

DIGITAL STORAGE TECHNOLOGY NEWSLETTER



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Table of Contents

INTRODUCTION	1
SYSTEMS / SUBSYSTEM STORAGE PRODUCTS	2
DESKTOP AND LAPTOP MARKET	7
CONSUMER ELECTRONICS MARKET.....	8
DISK DRIVES	17
STORAGE AND OTHER TECHNOLOGY	17
STORAGE COMPONENTS AND CAPITAL EQUIPMENT	19
ARTICLES	20
1) I know it's out there....somewhere.....	20
<i>A personal experience with data format obsolescence</i>	20
<i>How can we preserve older content</i>	21
<i>Examples of the dangers of format obsolescence</i>	21
<i>Solutions for families and individual users</i>	23
2) New magnetic recording areal density demonstrations	23
3) Dueling personal video players--Is there more to this than meets the eye? ...	24
PRODUCT / COMPANY NEWS NOTES	24
PERSONNEL NEWS	26
QUARTERLY NUMBERS UPDATE.....	28
NEWSLETTER SUBSCRIPTIONS	37

INTRODUCTION

This is the October issue of this newsletter and the second issue in the 2006-2007 annual volume.

We are adding some new features to the newsletter subscriptions. Your subscription to this newsletter will give you individual membership in the Entertainment Storage Alliance (www.entertainmentstorage.org).

Your subscription to the newsletter will allow you to get a \$100 discount on the annual Storage Visions Conference (next conference is January 6 & 7, 2007 in Las Vegas (www.storagevisions.com)). Storage visions is your chance to network with key people in the entertainment creation, distribution and reception market and the digital storage companies that serve them. Seating and hotel rooms are limited so register soon.

Again let your friends know about this newsletter. There is a subscription form at the end of the report. Feel free to pass this newsletter to your friends in the industry.

This issue provides updates on the regular storage and storage components news as well as two articles. The first discusses the implications of social networking and the creation of personal content on the growth of digital storage and the second discusses recent developments in hard disk drive areal density demonstrations and their implications.

SYSTEMS / SUBSYSTEM STORAGE PRODUCTS

Stealth mode start-up **Woven Systems** recently closed the second of two \$5-million tranches of funding, led by Goldman Sachs and Palomar Ventures, for the development of a 10-Gbit/s Ethernet switch aimed at enterprise server consolidation and storage networking. Other start-ups in this space have also received funding of late. **NetEffect**, a startup specializing in 10-Gbit/s Ethernet adapters based on **iWarp** -- a set of protocols designed to increase Ethernet's performance in high-performance computing (HPC) environments -- scored \$25 million in Series B funding. **Chelsio**, which recently received \$12 million in funding, and **Neterion**, which has partnered with IBM, claim to be in preproduction as well. Chelsio has tentatively put a timeframe of the first quarter 2007 for official release of its product. **Broadcom**, which purchased iWarp vendor **Silquent** a year ago, is said to be readying a product for release by the end of 2006.

Scentric recently came out of stealth with software that classifies and archives databases as well as unstructured data and email, a capability also claimed by **Solix**.

According to a **Channel News Asia** August 1 article: Small- and medium-sized businesses across Southeast Asia, including Singapore, are on track to spend US\$630 million on data storage-related investments in this year alone. Industry professionals say that even smaller companies are now recognizing the need to stay competitive by having faster access to business and customer information offline, as well as providing services online.

Kilopass Technology, a leading provider of semiconductor non-volatile memory (NVM) intellectual property (IP), and **BitMICRO Networks**, a maker of intelligent flash solid-state disk (SSD) solutions, announced that the companies have signed a corporate license agreement. BitMICRO is integrating Kilopass' XPM embedded, non-volatile memory technology in its next-generation system-on-chip (SoC) devices and large capacity E-Disk flash solid-state disks.

BlueArc Corporation announced that the company has qualified and integrated the latest storage arrays from **LSI Logic** into its high-performing Titan 2000 network storage systems. The new storage arrays, shipping immediately, deliver increased storage performance and density to customers, feature a 4-gigabit data pipeline, more throughput on both reads and writes, and RoHS compliance.

Data Domain announced today that the U.S. Patent and Trademark Office has granted Data Domain Patent Number 7,065,619 entitled "Efficient Data Storage System." This patent covers key technologies to allow inline deduplication of data at high speed.

DataDirect Networks has released the S2A9550, a dense and high performance storage system. The S2A9550 designed for high performance, high capacity network storage applications. The product provides up to 3 GB/s, enhanced and automated data protection, and 560TB in a single storage system. The product provides both block level and file system storage for open system computing environments.

Citrix Systems is making further moves towards the WAN/WAFS optimization space. The software company paid \$50 million in cash, plus a vested interest in some stock-based instruments, to acquire WAN optimization vendor **Orbital Data**. Citrix was attracted to Orbital in part because, in addition to offering WAN optimization appliances, it has managed to create software that duplicates the functions of those appliances on a regular PC.

CommVault and **Network Appliance** signed an agreement to deliver CommVault Galaxy Express Backup & Recovery software with the StoreVault S500 all-in-one network storage appliance to appeal to the SMB market.

Driven by increasingly stringent compliance regulations and growing demand for business continuity, demand for disk-based data protection is set to soar over the next four years, according to **IDC**. The company expects that this sector will have global sales of \$8 B this year exploding to more than \$50 B in software and hardware revenues by 2010.

Exabyte Corp. introduced the Magnum 448 LTOT (UltriumT) Tape Library, bringing scalability and enterprise-class functionality to SMB/departmental and remote office/branch office users. At an estimated street price starting at \$7,950,

the Magnum 448 delivers performance, capacity, reliability and features at the most aggressive pricing of any tape library available today.

Hitachi-Maxell will reportedly ship the first holographic storage media by Christmas, according to executives of the Japanese company. Rich D'Ambrise, director of technical marketing at Maxell, said that 300-Gbyte holographic disks will begin shipping either in November or December, as **InPhase Technologies**, the developer of the holographic technology, said last year. the company will move to a second-generation, 800-Gbyte disc in 2008, and has targeted a 1.6-Tbyte removable cartridge by 2010. the first incarnation of the InPhase technology would be used for archival purposes. media will be roughly \$120 to \$180 apiece, and drives will cost about \$15,000.

Hewlett-Packard announced an iSCSI SAN product for the SMB market that started to ship in September at a cost of about \$5,000 for 1 Tbyte, plus a complete set of management software. The announcement came a month after **Network Appliance** launched its StoreVault SMB system and a week after **EMC** CEO Joe Tucci said his company will expand its platform of SANs for SMBs. Debbie Young, HP's marketing manager, estimates the SMB storage market could hit \$2.5 billion in 2008.

Hong Kong-based **Huawei-3Com** (H3C) is putting together the pieces to make an Asian IP SAN push, using US partners for key components. H3C has revealed partnerships with IP software vendors **FalconStor** and **Intransa**, chip startup **iVivity**, and systems OEM **Xyratex**. H3C is a joint venture between Chinese networking vendor Huawei and U.S.-based 3Com.

lomega has doubled the capacity on its removable REV drive to 70 Gbytes. The drive is available in both internal and external versions; the USB 2.0 version of the lomega REV 70GB drive is \$599.95 while the internal drive will cost \$579.95. An individual 70-GB REV disk will cost \$69, or \$249 for a four-pack.

Microsoft entered the IP-SAN space by announcing the availability of the iSCSI Software Target Application Pack, which will be distributed to Windows Storage Server 2003 R2 OEMs. With the new offering, Microsoft using technology that it purchased from **String Bean Software**, which it has rebranded into the Application Pack.

Japanese hardware maker **Plextor** will release in the middle of September the PLEXERASER, a device that will help users and enterprises avoid leakage of sensitive data stored on CD/DVD media by destroying them in a few minutes. The device looks like an ordinary PC drive and will be available in the Japanese market first, for about 25,000 yen. The product operates as a stand alone external device, which means that no PC connection is required. When a disk is inserted into the drive, its data are automatically destroyed.

DataDirect Networks Inc., the storage performance leader, has added to its full range of industry proven nearline solutions with its S2A9500 Archive Solution, the industry's most reliable and scalable SATA disk based archive storage solution aimed at filling the gap between enterprise disk storage and archival tape. The product scales up to 480 TB capacity.

Nexsan Technologies' SATABeast packs 21TB of raw storage into a 4U (7-inch) chassis. A fully loaded SATABeast, with 21TB of raw capacity, costs \$42,100.

Network Appliance announced it is integrating its NearStore VTL Shadow Tape backup product with **Veritas** NetBackup and similar product packages from **BakBone**, **CommVault** and **Syncsort**.

Sun Microsystems, Inc. introduced the Sun StorageTek modular storage family and the first two products in the family -- the Sun StorageTek 6140 and 6540 arrays. The StorageTek 6140 array is a ROHS-compliant, 4 gigabits-per-second (Gb/sec) Fibre Channel (FC) array designed for both direct attached and SAN attached storage. The system features a fully redundant architecture with drive intermixing (FC or SATA-2 disk drives), 8x 4 Gb FC ports, 4GB cache, application-oriented management, switched drive connectivity, and a maximum capacity of 112 disk drives. The StorageTek 6540 array is a ROHS-compliant, 4 GB/sec Fibre Channel (FC) array focused on large databases and high-performance computing. The system features a fully redundant architecture with drive intermixing (FC or SATA-2 disk drives), 8x 4 Gb FC ports, 16 GB cache, application-oriented management, switched drive connectivity, and a maximum capacity of 224 disk drives.

According to a new report released today by **Heavy Reading Enterprise**, organizations of all sizes will increase spending for security products and services over the next two years: 66 percent of respondents from both large- and medium-sized companies and 55 percent of small companies.

Xiotech unveiled support for Fibre Channel-attached SSD drives on its Magnitude 3D 3000 storage systems, citing significant performance benefits over traditional disk. Xiotech, of course, is not the only vendor playing in the SSD space. In addition to Texas Memory Systems, BitMicro Networks, M-Systems, and Solid Data Systems are also pushing the technology.

3PAR has introduced a stripped-down version of its enterprise-class S-series InServ storage server designed to appeal to departments, replicated sites and remote data center segments of its enterprise and service provider customer base. The midrange InServ E200 Storage Server comes complete with the same software as the S400 and S800 InServ Storage Servers, including capabilities like rapid provisioning, dynamic optimization, thin provisioning, virtual copy and remote copy.

Asigra \launched Televaulting 6.2 with a CDP option. Asigra concentrates on backing up data from remote sites to data centers over the WAN. Most of Asigra's customers are service providers and enterprises with at least five remote sites.

Storage vendor **Capricorn Technologies Inc.** announced Wednesday that it is shipping new versions of its PetaBox storage products, built around power-efficient motherboards from **VIA Technologies Inc.** in Taiwan. The new offerings include GB3000, a 3 terabyte (TB), 1U standalone solution and the TB120, a 120 TB storage system built from racked GB3000s. Based on the VIA EPIA Mini-ITX motherboards, the new products in the PetaBox line deliver a very low Total Cost of Ownership (TCO) for data storage, the company said. The products have an entry price of US\$1.50 per GB.

D-Link began shipping its xStack Storage iSCSI 3000 series product line for small- to medium-sized businesses. The D-Link DSN-3200 with eight one-gigabit-per-second Ethernet ports can run up to 15 drives with storage capacity of more than 11 terabytes and handle more than 65,000 input/outputs (I/Os) per second. The D-Link DSN-3400, with a 10GbE interface, will be available in November.

The **U.S. Department of Energy** (DOE) is investing \$11 million in a project to solve the storage problems of high-speed supercomputers, a move which may ultimately help enterprises handle their own spiraling storage demands. The money is being used to fund the Petascale Data Storage Institute a research group of universities and government labs, led by Carnegie Mellon University, which will tackle the storage challenges posed by next generation supercomputers. With users now planning to deploy "petaflop" machines capable of a quadrillion (a million billion) calculations a second, the strain on storage will be immense.

Backup solutions vendor **ExaGrid Systems Inc.** has introduced the ExaGrid 2.3 Disk-Based Backup System, featuring additional data restore features for disaster recovery, enhanced flexibility for SQL (structured query language) databases, and expanded backup application support. ExaGrid 2.3 includes a number of product enhancements, including a facility for selectively copying data to a second site system. It allows customers to select the portion of their onsite backup data they want transferred to their second-site ExaGrid system for data restore for disaster recovery.

Hitachi Global Storage Technologies announced that it is offering a new enterprise-class version of its field-tested 3.5-inch Deskstar 7K500 Serial-ATA (SATA) hard disk drive. Called the E7K500 Serial-ATA (SATA) hard disk drive, the new 500 GB (gigabyte) drive delivers one million hours Mean Time Between Failure (MTBF), and comes with a five year warranty.

IBM is offering their N7000 unified storage product based on **Network Appliance** technology that provide end-to-end systems for enterprise class NAS (network-attached storage) and iSCSI offerings, ranging from 50-person businesses to large data centers. NetApp will produce the N7000 Series as branded IBM products while concurrently selling similar models under its own name.

Ponemon Institute LLC and **Vontu Inc.**, a San Francisco-based provider of data loss prevention products, conducted a survey of nearly 500 information security professionals. They found that eighty-one percent of companies surveyed reported the loss of one or more laptops containing sensitive information during the past 12 months.

Tandberg Data has acquired the U.S. data storage company Exabyte Corporation for USD 28 million. The merged company will have expected revenues of USD 215 million for 2006.

Hitachi Data Systems is also said to be working through the due diligence process to acquire high-end network attached storage supplier, **BlueArc Inc.**

DESKTOP AND LAPTOP MARKET

Jeffrey Wu, an analyst from research firm **iSuppli**, states that the number of notebooks made in the Shanghai region of China will increase from 82.6 percent of the world wide production in 2006 to more than 90 percent by 2008.

At the end of the second quarter, **Advanced Micro Devices** had 26 percent of the market for servers built on PC chips, more than double the share a year earlier, according to **Mercury Research** of Cave Creek, Ariz.

Apple Computer announced that it had completed a swift transition to computers based entirely on Intel processors.

Seagate, which closed its acquisition of **Maxtor** in May, will continue to use both the Seagate and Maxtor brands, with each having its own identity for a particular range of products.

An **In-Stat** report in July claimed that SSD's could get up to 50% of the total PC market by 2013. The company surveyed 389 mobile computer users and researched the current trends in Flash development to come to this conclusion. Their arguments are that there are user segments for which drive capacities far exceed the user's need and that users are willing to pay a premium for perceived advantages of SSDs.

Other World Computing (OWC) introduced it's Quad Interface Mercury Elite-AL Pro equipped with USB, FireWire 400, FireWire 800, and eSATA connections in

a single external HD solution up to 750GB, enabling plug-and-play operation with virtually any computer system.

IBM says it is making its Tivoli Continuous Data Protection for Files available through online retailers such as **Circuit City**, **CompUSA**, and **Staples** through a distribution agreement with Digital River. IBM's software costs \$35 per laptop or desktop PC. IBM anticipates individuals and small businesses using the CDP package to back up data to online servers through a broadband service provider, or to a server or USB drive in the home or office.

Intel introduced its desktop Core 2 Duo processors, also known as "Conroe." Conroe will have its two cores on the same silicon die, enabling faster inter-processor communication and a shared L2 cache. The basic Core 2 Duo family will consist of four processors: the E6300, E6400, E6600, and E6700. They will run at clock speeds of 1.86 GHz, 2.13 GHz, 2.40 GHz, and 2.67 GHz, respectively. The E6300 and E6400 will be equipped with a 2-MB L2 cache; the other two models will have a 4-MB L2 cache. All will have a 1,066-MHz front-side bus, and will pack 291 million transistors onto a 143 square-meter slice of silicon.

lomega Corp. has announced the availability of its new Desktop Hard Drive eSATA/USB 2.0 320 GB. The product's eSATA interface features triple the transfer rate of USB 2.0 for ideal performance with any application, from video editing to backups.

In March **Dell** agreed to acquire Alienware, a Miami-based maker of high-end PCs popular with gamers. Then on Sept. 28, the embattled Hewlett-Packard made a surprise acquisition of **VoodooPC**, a small, privately held Canadian company that also makes gaming-oriented personal computers.

CONSUMER ELECTRONICS MARKET

Seagate's Bill Watkins has stated that 120 GB 1.8-inch drives for portable video player applications will be available by December 2006. There may be some positive impact for Seagate in the CQ4 2006 quarter from the introduction of their new form factor product. By 2007 the 1.8-inch market will have several players with Toshiba, Hitachi, Fujitsu and Seagate (and possibly WD) all competing for this growing market segment.

Time Warner's Warner Bros. announcing back in May that it would try selling movies through **BitTorrent**. Meanwhile, the newest four movie studios to sign on with BitTorrent are relatively obscure names -- **Hart Sharp Video**, **Koch Entertainment**, **The Orchard**, and **Egami Media**, a unit of **Image Entertainment**. These studios, all described as independent outfits, plan to offer subscriptions to BitTorrent users, as opposed to Warner Bros.' pay-per-title plan.

Akimbo will be integrated with Roxio Venue, **Sonic**'s media application, providing service access to a broad base of PC users and letting them easily browse, purchase, manage and enjoy Akimbo's growing selection of over 14,000 programs. In the future, Akimbo plans to also incorporate Sonic AuthorScript® DVD-on-Demand™ technology so participating content partners can enable consumers to record downloaded entertainment to DVD.

Apple shipped 1,327,000 Macintosh computers and 8,111,000 iPods during the second quarter, representing 12 percent growth in Macs and 32 percent growth in iPods over the year-ago quarter, the company reported.

Apple has laid legal claim to the word "Pod," arguing that other companies that use the word as part of their product names risk infringing the trademark of its popular iPod music player.

Pericom Semiconductor Corp. recently developed 3.3-V devices that it claims are the first to support both USB 2.0 High Speed and high-fidelity audio signals in a single chip. The PI3USB411 and PI3USB412 USB 2.0 devices can switch high-speed differential signals at a rate of more than 1.2-Gbits/s, as well as low THD audio signals. The devices also feature USB 1.1 and USB 2.0 Full Speed support, high bandwidth (more than 600-MHz for USB channels), sub-1-ohm Ron (0.5-ohm typically) for audio channels, as well as off-isolation and crosstalk for all channels.

New Research from **The Diffusion Group** Finds One-Fourth of broadband consumers would be interested in an **Apple** iTunes Movie Download Service. According to new research from The Diffusion Group, close to 25% of broadband households would be interested in an iTunes online movie service if titles were priced at \$10 each. On the Viability of an iTunes Movie Service - Consumer & Strategic Perspectives, found that 23% of broadband households were to varying degrees interested in such a service but that interest declined rapidly as price per title increased. Total interest declined to 14% at \$15 per title, 12% at \$20 per title, and 10% at \$25 per title.

Cornice announced a 12 gigabyte (GB) capacity point to the existing one-inch Dragon product line designed for consumer electronics OEMs. It will allow OEMs to offer thinner and higher-capacity consumer electronics (CE) devices while featuring industry-leading robustness, durability, and low power requirements for everyday consumer use. The ultraportable 40mm x 30mm x 3.5 mm hard drive weighs in at 10.5 grams. Cornice not only boosted the capacity of its Dragon line, but it also decreased power consumption by 50%. Cornice's unique Crash Guard technology protects the drive from the rigors of everyday use and consists of Active Latch, Skip Control and Drop Safe which locks the head in the event of a drop.

The **Nike+iPod** Sport Kit, listing for \$29 and available from **Apple**, is designed specifically for the Nike+ footwear line and is touted as the first in a line of

collaborative projects between the two companies. A sensor and receiver embedded in the shoe provide a wireless link to the iPod, with workout information stored on the device and displayed on the screen. Runners receive audible feedback through the headphones, and data stored on the Nano can be downloaded to a Mac or PC after a run.

DirectTV unveiled its *second* HD DVR. More than a year in the making, the new HD DVR will eventually replace the DirectTV HD TiVo as the company's high-end DVR unit. The service has offered HD for quite some time, including HD versions of HBO, Showtime, ESPN, HDNet, and more. However, DirectTV's gameplan for the next several years includes using a trio of new satellites to carry many more stations in HD, including local channels in many major US markets. Those new satellites will transmit their HD content in the MPEG-4 codec, however, meaning that the existing HD TiVo user base won't be able to view or record the new channels.

Eighteen-to 26-year-old Gen Yers are integrating technology into their daily lives at a faster rate than any other generation, according to **Forrester Research, Inc.'s** North American Consumer Technology Adoption Study 2006 Benchmark Survey of 66,707 US and Canadian households. According to the study, Gen Yers spend 12.2 hours online every week 28 percent longer than 27- to 40-year-old Gen Xers and almost twice as long as 51- to 61-year-old Older Boomers. Gen Yers are also much more likely to engage in Social Computing activities while online. For example, they are 50 percent more likely than Gen Xers to send instant messages, twice as likely to read blogs, and three times as likely to use social networking sites like **MySpace**.

Hewlett-Packard researchers have developed a non-volatile memory chip with wireless networking capabilities that is roughly the same size as a grain of rice. Prototypes of the Memory Spot chip developed by HP Labs contain 256K bits to 4M bits of memory and can transfer data wirelessly at speeds up to 10M bits per second (bps). This amount of storage allows the chips to hold a short video clip, digital pictures, or "dozens of pages. Memory Spot chips get their power using a technique called inductive coupling, which allows power to be transferred from one component to another through a shared electromagnetic field. In the case of Memory Spot, this power is supplied by the device that is used to read and write data on the chip.

According to an **IDC** survey, while less than a quarter of consumers surveyed globally report currently owning a flat screen TV, but that number tripled in of the number of respondents who plan to purchase a flat panel TV by the end of this year.

Micron Technology, Inc., and **Intel Corp.** have begun sampling NAND flash memory built on 50 nanometer (nm) process. The samples were manufactured through **IM Flash Technologies**, a joint development and manufacturing venture

from Micron and Intel. Both companies are sampling 4 gigabit devices now, with plans to mass produce a range of densities on the 50nm node in 2007.

The worldwide subscriber base for Internet protocol TV (IPTV) services is expected to expand by a factor of more than 26 from 2005 to 2010, spurring a competitive battle between video providers both old and new, **iSuppli Corp** predicts. Global IPTV subscribers will grow to slightly more than 63 million in 2010, rising at a compound annual growth rate (CAGR) of 92.1% from 2.4 million in 2005. The IPTV subscriber base will generate more than US\$27 billion in overall IPTV services revenue in 2010. While video services will account for the largest portion of these dollars, value-added media services and IPTV operator advertising will combine to represent more than 14% of IPTV services revenue in 2010. Furthermore, across all IPTV services, the corresponding content licensing revenue will reach US\$11 billion in 2010.

Annual mobile music revenues will top \$14bn worldwide by 2011 – according to the latest report from **Juniper Research** - with Asia Pacific expected to contribute 40% by this time, Europe 27%, North America 18% and Rest of the World 15%. During the period 2006-2011 total revenues from mobile music services (including ringtones, ringback tones and OTA full track music) will see the proportional market share for ringtones fall from 81% to 51%, with OTA full track music rising from 9% to 32%.

According to **NPD** in the last year, the number of mobile phones sold with removable media slots has shot up more than 250 percent -- from 567 thousand phones in Q2 2005 to two million in Q1 2006. The most popular removable media format in the first quarter of 2006 was microSD, which now comes installed in nearly half of all phones sold with removable media slots. The next leading format in Q1 2006 was miniSD, installed in 31 percent of removable-media phones.

If mobile video providers are able to resolve a number of quality- and content-related issues -- and analyst firm **Infonetics Research** thinks they are -- revenue generated from mobile video services around the world is set to skyrocket from \$46.2 million in 2005 to \$5.6 billion in 2009, a staggering 11,997% jump in 5 years.

Samsung Electronics Co., Ltd., the leader in advanced semiconductor technology, today announced that it has begun mass producing an 8-Gigabit (Gb) NAND flash memory device. Mass production of the new 8Gb chip allows Samsung to offer an 8-Gigabyte (GB) solution by vertically stacking two 4GB packages, each package carrying a vertical stack of four 8Gb dies. Samsung plans to further utilize its 8-Gb NAND flash memory chip in Samsung's high-density MLC NAND, called moviNAND, to produce a 2GB-level NAND market solution. The recently introduced moviNAND combines NAND flash memory and a NAND controller and can be embedded in mobile handsets to accommodate

the high data storage requirements that accompany the increasing number of multimedia features on mobile phones.

SanDisk, announced on July 30 that it is acquiring Israeli data storage company **M-Systems** for \$1.55 billion in an all-stock transaction. M-Systems will become a wholly owned subsidiary of SanDisk, which said it will now be able to develop next-generation flash-enabled consumer applications for handsets, a SanDisk spokesman said.

The latest report from **eMarketer**, IPTV The Global Picture, projects that the total number of broadband households worldwide will grow to approximately 422 million by 2010. Of that number, 139 million will have sufficient bandwidth to receive IPTV. This excludes cable broadband subscribers who are unlikely to be offered an alternative method of receiving their TV programming soon.

Sony, Hitachi, Masushita/Panasonic, Sharp and **Toshiba** expect to begin selling IPTVs by early next year and forecast demand for 10 million to 20 million units by 2011. The partners reportedly set up the TV Portal Service Corp. company in July with Sony and Matsushita each holding 35 percent interest and the others holding 10 percent each.

A recent study by **Forrester Research** suggests that on-demand movies hardly cannibalize DVD sales. Households where someone recently watched an on-demand movie bought only 1 percent fewer DVD's each year than they had before they discovered the cable service, which amounts to about one-tenth of a disc. The survey contacted 4,581 households in late 2005; 321 said they had watched an on-demand movie within the last three months. Many of these households apparently do not consider video-on-demand a substitute for owning DVD's, said Josh Bernoff, an analyst at Forrester. "Just because it's available on demand and they can see it once doesn't mean they no longer want to purchase it," he said. But the story was different for DVD rentals. Video-on-demand watchers said they rented about 11 percent fewer movies than before.

Warner, the world's fourth-largest music company, is in the final stages of securing technical licenses that will enable it to sell a bundle of music and extra features on a single DVD. The DVD would include a music album that plays in both stereo and surround-sound on a standard DVD player -- plus video footage that plays on a DVD player or a computer. There will also be song remixes, ring tones, photos and other digital extras that can be accessed on a computer.

The market for legal movie downloads is still small with a handful of competitors like **Movielink**, **Vongo** and **CinemaNow** offering a fraction of the 60,000 titles available on DVD. Nonetheless, industry watchers and Hollywood studios--most of which have invested in download companies--believe the arena will one day eclipse store- and mail-based DVD rentals now dominated by **Blockbuster** and **Netflix**. As a result, investment in technologies to deliver movie downloads is

leaping forward. CinemaNow launched a service that lets consumers download movies and burn them directly onto DVDs to be played on standard DVD players. Selection is limited though, with about 100 older titles, such as 2003's "Charlie's Angels: Full Throttle" and 1992's "Scent of a Woman," available for the download-to-burn offer.

According to a new forecast by **Lyra Research** camera phones have now become the most prevalent image-capture devices in the world. The global installed base of camera phones has now surpassed that of film and digital cameras combined. Lyra estimates that the installed base of camera phones will reach approximately 850 million units in 2006, and this number is expected to grow to more than 1.5 billion units in 2010.

Amazon Unbox, will offer content from six major Hollywood studios, including **20th Century Fox** and **Warner Bros.**, as well as TV networks such as **CBS** and **Fox**, and cable channels like **Comedy Central** and **E! Entertainment**.

"Hitch," "24" and "Buffy the Vampire Slayer" are among the movies and television shows that **AOL** will sell through its new video portal under deals the Internet company has forged with major Hollywood studios.

Apple Computer Inc. said it will begin selling movie downloads from **Walt Disney Co.**'s film studios, aiming to turn its iTunes online music store into a one-stop shop for digital entertainment.

JupiterResearch, a leading authority on the impact of the Internet and emerging consumer technologies on business, finds that while consumers are interested in watching video on their cell phones, the majority of mobile subscribers are not willing to pay for it. According to a new JupiterResearch report, "Video on Cell Phones," eleven percent of mobile phones will be video capable in 2006, but only one percent of mobile subscribers will pay for a subscription this year.

The number of households around the world subscribing to Internet Protocol television (IPTV) services offered by telecom carriers will reach 48.8 million in 2010 according to **Gartner, Inc.** Buoyed by new service launches, IPTV subscribers will more than double in 2007 from an expected 6.4 million in 2006 to 13.3 million.

Toshiba Corp. and **Memory-Tech Corp.** have developed a three-layered hybrid DVD/HD-DVD ROM disk that would enable the reading of two data formats on a single-sided disk. The partners said they will propose the format to the DVD Forum and hope to make commercially available early next year. In December 2004, the companies together proposed the DVD Twin Format, a single-side, two-layer disk to store both DVD and HD-DVD content. That format hit the market in April 2006.

Pretec has released the 1st 16GB USB Flash Drive, the highest capacity thumb drive in the world.

HP introduced two home storage products for storing high-definition movies and rich digital content such as music and photos. The HP Media Vault, the first in a new product category for the company, is an expandable storage product that allows consumers to easily back up and share movies, music and photos across home networks. The HP Pocket Media Drive is an ultra-portable, 2.5-inch USB hard drive in 80 gigabyte and 120 GB capacities.

Note that if **Seagate's** new 120 GB 1.8-inch disk drive is incorporated into video music players such as the iPod it will offer laptop-like storage capacities in a pocket-sized device enabling many hours of video storage in a single device. With this product introduction Seagate will challenge existing suppliers Toshiba and Hitachi. Fujitsu and Cornice and possibly others will enter this market by 2007 leading to increased competition for this fast growing HDD form factor.

Toshiba Storage Device Division extended PMR technology to its "short" 1.8-inch HDD family. With a 10 percent smaller footprint than its first-generation 1.8-inch PMR HDDs and up to 80 GB of capacity. The 4,200 RPM, single-platter, 40 GB MK4009GAL and double-platter, 80 GB MK8009GAH products are specially designed for consumer electronics devices and ultra-portable PCs to provide higher capacity in a smaller form factor. These HDDs deliver an increased areal density of 134 gigabits per square inch and offer improved media rates of 356.8 Mbps.

iSuppli Corp. is predicting the global VOD market will grow to nearly \$13 billion by the year 2010. VOD growth will be driven by various delivery systems, including Internet Protocol Television (IPTV), broadband/Internet and networks run by cable and satellite operators. While 2006 will be a banner year for the VOD market, the real explosive growth will begin in 2008 when these delivery systems begin to mature. By 2010, the global VOD market will generate more than \$12.6 billion in revenue, up from \$1.7 billion in 2006, iSuppli predicts.

Msystems announced that mass production of the mDOC H3 embedded flash drive (EFD) has commenced and will start shipping to top-tier customers. Although initial announcements stated that mDOC H3 would have a write speed of 4-megabytes per second and a read speed of 10-megabytes per second, msystems has already achieved write speeds of up to 7-megabytes per second and read speeds as high as 25-megabytes per second. The high system performance of mDOC H3 is enabled by its advanced architecture and its embedded TrueFFS®-based flash management software, which operates internally within the chip as firmware.

Microsoft announced that HD content playback (such as BluRay and HD-DVD movies) on 32-bit computers with Vista will not be supported at the request of movie studios. Microsoft does plan to support HD playback on 64-bit computers.

Microsoft will start testing on Tuesday an Internet video-sharing service called Soapbox. Soapbox (<http://soapbox.msn.com>) is one facet of Microsoft's strategy to create attractive Internet content to lure away billions of Web advertising dollars from market leaders Google and Yahoo. Soapbox will be offered to a limited number of users during an invitation-only test phase, but Microsoft said on Monday it will go fully live as a part of MSN Video within six months. Microsoft is a late arrival into the crowded video-sharing market, following offerings from Google, Yahoo, Time Warner Inc.'s AOL unit and News Corp.'s social networking site MySpace. Note that there has been considerable recent consolidation in this market with Sony buying **Grouper**, News Corp. buying **MySpace** and Google purchasing **YouTube**.

Toshiba will be manufacturing the **Microsoft** Zune personal media player which the company is selling for less than the Apple iPod with the same 30 GB storage capacity, a larger screen (3" vs 2") and wireless capability. Microsoft has big plans for the wireless networking feature. Zune users will be able to send songs, photos, playlists and albums to other Zune devices. And users will be able to act as a virtual disc jockey using a feature that allows them to stream music to up to four other Zune devices.

Telephia in a recent report stated that ABC News is the Most Watched Mobile TV Channel, While CNN is No. 1 in access reach. The mobile TV audience grew 45 percent to 3.7 million subscribers in Q2 2006, according to Telephia. Total quarterly mobile TV revenues increased to \$86 million last quarter, an increase of 67 percent since Q1.

According to a survey of mobile industry professionals by **Mercer Management Consulting**, seven out of 10 don't believe that mobile TV will capture any sort of critical mass in the next three years. Each of those subscribers who do tune in will generate only \$5 of extra average monthly revenue by 2009. Surprisingly, there was no consensus on whether mobile phones will replace the iPod in the next three years.

South Korea passed a milestone for mobile TV in June by hitting the one million subscriber mark for its terrestrial mobile TV service. Currently, there are six terrestrial mobile TV broadcasters that offer ad-supported video content to Koreans who own terrestrial digital multimedia broadcast (T-DMB) handsets. On average, South Korean mobile TV subscribers watch about one hour of TV programming per day on their phones. **Japan** entered the commercial mobile TV arena in March 2006 with the launch of commercial mobile TV services. Using the same radio frequencies as digital television, the Japanese mobile TV market should get a regulatory bump in 2008 when mobile TV becomes a separate

service category from regular TV. 2008 will also be an important year for mobile TV in **China**. The country has publicly committed to having a robust mobile TV infrastructure in place in time for the Beijing Olympics. China's two largest mobile operators, China Unicom and China Mobile, announced mobile TV trials for 2007 along with pending announcements for TV-enabled mobile handsets, probably near the end of 2006.

The market for long form mobile/portable video content (video content of greater than 30 minutes) is currently in an experimental phase, and will likely remain at this stage for at least two years, reports **In-Stat**. By 2008, however, the industry will begin to gain traction and demonstrate its long-term potential, the high-tech market research firm says.

SanDisk has announced V-Mate, which turns a flash memory device into a portable video recorder. It can record video from a TV, cable, satellite or over-the-air, set-top-box, DVD player, personal video recorder, like TiVo, or a VCR. The V-Mate memory card can then be inserted into a mobile phone, video music player, hand-held game console, or notebook computer and the video replayed.

STMicroelectronics announced a new and enhanced version of its 32-Mbit Flash memory chip that is intended specifically for the automotive market. Offering high-speed memory access over a wide operating temperature range, the M58BW32F is designed for automotive customers' needs for power train and transmission-control modules, and for other high-performance automotive systems that use the latest generation of 32-bit microcontrollers.

A Chinese DTV alliance is being formed here with the goal of developing intellectual property that will help reduce patent payments to U.S., Japanese and European companies. The alliance brings together 13 top Chinese TV manufacturers, including **Haier, Changhong, Hisense, SVA, Shinco** and **Skyworth**. It will be led by the **China Video Industry Association (CVIA)**, according to Hao Yabing, vice secretary of CVIA.

Shipments of dual-mode (cellular/voice over Wi-Fi) wireless handsets will be well in excess of 300 million worldwide in 2011, but the arrival of femtocell access points may prove disruptive for the market, according to **ABI Research**. Of the 300 million units shipped, handsets based on the 802.11n protocol will outnumber those based on other protocols. By 2012, worldwide mobile capex would exceed \$150 billion, the research firm said.

User-Generated Content (UGC), such as that found on **YouTube** and **MySpace**, will continue to grow significantly in popularity and generate increasing revenue over the next several years, reports **In-Stat**. By 2010, the volume of downloads/views on these sites will surpass 65 billion, and revenues tied to UGC video are expected to exceed \$850 million by 2010. Revenues are those directly

linked to videos in the form of banner/skyscrapers, embedded video, **Google AdSense**, and/or branded pages/channels.

DISK DRIVES

Seagate Technology has combined Unified Serial Controllers from **Adaptec** with its own Cheetah 15K 146GB Serial Attached SCSI (SAS) disk drives in an SAS Evaluation Kit to Seagate system builders and resellers. Adaptec Unified Serial Controllers - the Adaptec Serial Attached SCSI RAID 4800SAS and 4805SAS - support both Serial ATA and SAS disk drives.

ArcSoft has developed a customized version of ArcSoft TotalMedia Backup, called WD Backup for the **Western Digital** My Book series of external hard drives.

Fujitsu Limited has announced the release of its MHW2 BH series of 2.5-inch hard disk drives (HDDs) for laptop computers. The 2.5-inch MHW2 BH hard disk drives are the first Fujitsu products to feature perpendicular magnetic recording (PMR) technology for enhanced storage capacity. Using PMR technology has helped Fujitsu to achieve a capacity of 80 GB (gigabyte) for one disk, and 160GB for a two-disk drive.

Hitachi Global Storage Technologies introduced the a 2.5-inch version of its CinemaStar product line. With an upper capacity of 160 gigabytes (GB), the new 2.5-inch hard disk drive is made for the next iteration of slim digital video recorders (DVR) by incorporating features that optimize the storing, retrieving, streaming and editing of digital video. The new product, called CinemaStar C5K160, is based on the Travelstar 5K160 notebook hard drive.

Western Digital introduced its first hard drive that uses perpendicular magnetic recording (PMR). The new 2.5" Scorpio drive stores up to 160 GB.

Toshiba Corporation announced that it would ship a cumulative 40 million 1.8-inch HDDs by October 2006 (it started in 2000).

STORAGE AND OTHER TECHNOLOGY

Freescale is shipping what is claimed to be the first commercial Magnetoresistive Random Access Memory (MRAM) chip. MRAM, which combines magnetic materials with conventional silicon circuitry, can deliver RAM-like speeds and flash-like nonvolatility. In contrast to conventional flash EPROM technology, MRAMs offer unlimited rewritability, a characteristic known as "endurance." Additionally, unlike flash memory, MRAM offers fast read/write cycle times -- currently 35 nanoseconds. The first commercial MRAM chip is a modest one, offering just four megabits (Mbits) of data storage and intended to

replace typical battery-backed SRAMs. The MR2A16A supports a commercial temperature range, and is a 3.3 volt device with 35 nanosecond read and write cycle times. It is an asynchronous memory organized as 256K words by 16 bits.

Heat-Assisted Magnetic Recording (HAMR) technology created by **Seagate Technology** may include a tough nanotube-based lubrication to allow the read/write head of a disk to get closer to the surface. HAMR requires the magnetic material to be heated during the writing phase, but this causes the lubricant film deposited on top of the magnetized recording layer to evaporate. Seagate's has a patent that resolves this problem by having a reservoir inside the disk casing that contains nanotube-based lubricant. Some of this is periodically pumped out as a vapor and deposited on the surface of the disk, replenishing the evaporated lubricant. The vapor deposition process is similar to that used in the production of CDs and DVDs.

Researchers at the **Center for Nanoscale Science and Technology** in Portland, Oregon, announced the development of a single-atom switch, which could be used to make high density memories. The switch is comprised of a Cobalt atom at the end of a chain of Copper atoms. When a small current is applied across the switch, it changes its physical orientation in the structure, but remains attached to the Copper atoms, which appear unaffected by the current.

Standards organization are looking at higher speed interfaces after 10 Gb Ethernet. One such organization is the **Ethernet Alliance**, which -- in conjunction with the **IEEE** -- has formed an advanced study group (the imaginatively titled **Higher Speed Study Group**, or HSSG) to prepare for the transition to hyper-gigabit standards well before actual deployments are feasible. Other organizations that are at least exploring the possibility of hyper-gigabit Ethernet include the **Optoelectronics Industry Development Association** (OIDA), which has suggested 100 Gigabit Ethernet as one potential standard.

Samsung Electronics Co. unveiled a new type of memory chip that it said will allow digital devices to work faster by saving new data more quickly. The phase-change random access memory, or PRAM, chip is nonvolatile, meaning it will retain data even when an electronic device is turned off, and is about 30 times faster than conventional flash memory, Samsung said. It is expected to be available in 2008, Samsung said. A 512-megabit. PRAM device was unveiled at a news conference in Seoul on Monday.

Samsung Electronics showed off its first 40-nanometer chip, a 32-gigabit NAND flash memory module that can be used in memory cards able to store up to 64 gigabytes of data

Mark Kryder of **Seagate Technology** announced that the company used perpendicular recording heads and media created with current production equipment to achieve a recording density of 421 Gbit/inch².

TDK announced making a prototype of a 200GB Blu-ray laser disc.

Scientists at the **National Institute of Standards and Technology (NIST)**, **Seagate** Research Center and **Hitachi Global Storage Technologies** have discovered how groups of nanoscale magnetic oscillators are known to synchronize their individual 10-nanowatt signals to achieve a signal strength equal to the square of the number of devices--the oscillators accomplish this feat by communicating by means of "spin waves," their magnetic emissions caused by oscillating patterns in the spin of electrons.

STORAGE COMPONENTS AND CAPITAL EQUIPMENT

Intevac, Inc.'s wholly owned subsidiary Intevac Asia Private Ltd. (Intevac Asia) has opened a 3,000 square-meter manufacturing center in Singapore as part of the Company's plan to expand production capacity and provide more comprehensive and timely support for customer operations in Asia. Luke Marusiak, Intevac's chief operating officer, said: "Our new Singapore plant will initially manufacture advanced deposition sources for Intevac's 200 Lean® media manufacturing system. We are also placing design engineering staff in our expanded facility to better support customer enhancements to our products and reduce design cycle times."

Malaysia, China, Thailand and Singapore are set to be beneficiaries of a large chunk of the \$1.3 B capital investments earmarked by **Seagate Technology** for its 2007 fiscal year.

Test costs for NAND flash memory are soaring out of control and escalating by up to 70 percent per chip density. Suppliers of automatic test equipment (ATE) have announced new, high-speed NAND flash testers, which are equipped with the latest and greatest test handlers. The new gear is supposed to keep up with the explosion in NAND densities and volumes by using conventional parallelism techniques. **Advantest**, **Nextest** and **Verigy** are the main NAND flash-memory ATE suppliers in the market. For today's leading-edge devices, it can take a whopping 10-to-30 minutes in order to test each NAND flash-memory part. NAND flash lacks a viable built-in-self-test (BIST) or scan solution, causing headaches for suppliers of these parts.

Toshiba Corp. and **SanDisk Corp.** have announced that they are forming a joint venture to build a multibillion-dollar factory for flash memory chips. This new factory would be built at Toshiba's Yokkaichi plant in central Japan. Production from the new plant should begin by the fourth quarter of 2007. Their joint venture company is being called **Flash Alliance Ltd.** and Toshiba holds a 50.1 percent share in the company. SanDisk owns rest of the share.

KLA-Tencor unveiled its Candela Optical Surface Analyzer 6300 series system for metrology and inspection of data storage substrates and finished media. The

6300 series has a spatial bandwidth coverage (from 0.22 microns to 2,000 microns) and a noise floor below 0.5 angstroms.

Xyratex Ltd announced the release of its X700 high-speed media test automation solution. The new X700 system, based on many of Xyratex's proven test automation elements, offers substrate and media manufacturers the benefits of ultra-small footprint and 700 disks per hour output, in a fully self-contained, third-party certified class 10 enclosure.

STMicroelectronics announced a compact and highly-integrated hard disk-drive (HDD) Motor Controller intended for the 1.8-inch and sub-1.8-inch drives used in portable consumer electronics (CE) products such as MP3 and video players. The new L7208 HDD Motor Controller integrates all of the circuits needed to control and drive the HDD spindle motor and voice coil actuator -- including all the necessary power-FET (Field Effect Transistor) devices -- and is designed to save space and to minimize the drive's power consumption.

Seagate Technology Inc., the world's largest maker of hard disk drives by sales, Thursday said it will invest 1.3 billion Singapore dollars US\$819 million to build a third recording-disk plant in Singapore.

ARTICLES

1) I know it's out there....somewhere...

A personal experience with data format obsolescence

This Summer I had a project that I was working on that required information from work that I was involved with in the mid-1990's. The computers that I used at the time were mostly long gone and I had to access backup copies of the data from old Syquest drive cartridges, Zip floppy cartridges, old 1.4 MB floppy disks and recordable CDs. Some of the Zip cartridges contained Macintosh files since during that period I was using Apple computers. Getting the data back off of these old media formats and between multiple OS versions and types took some time. I still had Zip and Syquest drives to read the cartridges but I had to find old computers that I could install the drivers on. The whole process took about 3 months and I was unable to recover (or in the case of recovered Macintosh files recognize) all the original data. Fortunately, much of the information was contained in published works in journals that I was able to access and I had kept some paper copies of memos and other data that I was able to scan into my computer to use in completing the project.

Many of the 1.4 MB floppy disks were unreadable due to data corruption and the source programs were not recognized by my XP Windows OS computer for most of the recovered Macintosh files. These files were about 10 years old and 4-5

computers ago. My experience is not unique. I think many people would have the same issue recovering data from older computers and now obsolete storage media formats. I hope that when you have to recover some old information that you have much more success and an easier time than I did.

There is a serious problem for most people in the preservation of personal data and other content. Besides the issues with media and file formats becoming obsolete I have run into repeated issues trying to backup my data onto various backup storage devices and especially with direct copying of files. Frankly, although I use backup programs, I don't trust that I will be able to recover the data I have backed up, due to prior experiences. With file copying the issue I have repeatedly run into is that it won't copy files with too long a file name! So the file copy stops and some of my files are not copied. I wish that the Windows OS would have an option to truncate file names that it felt was too long or even just keep copying all the files it could and let me know the ones it couldn't copy so I could deal with the limited number of files with too long a file name. The consequence of these problems is that I don't feel secure in backing up my data. Am I alone in this? I don't think so!

How can we preserve older content

The idea of automatic movement of data from one storage device to another as the data ages is the basis of Information Lifecycle Management (ILM). ILM is used in storage system hierarchies to move data from more expensive faster higher performance storage systems to less expensive lower performance storage systems as the data ages or its use declines. An ILM system can have many levels with the final data repository being magnetic tape, optical disk or some other long term data retention media. This approach is becoming increasingly common in enterprise storage systems as a way to economically save data to meet compliance requirements and to retain content not in active use but that still has value. Such systems also create a final data repository such as tape or optical disks that can be archived for later access. **Figure 1** shows a schematic of the flow of data in an ILM storage system hierarchy.

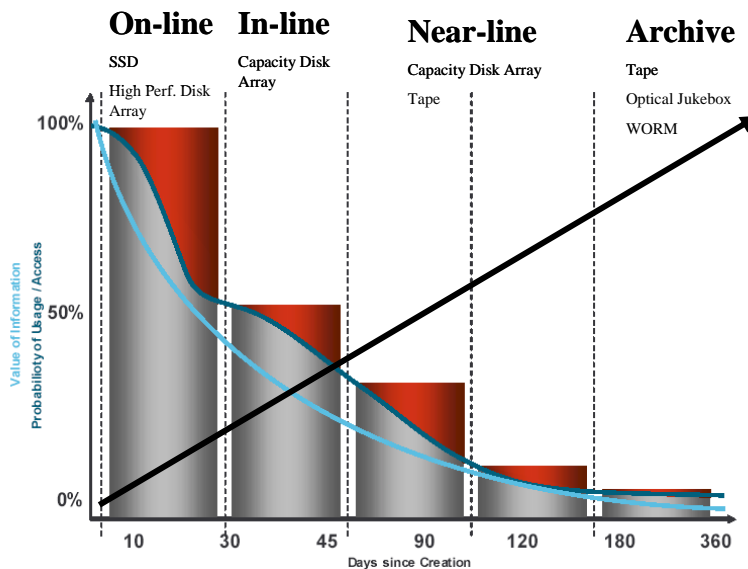
Storage system content is generally given a higher economic value than is the case for most individual content. Despite this higher perceived value for corporate and other organizational data the record for long term data retention is not as good as it could be.

Examples of the dangers of format obsolescence

A recent report from the UK, Mind the gap: assessing digital preservation needs in the UK done by the Digital Preservation Coalition (DPC), contains some revealing information on the level of data vulnerability due to format obsolescence and some significant examples.

The report includes a survey that reveals that the loss of digital data is commonplace - it is seen as an inevitable hazard by some - with more than 70% of respondents saying data had been lost in their organization. Awareness of the potential economic and cultural risks is high, with 87% recognizing that corporate memory or key cultural material could be lost and some 60% saying that their organization could lose out financially. In 52% of the organizations surveyed there was management commitment to digital preservation - but only 18% had a strategy in place.

Figure 1. Data flow in an ILM storage hierarchy with time (Original Source: STC)



Prior to the survey, a number of high profile cases had helped raise awareness of the risks of digital data loss. In a recent judgment in the US, Morgan Stanley had more than \$1 billion awarded against them as a result of their failure to preserve and hand over some documents required by the courts. The Securities and Exchange Commission in the US are also looking at fining the same bank over \$10 million - specifically for failing to preserve email documents.

The data tapes from the 1975 Viking Lander mission to Mars were recently discovered to have deteriorated despite careful storage, and scientists also found that they could not decode the formats used and had to rely on the original paper printouts.

The BBC's 1986 Domsday project is another example of the unique fragility of digital material. Designed to capture a picture of Britain in 1986, the collection of photographs, maps and statistical information was recorded onto 30cm laserdiscs. But less than 20 years later, the laserdiscs and player are obsolete. The data was only rescued thanks to a surviving laserdisc player and more than a year's effort by specialist teams.

Solutions for families and individual users

Given that corporations and governments don't have that good a history of long term data retention what hope is there for families and individual users to keep their data long term. Do the forces of thermodynamics and entropy doom the preservation of individual as well as corporate content? There may be things that individuals can do to preserve their personal and family history, but we will need help from technology providers.

There is a need on the part of operating system manufacturers and backup software vendors to create more robust ways to copy, backup and organize content so that it can be more easily preserved and recovered when needed in the future. Getting rid of issues such as file name length in copying files or backing up content will go part way in achieving this but there is also a need for better data indexing and organization so that data can be found more readily and data to be preserved can be managed and preserved better. Another need is to create storage hierarchies in the home that can keep track of where data and content is and to make sure that it is copied and backed up to new data formats as they become available before the older formats are obsolete. Storage out of the home for the most valuable content with professional backup and data protection is another way that users can protect their personal content.

2) New magnetic recording areal density demonstrations

The digital storage capacity of a hard disk drive is a function of the number of heads and disks and the areal density of recording (the amount of data that can be recorded on a unit of surface area on the disk). Each disk surface can hold a number of bits that is the product of the areal density (e.g. bits per square inch) and the surface area for user data. Hitachi's recent demonstration of 345 billion bits per square inch and Seagate's announcement of 421 billion bits per square inch a day later together represent a significant increase the storage capacity of hard disk drive data recording.

By 2007 HDDs with 200 Gbps (200 billion bits per square inch) will be introduced leading to over 1 TB (terabyte) 3.5-inch HDD storage capacity, 1-inch HDDs with over 20 GB of storage capacity (and 1.8-inch drives with over 100 GB capacity). Products with these anticipated areal densities have already been announced by HDD companies. In order to continue increasing HDD storage capacities in the future and remain competitive against alternative storage technologies higher storage capacities in the laboratory are required. In general a HDD laboratory demonstrated areal density will appear in announced HDD products within 2.5-years of the laboratory demonstration.

HDD technology is not staying still. It continues to grow in storage capacity and performance. Such development is required for HDDs to remain the mass storage technology of choice for many applications. I expect that we will continue to see developments in product and laboratory areal densities with 400+ Gbps products appearing as early as 2008 and possibly Tbps products by 2010.

3) Dueling personal video players--Is there more to this than meets the eye?

The next major development in personal media players is the proliferation and use of video content. Apple's video iPod and well as many competing devices offered by Creative, iRiver, Archos and others have been available for several years. These have found a gradually growing market but in the author's opinion a number of technologies and critical alliances with content owners are creating the conditions eminent major growth in the market for these devices.

Longer video requires larger digital storage devices and also an enjoyable viewing experiences and sufficient battery life. Larger form factor display devices with lower power usage are now becoming available to design engineers. Such larger sized screens leave room for 1-inch or 1.8-inch form factor hard disk drives currently with storage capacities of 12 GB and 80 GB respectively. By 2007 these storage devices will have storage capacities that exceed 20 GB and 100 GB respectively. With such high capacity mobile storage higher quality video of a few hours can be stored on these devices so they can serve as a portable library of video (and audio) content such as movies or TV shows.

In addition to better hardware becoming available for portable video viewing devices there is more video content available for moving to these devices. Apple iTunes and Amazon now offer television shows and full-length movies for downloading content into portable media players. Also audio podcasts and even video podcasts and short video will provide even greater amounts of free or almost free content to fill such devices. We face a future where everyone may be a content creator as well as content consumer and this could be a further source of portable storage growth in devices that can record as well as play. Someday soon many people could be carrying 100's of GBs or even TBs of storage containing commercial, shared and personal content.

PRODUCT / COMPANY NEWS NOTES

3M introduced Serial Attached SCSI (SAS) interconnects feature 29-position combination signal and power connectors providing a data transfer rate of up to 3.0 Gb/s in full duplex mode.

Brocade purchased **McData** for \$713 million.

Coraid, Inc., makers of EtherDrive storage appliances, announced that **2^oFrost Software** has released an AoE (ATA over Ethernet) driver for Mac OS X. This new driver enables a significant breakthrough in cost and scalability of storage for the Apple Macintosh platform.

EMC has plunked down \$175 million in cash to purchase **Network Intelligence Corp.** of Westwood, Mass., adding to EMC's newly founded security division in Bedford, Mass.

Emulex announced the completion of its purchase of **Sierra Logic Inc.** for roughly \$180 million in cash

IBM has purchased publicly traded software vendor **FileNet** for \$1.6 billion. FileNet's flagship offering is its P8 platform, which is designed to let users manage a wide range of content, from forms to images and emails. The software also works with magnetic Write Once, Read Many (WORM) technologies from storage vendors such as **NetApp, HDS, IBM, and EMC.**

Infineon Technologies AG announced it has demonstrated functionality and data rates exceeding 2.6 Gbs (gigabits per second) for a hard disk drive read channel IC core, which is the industry's highest data rate for a 90 nm (nanometer) read channel and is almost 30 percent faster than the previous-generation devices. The core is the third generation of read channels developed in cooperation with **Hitachi Global Storage Technologies.** It is being integrated into a system-on-chip (SoC) device that will contain all the functions necessary to control a hard disk drive, including a PHY (Physical Layer) core that will be the first designed to support both the 4.25 Gbs Fibre Channel and the upcoming 6 Gbs SAS (Serial Attached SCSI) and S-ATA (Serial ATA) standards. The SoC is expected to be in full production by early 2007.

Kazeon has scored \$21 M in Series B funding, spotlighting momentum in the unstructured data classification and search market. The round, led by Menlo Ventures, included Focus Ventures and all of Kazeon's previous investors. This raises total funding for Kazeon to \$44 M.

Nvidia Corp. has apparently won a major design win for **Apple Computer Inc.**'s next-generation video iPod product line — at the expense of **Broadcom Corp.**, according to an analyst, **American Technology Research Inc.** in a new report. "We believe the Nvidia chip adds 3D graphics functionality in addition to all of the existing features (such as H.264) that Broadcom supported with the existing vPod," Satya Chillara, analyst said.

ONStor Inc. announced this week its clustered NAS (network attached storage) system, called Pantera. This is the first complete NAS storage system from ONStor which has been so far primarily into providing NAS gateways.

Quantum acquired all of **ADIC** and its outstanding shares for approximately \$770 million, primarily in cash.

SanDisk spent \$1.35 billion for Israeli flash pioneer **M-Systems**. M-Systems introduced the first USB drives in 2000.

SanDisk announced results for the second quarter ended July 2, 2006. Total second quarter revenues increased 40% on a year-over-year basis to \$719 million. Second quarter net income as reported in accordance with U.S. Generally Accepted Accounting Principles was \$96 million, or \$0.47 per diluted share.

Sony Electronics has begun U.S. shipments of 50GB dual layer Blu-ray Disc(TM) recordable (write-once) media with AccuCORE(TM) technology. Sony's 50GB dual layer recordable disc has a suggested retail price of around \$48.

PERSONNEL NEWS

Nearly 3,500 workers at **Maxtor Corporation's** plants in Singapore will lose their jobs by the end of the year.

Atmel said it fired **George Perlegos**, its chairman, president and chief executive since the company was founded in 1984, along with his brother, Gust, executive vice president.

Komag promoted **Timothy Harris**, the company's chief operating officer, as CEO replacing longtime CEO **T.H. Tan**. T.H. saw the company through tough times in the late 1990's and early 2000's leading it to become one of the largest independent suppliers of media for HDDs. Harris, a veteran of the hard-drive industry, has been COO since last October. He has also been appointed to the board of directors.

Komag Chief Technical Officer Michael Russak retired and was replaced by Tsutomu T. Yamashita. Yamashita, 50, will receive a base salary of \$350,000, and will receive 25,000 restricted shares. He previously served as senior vice president, process and product research and development.

MaXXan Systems announced the promotion of **Nelson Bye** to the role of president and chief executive officer. Bye previously was president and chief operating officer.

SanDisk announced the appointment of **Dr. Atsuyoshi Koike** as president of SanDisk Limited (**SDKK**), the company's wholly-owned subsidiary in Japan. Dr. Koike's primary focus will be on technology and fabrication operations at

SanDisk's flash wafer development and manufacturing facility at Yokkaichi, where SanDisk has a strategic partnership with Toshiba

Veeco Instruments Inc. announced that **Don R. Kania**, Ph.D., President and Chief Operating Officer, will be leaving the Company. Dr. Kania will be joining FEI Company in Portland, Oregon (Nasdaq: FEIC) to become President and Chief Executive Officer.

Gateway Inc. named 30-year technology industry veteran **J. Edward Coleman** to lead the computer maker. Coleman, 54, replaces interim Chief Executive Rick Snyder, who will remain chairman of Gateway's board of directors. Coleman joined Gateway from **Arrow Electronics** and is the former CEO and chairman of **CompuCom**.

Sony Pictures named former Metro-Goldwyn-Mayer Inc. executive **David Bishop** to take the reins of its DVD and video division. He replaces Benjamin Feingold, who guided Sony's home video and DVD business for the past 12 years.

QUARTERLY NUMBERS UPDATE

Following are updated Q2 2006 numbers as well as estimates for Q3 2006 and for the balance of 2006 and onwards. Note that at the time of publication only Seagate Q3 drive company announcements had been made. Thus we will give corrected Q3 2006 data in the next newsletter.

Table 1. AVERAGE DISK DRIVE SALES PRICES (ASP) AND UNIT VOLUMES (UNITS MILLIONS/\$ PER UNIT)

COMPANY	Q2 05 UNITS/\$	Q3 05 UNITS/\$	Q4 05 UNITS/\$	Q1 06 UNITS/\$	Q2 06 UNITS/\$
MAXTOR	12.1/\$77.00	13.2/\$70.00	14/\$71.00	12.1/\$73.00	N/A
HGST	13.9/\$74.60	14.3/\$76.22	16.2/\$78.00	14.7/\$75.85	14.8/
SEAGATE	27.3/\$80.12	26.8/78.00	28.8/\$80.00	29.5/\$79.00	37.3/\$75.22
WEST. DIG.	15.8/\$75.20	17.1/59.00	18.1/\$60.00	18.8/\$60.00	19.2/\$58.00
COMP.AVE.	69.1/\$77.32	71.4/\$71.60	77.1/\$71.99	75.1/\$71.66	56.5/\$69.37

Figure 2. Average Drive Price Trend for Seagate, Western Digital, and Maxtor (Q4 '98 to Q2 '06)

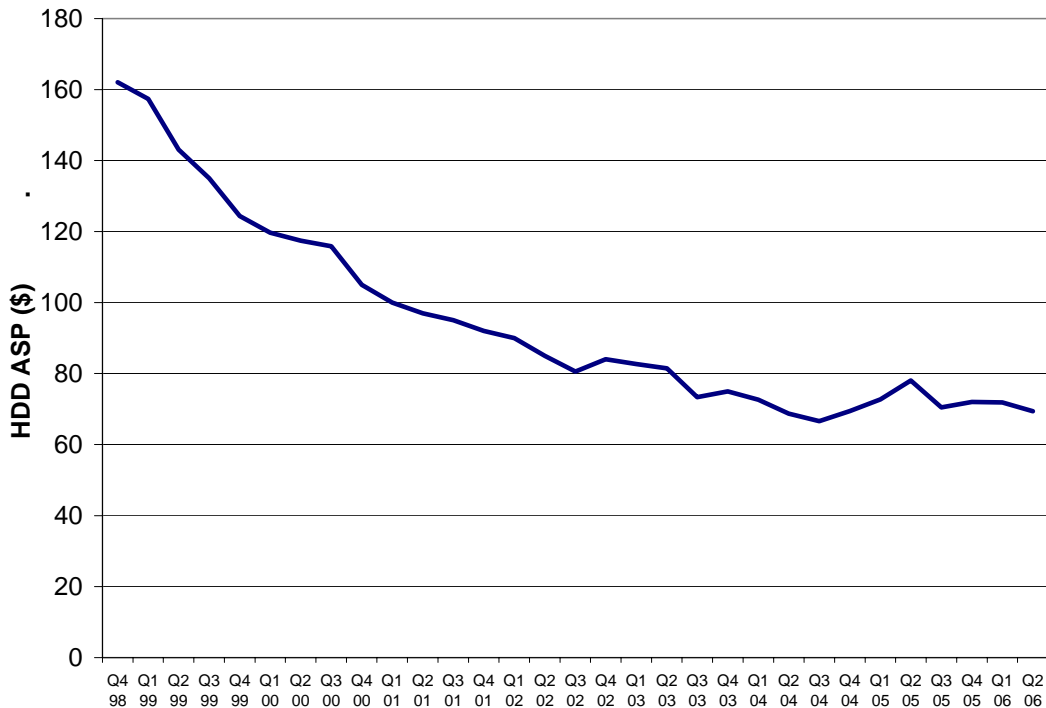


Table 2. CALENDAR Q2 2006 DISK DRIVE SHIPMENTS (UNITS IN MILLIONS, CORRECTED)

Company	Mobile	CE	Desktop	Ent. ATA	Enterprise	Total Q2
Seagate	3.4	5.5	16.0	0.5	3.9	29.3
Western Digital	1.6	2.2	15.2	0.2	0.0	19.2
Maxtor	0.0	1.0	5.4	1.0	0.6	8.0
Samsung	3.1	2.8	6.0	0.0	0.0	11.9
Hitachi	7.1	1.0	5.6	0.1	1.0	14.8
Fujitsu	5.2	0.0	0.0	0.0	1.4	6.7
Toshiba	3.1	5.3	0.0	0.0	0.0	8.4
Others	0.0	0.7	0.0	0.0	0.0	0.7
Total	23.5	18.5	48.2	1.8	6.9	99.0

Table 3. CALENDAR Q2 2006 DISK DRIVE FORM FACTOR SHIPMENTS (UNITS IN MILLIONS, CORRECTED)

Company	0.85 inch	1 inch	1.8 inch	2.5 inch	3.5 inch	Total Q2
Seagate	0.0	0.9	0.0	3.4	25.1	29.3
Western Digital	0.0	0.0	0.0	1.6	17.6	19.2
Maxtor	0.0	0.0	0.0	0.0	8.0	8.0
Samsung	0.0	0.0	0.0	3.1	8.8	11.9
Hitachi	0.0	0.3	0.7	7.2	6.6	14.8
Fujitsu	0.0	0.0	0.0	6.7	0.0	6.7
Toshiba	0.1	0.0	4.5	3.9	0.0	8.4
Others	0.0	0.7	0.0	0.0	0.0	0.7
Total	0.1	1.8	5.2	25.9	66.1	99.0

Table 4. ESTIMATED CALENDAR Q3 2006 SHIPMENT APPLICATIONS PROJECTIONS (UNITS IN MILLIONS)

Company	Mobile	CE	Desktop	Ent. ATA	Enterprise	Total Q3
Seagate	4.2	6.5	22.8	1.6	4.1	39.2
Western Digital	1.8	2.3	16.5	0.2	0.0	20.8
Maxtor	0.0	0.0	0.0	0.0	0.0	0.0
Samsung	2.8	3.0	7.2	0.0	0.0	13.0
Hitachi	7.8	2.4	4.6	0.1	1.0	15.8
Fujitsu	5.6	0.0	0.0	0.0	1.9	7.5
Toshiba	4.6	5.5	0.0	0.0	0.0	10.1
Other	0.0	0.8	0.0	0.0	0.0	0.8
Total	26.8	20.5	51.1	1.9	7.0	107.2

Table 5. ESTIMATED CALENDAR Q3 2006 DISK DRIVE FORM FACTOR PROJECTIONS (UNITS IN MILLIONS)

Company	0.85 inch	1 inch	1.8 inch	2.5 inch	3.5 inch	Total Q3
Seagate	0.0	1.0	0.0	4.2	34.0	39.2
Western Digital	0.0	0.0	0.0	1.8	19.0	20.8
Maxtor	0.0	0.0	0.0	0.0	0.0	0.0
Samsung	0.0	0.0	0.0	2.8	10.2	13.1
Hitachi	0.0	0.9	1.0	7.8	6.2	15.8
Fujitsu	0.0	0.0	0.0	7.5	0.0	7.5
Toshiba	0.2	0.0	5.4	4.5	0.0	10.1
Other	0.0	0.8	0.0	0.0	0.0	0.8
Total	0.2	2.6	6.4	28.6	69.4	107.2

Table 6. ESTIMATED 2006 APPLICATION MARKET SHARE PERCENTAGES

	Total	Mobile	CE	Desktop	Ent. ATA	Enterprise
Seagate	33.7%	14.9%	31.5%	39.9%	57.6%	57.5%
Western Digital	19.0%	6.4%	11.1%	31.6%	11.2%	0.0%
Maxtor	4.6%	0.0%	2.6%	6.9%	25.6%	5.5%
Samsung	11.4%	11.3%	14.5%	12.1%	0.0%	0.0%
Hitachi	14.5%	28.5%	10.6%	9.4%	5.6%	13.8%
Fujitsu	6.8%	21.4%	0.3%	0.0%	0.0%	23.2%
Toshiba	9.3%	17.5%	26.0%	0.0%	0.0%	0.0%
Others	0.7%	0.0%	3.4%	0.0%	0.0%	0.0%

Table 7. ESTIMATED 2006 FORM FACTOR MARKET SHARE PERCENTAGES

Company	0.85 inch	1 inch	1.8 inch	2.5 inch	3.5 inch
Seagate	0.0%	39.1%	0.4%	13.8%	44.4%
Western Digital	0.0%	3.3%	0.0%	6.0%	26.4%
Maxtor	0.0%	0.0%	0.0%	0.0%	7.1%
Samsung	2.2%	0.0%	0.0%	10.5%	13.1%
Hitachi	0.0%	26.2%	16.9%	26.7%	9.1%
Fujitsu	0.0%	0.0%	0.0%	25.9%	0.0%
Toshiba	97.8%	0.0%	82.7%	17.1%	0.0%
Others	0.0%	31.4%	0.0%	0.0%	0.0%

Figure 3. BANDED HARD DRIVE VOLUME PROJECTIONS

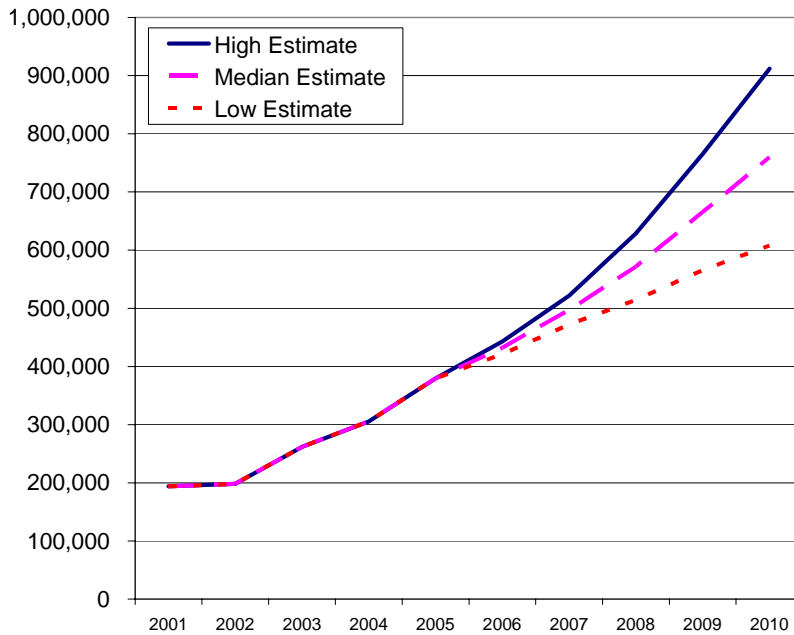


Table 8. ESTIMATED TOTAL 2006 DRIVE SHIPMENTS (Units in Millions)

Company	Mobile	CE	Desktop	Ent. ATA	Enterprise	Total
Seagate	16	26	82	5	16	145
Western Digital	7	9	65	1	0	82
Maxtor	0	2	14	2	2	20
Samsung	12	12	25	0	0	49
Hitachi	30	9	19	0	4	63
Fujitsu	23	0	0	0	7	30
Toshiba	19	22	0	0	0	40
Other	0	3	0	0	0	3
Total	106	83	206	8	29	432

Table 9. ESTIMATED TOTAL 2006 DISK DRIVE FORM FACTOR SHIPMENTS (Units in Millions)

Company	0.85 inch	1 inch	1.8 inch	2.5 inch	3.5 inch	Total
Seagate	0	4	0	16	126	145
Western Digital	0	0	0	7	75	82
Maxtor	0	0	0	0	20	20
Samsung	0	0	0	12	37	49
Hitachi	0	2	4	31	26	63
Fujitsu	0	0	0	30	0	30
Toshiba	1	0	20	20	0	40
Other	0	3	0	0	0	3
Total	1	9	24	114	284	432

Table 10. ESTIMATED MAGNETIC DISKS PROJECTIONS (BY FORM FACTOR)

	2004	2005	2006	2007	2008	2009	2010
3.5 INCH	361,384	373,482	397,368	418,835	438,576	468,533	482,823
2.5 INCH	114,102	175,041	231,309	279,925	334,037	390,753	444,742
1.8> INCH	17,708	34,490	32,808	58,606	84,810	119,550	168,039
TOTALS	493,194	583,013	661,485	757,365	857,423	978,836	1,095,604

Table 11. ESTIMATED MAGNETIC HEAD PROJECTIONS (BY FORM FACTOR)

	2004	2005	2006	2007	2008	2009	2010
3.5 INCH	577,808	593,628	596,053	589,908	622,093	669,333	689,747
2.5 INCH	176,858	280,065	370,094	445,009	527,427	633,654	716,529
1.8> INCH	27,886	65,101	58,937	99,530	144,034	203,031	285,381
TOTALS	782,552	938,794	1,025,083	1,134,447	1,293,553	1,506,018	1,691,658

Figure 4. UPDATED PROJECTION OF DRIVES BY MARKET NICHE

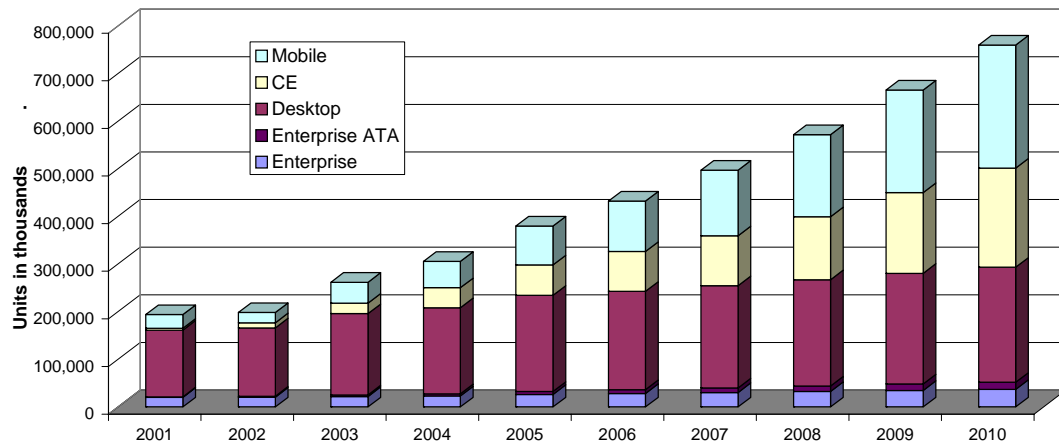


Figure 5. UPDATED PROJECTION OF DISK DRIVES BY FORM FACTOR

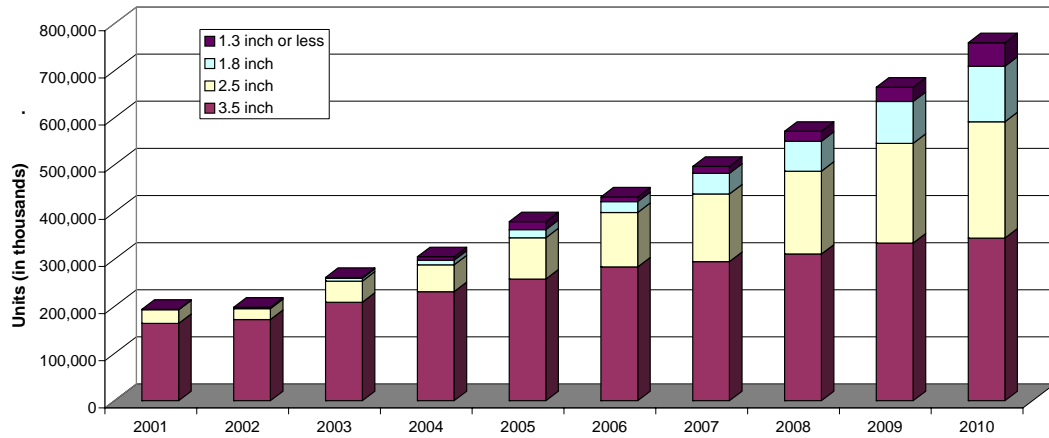
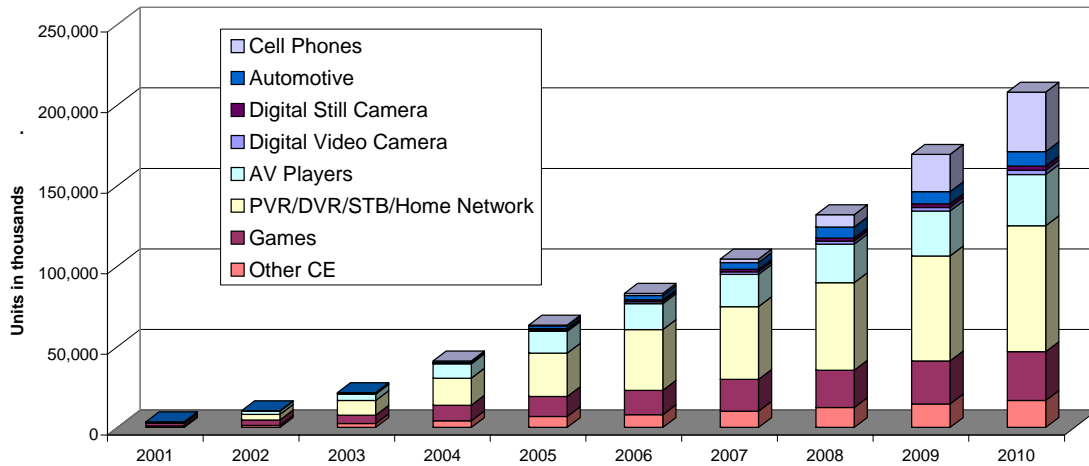


Figure 6. PROJECTION OF CE DISK DRIVES





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