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FEATURES

EXPERIENCE IS THE NAME HARD DISK DRIVE MAKERS GIVE TO THEIR MISTAKES

By John Monroe, Research Vice President, Gartner Dataquest

OVERVIEW

After many heady developments in 2005 – during which we saw extended price stability and record revenue, mostly because the industry built to actual needs and kept surplus inventories to a minimum while fulfilling a richer range of demand - the results of the first half of 2006 have been sobering.

THAT WAS THE YEAR THAT WAS

For many years, Gartner Dataquest has insisted that - despite the dynamics of a competitive chaos and too many suppliers - the HDD industry is capable of a maturing self-discipline that can lead to more-stable and - profitable market conditions even prior to further consolidation.

Maturing self-disciplines were clearly evident throughout 2005, one of the most exceptional years in our history. Because they were able to combine shipment increases with limited price erosions, the drive makers managed some unprecedented results:

- Astonishingly stable quarterly ASPs: $74.8, $74.5, $72.7, $73.4. An annual ASP decline of only 1.5% (from $74.9 in 2004 to $73.8 in 2005). The ASP in 1Q05 ($74.8) was higher than in 4Q04 ($73.0). We historically see 4Q-to-1Q ASP declines.
- Most inventories in most channels for most products remained in a profitable balance of supply and demand in every quarter of 2005.
- There was a richer range of form factor and capacity demand from a richer range of customers and markets, and new non-PC markets expanded to 16.5% of total shipments.
- A revenue increase of 22.7% and a shipment increase of 24.5% were greater than in any year since 1995; the 23.2% enterprise HDD revenue increase was greater than in any year for which we have records.

The results of 2005 proved - as if we needed any proof - that even a slight amelioration in the pace of price declines can make an enormous difference in industry earnings.

It's been different in 2006. ASP has declined from $73.4 in 4Q05 to $72.2 in 1Q06 to $68.8 in 2Q06. Inventories, though far from unwieldy, have displayed some awkward imbalances. After three successive quarters of revenue above $7 billion, industry revenue dipped to $6.8 billion in 2Q06. And, subsequent to Seagate's announcement of its intent to purchase Maxtor in December 2005 and the consummation of the merger in May 2006, we have seen some irrationally fierce contention for market share, particularly in the distribution channels, resulting in some needless price erosions (more on this later). Although hardly surprising for the first half of the year - historically, it's "normal" and to be expected; in 2002, 2003 and 2004, respectively, 4Q-to-2Q HDD industry ASP declined as follows: $96.2->$86.9->$83.7, $86.2->$85.5->$80.7 and $78.9->$76.1->$72.4) - this is surely disappointing compared to the extraordinary results of 2005.

Tables 1 and 2 below detail some top-level HDD industry history for the past nine quarters.

Table 1
Quarterly HDD Shipments and inventory Changes, 2Q04 to 2Q06

	2Q04	3Q04	4Q04	1Q05	2Q05	3Q05	4Q05	1Q06	2Q06
Shipments	67,456	79,153	89,118	88,263	90,030	96,580	105,396	102,159	99,450
Change (%)	(3.1)	17.3	12.6	(1.0)	2.0	2.0	9.1	(3.1)	(2.7)
Inventory	20,280	21,539	20,390	19,889	21,190	21,933	22,551	23,755	22,998
Change (%)	5.3	6.2	(5.3)	(2.5)	6.5	3.5	2.8	5.3	(3.2)
Inv./Ship. (%)	30.1	27.2	22.9	22.5	23.5	22.7	21.4	23.3	23.1

Note: "Inventory" is an estimate of the combined total of drives in all distribution channel and OEM JIT warehouses only, excluding work-in-progress and finished goods in other vendor warehouses and factories. Source: Gartner Dataquest (August 2006)

Table 2
Quarterly HDD Revenue and ASP Changes, 2Q04 to 2Q06

	2Q04	3Q04	4Q04	1Q05	2Q05	3Q05	4Q05	1Q06	2Q06
Revenue (in USD millions)	5,134	5,727	6,509	6,599	6,703	7,019	7,738	7,374	6,838
Sequential Change (%)	(6.6)	11.6	13.7	1.4	1.6	1.6	10.2	(4.7)	(7.3)
ASP (in USD)	76.1	72.4	73.0	74.8	74.5	72.7	73.4	72.2	68.8
Sequential Change (%)	(3.9)	(4.9)	0.8	2.5	(0.4)	(0.4)	1.0	(1.7)	(4.7)

Note: "ASP" is the average selling price for all classes of HDDs.
Source: Gartner Dataquest (August 2006)

Despite some unnecessary price aggression in the desktop and mobile arenas, there are also many bright spots. With only three suppliers, no excess inventories and continuing real demand in excess of 6.5 million units per quarter, enterprise markets are profitable and pricing is as stable as it has ever been. Partially because there was curtailment of desktop and mobile build and ship plans by some vendors in June, we estimate that 2Q06 OEM JIT warehouse and distribution channel inventories declined sequentially for the first time since 1Q05, setting the stage for a more profitable balance of supply and demand in the back half of the year. And mid-quarter reports indicate that demand is expanding in all markets; shipments of 110.7 million drives in 3Q06 and 120.6 million drives in 4Q06 (our current estimates) should meet, and not exceed, evolving demand, thereby engendering more-lucrative market conditions.

We foresee many opportunities for profitable growth in 2H06 and beyond. But the drive makers must cast a cold eye on some of the more disturbing aspects of their recent history and change some self-destructive tendencies.

A PROFUSION OF REBATES AND DOWNWARD PRICING SPIRALS

As expected, mobile and desktop mainstream pricing became more aggressive in 1H06, but in some cases was unexpectedly and unnecessarily combative. To cite only two examples:

- During 2Q06, 80GB/7200-rpm desktop 3.5" pricing dropped to below $40 for some major deals; pricing for this class of product certainly could have remained in the profitable range of $43-to-$48 for all channels, but it did not.

- During 2Q06, 40GB/5400-rpm mobile 2.5" pricing dropped to below $43 for some major deals; pricing for this class of product certainly could have remained in the profitable range of $46-to-$51 for all channels, but it did not.

What we saw in 1Q06 and continued to see in 2Q06 were further embodiments of Monroe's Law III: "Market share for the sake of market share + disinformation throughout the supply chain = a sludge of needlessly wasted profits."

By a combination of disinformation and the pursuit of market share for the sake of market share, the industry managed to sell many mainstream mobile and desktop HDDs at $3-to-$5 less than was strictly required by any mindful strategic imperative. There have been no share shifts of any meaningful or lasting value, certainly not in the distribution channels, where the price wars have been most fiercely fought.

Surplus channel inventories, coupled with distribution price declines and a multitude of special quarter-end deals, are "standard procedure" in March and June of almost every year. This changed in 2005. Partially because of media shortages combined with increased demand, distribution channel inventories were kept to a minimum and the drive makers managed to keep special distribution deals to a minimum.

What happened in 2006? A major merger proposal (Seagate's purchase of Maxtor) was announced in December 2005, and some surprisingly aggressive price moves became apparent in late January and early February 2006 (rather than in mid-to-late March, which would have been "normal"). These price moves were not in apparent response to any inventory pressure - we did see some surplus inventories at the end of March, but in January and February inventories were closely aligned to run rates (as opposed to swelling toward a surplus state, which would have been "normal"). Rather, we believe that distribution desktop pricing heated up as a result of a deluded quest on multiple fronts to proactively "sew up" - or perhaps "sow up" is more accurate, since channel management was effectively making sow's ears out of silk purses - the potential desktop share that would become available as Maxtor got absorbed into Seagate.

Trying to shift a quarterly or annual share merely by means of aggressive price has always been a sign of senseless marketing and wasted resources (or badly constructed sales commission programs). I should know; prior to becoming a Gartner analyst, I had to deal with insane pricing almost every day during my 1980-to-1997 career in the "dirty ditches of the VAR channel," and it was almost always impossible to know with certainty whether a price reduction was necessary or needless. But I did learn this: Whatever distribution share you manage to buy for, say, $3 this week can be bought for $4 next week by your arch rival and then must be repurchased for $5 the following week (by you or some other low-bid

competitor). Despite their protestations to the contrary (when they want to curry favor with a particular vendor), the distribution brokers and high-volume system integrators in the channel, who purchase a high percentage of the total distribution volume, are largely loyal to price and not to any particular vendor (since most desktop drives in most desktop systems are mostly interchangeable most of the time). But it is also true that many large customers are, in fact, loyal to particular vendors, but threaten to change vendors constantly (with no real intention of doing so), thereby managing to play one distributor off another to obtain lower prices by means of lies and misdirection (and, in many cases, effectively managing to make a vendor compete against itself). All major distributors and their major customers have become masterful at claiming - and double-claiming - vendor rebates, whether earned or unearned.

The more rebates there are, the more chance there is of paying an illegitimate claim. A profusion of rebates always generates a downward pricing spiral. And any accelerated downward spiral caused by a frenzy of disinformation churned up by distributors and their high-volume customers is always profitless and non-strategic, clearly an example of the drive makers collectively practicing short-term tactics at extreme odds with their stated long-term strategic aims.

The difference between dropping price to maintain share as opposed to dropping price to gain share is irrelevant in this atmosphere. There is no “moral high ground” and there is no such thing as an “innocent bystander.” And it really does not matter who fired the first shot. What’s more important is who fired the second, third and fourth shots, and why they “believed” they “had” to fire them. All players are perpetrators.

On the bright side, pricing now seems to have stabilized (albeit at needlessly low levels), and we expect burgeoning demand in legacy and emerging markets throughout 2H06. A richer mix of qualified high-end mobile and desktop products sold to a more-diverse customer base can substantially offset low-end price erosions - this proved true for some vendors in 1H06 and should certainly be an increasing factor in 2H06 industry profitability.

Meanwhile, the enterprise markets have never been healthier. The industry set a new record at 6.929 million units in 2Q06, pricing is stable, there is no evidence of any surplus inventories, and 2H06 demand from the key enterprise OEMs seems solid and predictable. Shipments of SCSI-, SAS- and FC-interface HDDs could increase to more than 27.5 million units in 2006.

We had hoped that the merger of Seagate and Maxtor would help to usher in a new era of sustained profitability and wiser market management. The potential for win/win market share shifts was (and still is) substantial: The number of desktop HDD suppliers has been reduced from five to four, the number of enterprise HDD suppliers has been reduced from four to three, and Seagate’s stated aim is to try to retain only 50 percent (best case) of Maxtor’s revenue, leaving plenty of room for the surviving desktop and enterprise drive makers to profitably garner increased share. To date, and disappointingly, the announcement of this merger and its consummation have generated more rather than less chaos and pricing instability in the desktop HDD markets.

Many investors once again have become wary, and - with good reason - once again have begun to doubt the supposedly growing maturity of this industry.

GETTING (ONLY) WHAT YOU PAY FOR

Surely at least one sign of maturity is the degree of integrity inherent in the decisions made by a person, group, company or industry. From this perhaps limited perspective, the HDD

industry is still immature. With few exceptions, the drive makers have seldom, individually or as a group, displayed consistent courage, conviction or integrity with regard to pricing and market management.

This has changed much for the better in recent years, and some drive makers – most notably Seagate and Western Digital – have reported consistent and record-setting profits. However, in recent months, profitability as a strategic aim once again has been undermined by tactical behaviors in certain markets that have decimated possibilities for more-lucrative business engagements. Compounding the vagaries exhibited by fervid grapplings for market share have been the drive makers' collective tendencies to allow major customers to get whatever they want whenever they want it.

Most major HDD customers can behave tactically (to obtain the best daily price) or strategically (to obtain, among other things, guaranteed allocation in tight times) without being required to extend, in return, adequate commitment to or partnership with a vendor. In most mature industries, one eventually gets only what one pays for. In the HDD industry, the major customers almost always get much more than they are willing to pay for.

There has been growing strategic alliance in recent years, with more examples of shared risks and shared rewards among vendors and customers throughout the supply chain, but HDD vendors still seem to be more at the mercy of their major customers than in other maturing industries.

As industry consolidation progresses, vendors and customers must soon decide between two distinct forms of dealing with each other. Will we continue to be more completely defined by an irrational, cut-throat competition or by a more highly evolved, open and efficient symbiosis on a large scale? As persons, groups and companies, we cannot have it both ways, depending on whim and circumstance. We must choose. And we must recognize that our choices will have inescapable consequences.

TACTICAL DEALS OF THE DAY

Many major HDD customers have been auctioning their available volumes to the lowest bidder. Auctions may occur with precise planning or unexpectedly. Auctions encourage distrust, disinformation, fear, tactical share shifts and frequent price reductions. Auctions discourage trust, clarity, alliance and any long-term strategic commitment.

If a major customer demands the right to have continuous tactical access to the best deal of the day during times of relative surplus, then this same customer should not be granted the privilege of stable price and strategic support during times of relative scarcity of product. To their detriment, the drive makers have let the tactical deal-of-the-day players have the best price and the best service and support in times of surplus as well as in times of scarcity.

No appreciable loyalty has been engendered by this practice of generous accommodation. Since strategic support and acceptable quality and performance are taken for granted, major customers generally consider an HDD vendor to be only as good as the best available price. In turn, HDD vendors consider their suppliers to be only as good as the best available price. Occasionally the best available technology or quality wins, irrespective of price, but this seems to be happening with decreasing frequency. To say that price has become increasingly the final arbiter in every deal may be a calculated and obvious overstatement, but it remains disturbingly true throughout the supply chain. The drive makers almost always cave in to brutal pricing pressures from their major customers, even when prevailing market conditions would permit more-sensible ASP management, and then put an inordinate, bankrupting pressure on their suppliers.

The thing about the best deal of the day that HDD makers and major customers have failed to acknowledge is that this deal may be low or it may be high compared to the previous day; the sword must cut both ways for vendors and customers. If one plays the deal-of-the-day game, the rules should stipulate that the price must be solely dependent on the specific circumstances of the day. Scarcity creates value. During days of scarcity, the price must go up, and the customer must expect to pay more (at times significantly more) to obtain desirable allocations of product.

Price fluctuations up and down are a vital part of playing the game of cut-throat competition with integrity. Price protections are rare, as are strategic privileges in times of need.

In this game, only he who has the most blood can live for long. Very few players will survive. Those surviving players may become insatiably greedy and major customers may be amazed by the destructive power of their appetites. What goes around eventually comes around…

MATURE AND ENDURING ALLIANCES

A certain degree of feral competition may be inevitable (even desirable), but a deep commitment to the creation of more mature and enduring alliances may be the only thing capable of showing us the ways in which fair and sustainable profits can become a reality in the HDD industry. In this hopeful scenario, all drive makers will maintain and enhance all relationships at each stage of the supply chain by developing in-depth, confidential, mutually beneficial partnerships with carefully chosen vendors and strategic customers. For such alliances to be truly effective, at least a few major customers must become less-adversarial participants in these evolving relationships.

Those that choose to play the strategic alliance game should play with integrity. The option of reverting midstream to feral tactics for expediency and convenience should be shunned. In the game of strategic alliance, all vendors must -- in exchange for long-term, mutual commitments -- deliver consistent service to their chosen strategic customers and resist the temptation to arbitrarily raise (or lower) prices or unfairly allocate product to higher-paying customers when changing market conditions permit.

Tactical manipulation should not be rewarded with strategic levels of service, and valued strategic partnerships should not be degraded by tactical manipulation.

MANAGING A NEW ERA OF LOWER PRICES

It's strange and sobering to think that, in early 1998, coming off one of the worst years in industry history, facing an enormous inventory overhang in excess of 35 percent of quarterly shipments, the drive makers were wracked with fear and loathing, wondering how they could profitably build drives for $89 to $99 to satisfy the craze for sub-$1,000 computers. In 1998, no one we talked to imagined that profits could be made at sub-$80, much less sub-$60, ASPs. But the industry managed to prove its resiliency and operational brilliance, cutting production costs and increasing per-platter capacities while simultaneously decreasing power requirements and increasing performance, ruggedness and reliability in a growing variety of designs and form factors. After great pain and many setbacks, and partially because drive makers managed build plans and inventories with greater wisdom, the industry learned how to be profitable with sub-$50 ASPs for entry-level mobile and desktop HDDs.

However, in recent months, and in stark contrast to 2005, the drive makers managed as usual to lower entry-level HDD prices to mostly profitless levels.

Oscar Wilde once wrote: "Experience is the name people give to their mistakes." The HDD industry is experienced enough to know how to act wisely. But our recent behavior would indicate that few industry players can be sanely accused of enlightened self-interest.

SOME DEEPER RECKONING

The year 1988 seems a reasonable starting point for developments that led from an era of continuous expansion of HDD vendors to an era of widespread HDD industry consolidation. We had some trouble determining precisely how many companies were producing proprietary HDD designs in 1988. Some sources claim that there were more than 60 drive companies in 1988, but this number usually includes optical and floppy disc drive makers as well as HDD makers. We did manage to uncover one hard fact: At the Fall Comdex show in Las Vegas in November 1987, 28 companies announced proprietary new HDD designs that were destined to be built in 1988. We conservatively guess that there were at least seven other smaller drive makers who did not exhibit at this show. We therefore believe that were at least 35 companies in 1988 that designed and manufactured proprietary HDDs. These companies delivered a mere 15.8 million drives during that year.

Now there are only 7 major suppliers (only four for desktop HDDs). In 2005 these companies shipped 380.3 million drives (239.8 million of which were desktop HDDs, up from 209.2 million in 2004). Since 1988, the markets for HDDs have grown enormously (and will continue to grow), and the number of HDD suppliers has dramatically declined.

These developments should have created -- within the legal limits of free enterprise -- some kind of constructive, cooperative incentive for strategically lucrative business endeavors. And yet the industry still finds itself incapable of producing consistent profits. History has shown us that -- despite the favorable chances created by expanding markets -- consolidation, in and of itself, will not be sufficient to change the HDD industry's tendency to engage in profitless pricing practices. Some deeper reckoning will be required.

A FUTURE OF CONSISTENTLY PROFITABLE COMPETITIONS?

The Navajo Indians used to say that coyotes were too wise to engage in hopeless competitions.

For much of the last decade, most hard disk drive makers, from a fiscal perspective, have been too foolish to engage in anything but hopeless competitions, behaving more like lemmings, who routinely, and for no apparent reason (except, perhaps, for population control), commit spontaneous mass suicide by running over the edge of cliffs.

We've seen some recent price wars, but they pale in comparison to our colorful past. To our mind, the most stunning example of irrational behavior would be the desktop price wars of June 1999, during which low-end desktop pricing dropped more than 20 percent in less than two weeks. When the smoke had cleared, we saw no meaningful share shifts and no winners (at least among the drive makers: the OEMs "won" some incredible, prematurely low prices), we saw only decimated profits…

This will change. It already has changed. Throughout 2005, we saw more executives and directors at more companies at more levels in the supply chain making consistent decisions to manage for profit, not market share. And in 2006, despite some toughly twisted and turbulent contentions for market share, a few drive makers managed to report substantial profits. In the past, such contentions would have decimated profits for the entire industry.

There is always the danger of history repeating itself (as it did to some degree during the

first two quarters of 2006), but we still believe that the largest HDD makers, with a freshly minted balance of operational excellence and fiscal wisdom, are now poised and determined to engage only in consistently profitable competitions.

If not, if we are wrong about this, then – obviously - the industry's chances for more-reasonable and judiciously expanded future earnings will be diminished. As Dan Quayle once said, "If we don't succeed we run the risk of failure."

ENORMOUS OPPORTUNITIES

The natural world has always been a network of complicated and intricately interdependent ecosystems. In recent years, pervasive computing has transformed a large part of our human world, and we have created a gigantic network - literally, a worldwide web - for efficient data exchange.

The ease of accessing data is increasing and the speed of access to data is accelerating. Local and global networks will continue to expand. A typical user will manipulate multiple kinds of personal and business data at multiple locations using multiple devices. Broadcast data - from emails to television programs, spreadsheets to movies, legal and financial documents to songs - will be increasingly "captured" and stored on stationary and portable systems. In many guises, and bi-directionally, the "enterprise" will become part of the "fabric" of our daily lives, and the "fabric" of our daily lives will become part of the "enterprise." From the consumer to the data center: Living rooms, automobiles, portable media players, cell phones and the traditional realms of enterprise computing will increasingly reflect the same global network.

The kind and capacity of storage devices needed in this network will depend upon the size and shape and extent of commercial and consumer computing and entertainment environments, which in turn will depend upon the bandwidth and ubiquity of wired and wireless networks and the variety and affordability of the kinds of content that can be accessed and downloaded.

It's very hard to make sensible predictions of how that kind of seething turmoil will evolve. However, several trends are clear and not likely to change:

- Consumers throughout the world have demonstrated an almost insatiable desire to view movies and listen to digital music at home and on the road.
- The digitization of the world's cultural artifacts is still in its infancy.
- New directions and dimensions in networking and corporate compliance will demand greater storage capacity and quick, seamless access to huge databases.

Most if not all of the perceptible trends in commercial and consumer uses of digital data point toward a steadily increasing demand for multiple kinds of HDDs from multiple storage markets.

At no time in history has Gartner Dataquest seen greater chances for profitable HDD industry growth.

It will be a sad and preventable waste if the surviving drive makers persist in failing to take full competitive advantage of their enormous opportunities.

About the Author: John Monroe

Mr. Monroe is a research vice president in the Storage Group at Gartner. He is responsible for tracking all aspects of the hard disk drive industry, including technology and market trends as well as financial results. Mr. Monroe has established a reputation as an eloquent, imaginative industry spokesperson, has been quoted in many newspapers and magazines, including Forbes, the Wall Street Journal and the New York Times, and has been an invited speaker at conferences in Japan, Singapore, Thailand, China, France and the United States.

Mr. Monroe has been involved with disk drive sales, product management and market analysis for more than 25 years. Unlike many analysts, Mr. Monroe has had extensive experience as a business line manager, responsible for the profitable purchase and resale of disk and tape products. Prior to joining Gartner in October 1997, Mr. Monroe spent seven years as vice president of storage products at SYNNEX Information Technologies (where, among other duties, he coordinated the flow of more than two million hard disk drives per year), two years as director of North American sales and marketing for Kalok Corporation, five years as vice president of OEM products and sales for Media Winchester Ltd., and three years as a general manager at Electrolabs, a small distribution company, where he began his electronics career in 1980 by selling hybrid ICs and 8-inch floppy disc drives.

Mr. Monroe earned a bachelor's degree Phi Beta Kappa, summa cum laude from Amherst College in 1976 and also earned a master's degree in fine arts with honors from Columbia University in 1980.

DATA RECOVERY HOT ON HEELS OF THE HARD DRIVE EVOLUTION

New storage device technologies keep data recovery professionals nimble as data usage grows

By Tim Margeson
General Manager, CBL Data Recovery Technologies Inc.

Industries have given birth to new industries; new technologies create the need for other technologies and services. Such is the case with data recovery. The evolution of data recovery has been driven by the innovation in data storage technologies.

With the hard drive celebrating its 50th anniversary, the discipline of data recovery has continued to stay abreast of data storage technology improvements. However, the history of professional data recovery is somewhat shorter and it hasn't been until the past decade or so that the data stored in a computer system has become more valued than the hardware itself.

The first commercially available hard drive held only five megabytes of data, and it wasn't until the 1990s that hard drives ranging in capacity from 20MB at the start of the decade to 20GB by the end became widespread. That availability, particularly for individuals and small- and medium-sized businesses, meant more and more indispensable data was finding its way on to computers.

As with any commoditized technology, the cost of hard drives began progressively dropping in 1994. Whether or not the hardware could be repaired became less relevant than whether or not the data could be resurrected.

It's this "flip flop" that has given birth to the discipline now known today as data recovery.

As the personal computer market matured, computer systems were actively adopted by businesses to the point now where almost every employee in an office has a computer on their desk and frequently one or more at home. Even retail operations were finding reasons to have computers at service counters.

WHERE DATA GOES, THREATS FOLLOW

With computers everywhere, information was facing all sorts of threats it had never faced before. While the storage technology itself has become highly reliable, there are still external, unpredictable threats that cause damage to hard drives and lead to data loss.

Physical damage remains one of the most common threats to computers, whether it's a personal computer at home, a laptop used for the business traveler, or a high-end server tucked away in a corporate data center.

Mother Nature is one of the worse offenders – storm damage can have a devastating physical impact on computer hardware. While power surges and power outages are more frequent, flood damage is often the worse culprit because it doesn't occur to individuals and businesses that flood levels could ever reach their hardware. The environment where a hard drive is stored is critical to the drive's longevity. Insufficient air cooling and circulation can cause the best technology to overheat.

While servers and desktops are rarely physically handled, laptops now account for more than half of computers sold, and users often forget that despite their smaller form factor and lighter weight, mobile computers are delicate pieces of equipment. Even the most ruggedly designed laptops still need to be handled appropriately. Physical damage always causes the vast majority of severe data loss problems. However, software, or logical, problems can be just as ruthless. Logical damage can be caused by even the most innocent of situations. Incorrectly shutting down a computer can prevent the file system from accurately re-allocating physical data blocks at the end of the user's session. This can lead to a variety of problems, such as invalid partition tables, drives reporting negative amounts of free space, system crashes or corrupted data.

Viruses are also a very common threat to hard drives. While some of them only affect the performance of an operating system, some viruses are specifically designed to delete data or corrupt partitions and file systems. Insufficient protection because of poorly configured or updated anti-virus software and firewalls can overcome the best hardware fail safes as can poor user behavior. Employees opening an e-mail attachment they don't recognize can be a frequent destroyer of important business data.

Most damage, whether it is physical or logical, cannot be repaired by end users and that's where the data recovery specialist comes into the picture. Opening a hard disk in a normal environment will allow dust to settle on the platter surfaces, causing further damage to the platters and thereby complicating the entire recovery process. In addition, end users generally do not have the hardware or technical expertise required to repair hard drives**.**

DATA VALUE RISING

Until the mid-90s, most users would simply take their hard drive to a service depot and resign themselves that some of their valuable information was lost forever.

As hard drives were relatively costly at the time, repair made financial sense. However, like many electronic devices, the cost of the hard drives came down to a point where replacing the drive was more reasonable than just a repair; hard drive repair shops found themselves having to adapt or face oblivion.

This do or die situation is in part why many data recovery techniques stem from processes used to repair hard drives. Understanding the various types of drives was just as important to the retrieval of data as it was to returning the hard drive to a properly functioning state.

It was also important to understand the various operating systems – Windows, UNIX, Novell and others – as they evolved. Newer operating system developments, such as Linux, have pushed data recovery firms to deal with evolving file systems.

In the early days, documented procedures for data recovery did not exist and hard drives never came with a recovery guide. For all intents and purposes, data recovery specialists had to innovate and invent their own proprietary techniques to deal with data loss as they encountered new situations.

In addition to there being no written guide for data recovery, the process of retrieving data requires a wide variety of equipment and tools. Data recovery companies have had to invest in their own labs to keep up with evolving technology. Flow benches and/or clean rooms are a necessity as are digital oscilloscopes, high powered microscopes, static dissipaters, proprietary software solutions and a warehouse of hard drives for part replacements. Each one is vital to maximize the recoverability of every single project.

SCHOOL IS NEVER OUT

While data recovery specialists are able to take one data loss experience and apply it to other situations for quicker recovery times, the learning process never ends since the storage industry and the technology it fosters continue to evolve.

The increase in capacity of hard drives single-handedly illustrates how data recovery experts have had to adapt. There simply is both more physical disk space to read and larger files that need to be recovered. An early 1990s hard drive may have only stored 100 MB of information, but now its commonplace to find one file which exceeds that size. Databases and large e-mail files can easily have file sizes well into the gigabytes.

Operating systems affect where and how much data is stored on the disks while new recording technologies are being introduced to increase storage density. For example, perpendicular recording (PR) is noted to be capable of delivering up to 10 times more storage density on the same recording media than longitudinal recording. This shift presents new challenges to data recovery companies as storage densities are predicted to exceed 1GB per square inch. More information can be stored on smaller disk surfaces and marketed into a variety of new devices. Laptops now ship with 100GB or more of disk space on 2.5 inch units while mp3 players and soon a multitude of PDAs will use PR drives in 1.8 inch form factors. Users are putting more and more vital data onto mobile devices which increases data loss occurrences and therefore increases the need for data recovery.

GREATER AWARENESS MEANS MORE WORK

Not only has the number of personal computers and data storage devices contributed to the

growth of data recovery as a discipline, but so has awareness within the storage industry and from users themselves. More users understand now that data is not completely lost just because they're confronted with a "blue screen of death" or because their computer won't start and seek out a solution to their data loss dilemma.

In addition, individuals and more so businesses simply cannot afford to give up on their data – whether it is too emotionally important to lose, too costly to re-create or, as often the case in the healthcare and financial sectors, required by legislation. Data recovery is a much more efficient and sensible course of action for information that needs to be retrieved quickly and effectively, especially before its absence causes the complete collapse of a business.

Fortunately, data recovery successes and overall recovery rates have improved in the past decade with professional firms enjoying retrieval success rates in the region of 85 per cent.

MORE DATA, MORE LOSS

Despite the immense technological advances in hard drive technology, data loss will always be with us and the instances of it will only increase, simply because there is more digital information coursing through increasingly more complex computing infrastructures. Human intervention will inevitably cause problems no matter how advanced the technology becomes.

The proliferation of new digital devices such as mp3 players, PDAs, ultra light-weight laptops, tablet computers and even external hard drives have placed data into the hands of individuals who in the past had very little digital information to worry about, even in the hands of those who may have avoided computers altogether. And since most of these devices are mobile, they are more likely to incur physical damage simply from day to day to handling.

Coupled with threats from Mother Nature, computer viruses as well as inevitable human error and it's a sure thing that professional data recovery specialists will continue to be kept busy creating new solutions to new problems.

About the Author: Tim Margeson

General Manager, CBL Data Recovery Technologies Inc.

Tim Margeson is General Manager of CBL Data Recovery Technologies Inc., a leading international provider of data recovery services to consumer, enterprise and public-sector clients who experience data loss disasters. In his role as GM, Margeson is responsible for the day-to-day operations of CBL's Canadian and US offices.

Margeson has been with CBL since the company's inception in 1993 and is well-versed both in the administrative, operational and technical aspects of the company's operations. He first held the position of Client Services Representative where he lent an empathetic ear and voice to distraught customers who called CBL seeking its assistance to recover their lost data. As Customer Service Manager, Margeson managed the North American team of Client Service Representatives and instilled in employees that the satisfaction of CBL's customers is his or her individual responsibility and duty.

As the storage market has evolved and given rise to new devices and technologies, so too has CBL witnessed a growing demand for its data recovery services which compelled the

company to expand the capacity of its North American data recovery laboratories. Margeson currently oversees the latest expansion efforts of CBL's corporate headquarters located near Toronto in Markham, Ontario, Canada's high tech capital.

Margeson also served as CBL Data Recovery Technologies' delegate on the Team Canada 2001 Trade Mission to China where CBL, under a cooperative venture with the Chinese government in 2000, facilitated the establishment of a data recovery laboratory in Beijing which is managed by China's Information Security Research and Service Institution of the State Information Center.

Prior to joining CBL, Margeson studied Political Theory at Trent University in Peterborough, Ontario.

DISKCON USA 2006, Celebrating the 50th Anniversary of the Hard Drive

The hard disk drive is celebrating its 50th anniversary and the future has never been brighter for the disk drive industry. The industry is expected to ship as many drives in the next five years as it did in the last 50 years. Industry analysts such as Gartner, IDC and TrendFOCUS continue to forecast impressive unit and revenue growth for the global HDD market.

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