

When will we see Higher Performance Hard Disk Drives?

Key Points:

- Hard disk drive capacities have grown to support higher resolution consumer and other applications.
- While HDD capacities have increased about 5,700 times over the last 15 years data transfer rates have only increased about 91-121 times depending upon the modern HDD.
- HDD storage capacity has increased about 60 times faster than the data transfer rates.
- Thus the performance relative to the amount of data (the time to a random piece of data on the drive) has increased over the last 15 years. For instance fifteen years ago it took 37 seconds to read one 26 MB platter while in 2006 it takes about 52 minutes to read one 200 GB platter.
- The longer time to data of modern disk drives impacts user experiences

Over the years hard disk drives have increased in storage capacity due to increases in the areal density (the amount of data that can be stored on an area of disk surface). This growth in areal density has enabled the high capacity hard disk drives that support the storage requirements needed for today's enterprise, computer and consumer applications. At the same time that areal density has increased so dramatically (say 6,000 times over the last 15-years) the time it takes to get to data on the disk drive has increased. The time to data on a hard disk drive is a function of the linear density of data on the hard disk drive tracks, the rotational speed (RPM) of the disks and the layout of data on the hard disk drive.

Users of storage would like to get to their data faster as well as have lots of it stored economically and this will lead to some changes in hard disk drives. The introduction of Vista will bring some new supported options related to hard disk drives that may also help. Vista supports new write cache and read cache options that could accelerate the user storage experience. ReadyCache is a feature in Vista that allows plugging in a USB flash device that can act as a read cache that can hold frequently used data off of the hard disk drive and provide it faster than a hard disk could. Vista also supports ReadyDrive which is a hard disk drive with a flash write cache inside the drive that holds information that is to be written to the hard disk drive (this is primarily for power savings in mobile products) but some of the operating system boot information can be stored on the flash memory and used to boot the computer faster than would be the case with the hard disk drive alone.

Another feature supported in feature is an increase in the sectors of data on the hard disk drive from 512 byte up to 4,000 bytes. The sectors of data break up the data on the tracks of the hard disk drive into chunks equal in size to the

specified sector size. The sector size in hard disk drives has been limited to 512 bytes for many years. Increasing the sector size in hard disk drives will allow higher storage capacities since the overhead for the sector header data will be less and could also give faster data access since the drive would not have to read as much sector data and thus could reach user data more rapidly.

The traditional way to increase the speed of accessing data is to increase the rotational rate of the disks, that is increase the disk drive RPM (rotations per minute). The maximum speed of hard disk drives is currently 15,000 RPM used in very high performance and higher cost enterprise hard disk drives. The highest RPM in desktop drives is 10,000 (WD Raptor product). The maximum RPM has not increased for many years. It may be time to introduce higher RPM disk drives (say 20,000 RPM) to allow higher data performance (in particular for high performance enterprise applications). Moving to higher RPM in combination with the increasing areal density of hard disk drives will require greater use of dual stage actuator heads that can follow the run-out of rapidly rotating disks as well as new disk substrates that can support higher RPM without having vibrational mode issues.

I believe that the need is there and the technologies are available to enable such improvements in time to data. While I don't think disk drives will generally get to data faster than in the past these new technologies could help prevent time to data from getting even longer.