searches for data to be completed in less time. With latency, every millisecond of search time counts. Take, for example, a non-linear video editing application running at a typical frame rate of 30 frames per second. Now suppose the editor is creating a huge montage of video images, where every single frame is from a different clip of film. That means that each frame must be ready to post to the screen every .033 seconds. The Cheetah family of disc drives require less than .003 seconds for average latency, or about 1/11th of the total time allotted for the loading of a frame. Over time, however, this adds up--over the course of one second, a total of .09 seconds on average is dedicated for latency, or almost the same amount of time to post three frames of film. Thus, every millisecond truly does count towards sustained performance, especially in applications where a large number of random blocks of data must be accessed.

Latency measures the amount of time necessary on average to rotate a platter to the point where the head is positioned at the beginning of the data stream that will be read. It is analogous to making a chalk mark on a tire and then determining how long it takes until the tire rolls over the mark. Obviously, the faster the tire is rolling, the sooner the chalk mark will touch the ground. While the specific position of the chalk mark on the tire may vary throughout many performances of the experiment, the time necessary for the chalk mark to touch the ground will, on average, be decreased as the rotational speed of the tire increases. The Cheetah drive naturally provides a low latency due to its high spin rate.

Delivering Top Performance

Seagate's Cheetah family of disc drives, now available with 18.2- and 36.4-Gbyte capacity points, rely on the latest in interface technology in order to deliver and maintain leading-edge performance to the rest of the system. Both Ultra2 SCSI and Fibre Channel-Arbitrated Loop (FC-AL) versions of the Cheetah disc drives will be available for users who demand the highest in throughput performance. With Ultra2 SCSI, parallel storage technology is extended to provide up to 80 Mbytes/second of sustained throughput. FC-AL goes one step further by raising serial interface performance to up to 100 Mbytes/second per loop, with up to two loops connected to each device, delivering high reliability and data availability to subsystems. This unprecedented performance rate can be sustained on links up to 10 kilometers in length, with up to 126 devices in a single chain.

Keeping Everything Cool

Heat is a natural byproduct of friction, and the greater the friction, the greater the heat potential. Thus, just as a car engine heats up faster running at close to 5,000 rpm than when idling at 1,000 rpm, disc drives have the potential for extra heat dissipation at higher rotational speeds.

Seagate understands the need for disc drives to maintain extremely high reliability levels, as the company's drives are relied upon for use in mission-critical applications. Because of this, Seagate was the first manufacturer to pioneer the use of 3.0” media in 10,000-rpm disc drives, which nearly negates the influence of the higher spindle speed in increasing heat dissipation. Seagate’s Cheetah disc drives are designed to be able to be integrated into nearly all systems where 7,200-rpm drives are currently used.

Seagate: A Natural Leader in Data Technology

With over 100 million disc drives designed and manufactured by Seagate, the Cheetah is the latest in a long line of products and technological leadership. When Seagate introduced 5,400-rpm and 7,200-rpm disc drives to the world, entire industries outside the realm of computers were revolutionized. Seagate brings the potential for faster access to vital data, greater productivity, more flexibility, and the ability to imagine for the future.

Seagate is founded in a commitment to provide breakthroughs in data technology. For nearly 20 years, the company has proven time and time

again with countless pioneering efforts that it has the boldness to ask "What if?" The 10,000-rpm Cheetah family of disc drives is proof that the answer to that question can make a world of difference.

By Tyson Heyn
November, 1998