Steady demand marked the storage industry from the early 1970s until late in the year 2000 and was evident in just about every statistic and measurement. Often called the Infinite Disruption, the worldwide events of 2001 brought significant changes to the IT and storage industry landscape. Growth rates slowed, worldwide storage revenue declined, thousands of IT jobs were eliminated while many others have moved offshore.

In 2000, 93 new storage companies were launched with a first round of funding. In 2007 just five new storage companies were funded with first-round money. This has had the effect of slowing down the flow of new ideas and invention, suggesting that we are now in a period of re-invention rather than invention. There were over 60 disk drive manufacturers in 1980 and today just six remain as consolidation has taken its toll. Data centers are consolidating their oversupply of storage devices by undertaking extensive virtualization projects. Five tape formats make up the majority of all tape sales and 12 vendors supply or OEM tape libraries.

As a result of these indicators, the disk industry generated revenues of $26 billion and the tape industry just over $4 billion in 2007. Revenues are down from the beginning of the century when the disk industry generated revenues of $31 billion and the tape industry totaled $4.3 billion. Optical disk plays a primary role in the entertainment and personal appliance markets but is seldom used in the data center. Personal appliances are driving a new set of data management and security concerns as over 20 percent of the world’s IT force uses mobile computing.

IT executives identify security, data classification, virtualization, e-mail management, tiered storage, e-mail and database archiving and virtual tape libraries as their more pressing storage priorities. High on the storage ‘to-do’ list is addressing underutilized resources, particularly for non-mainframe systems, where storage management capabilities lack those of mainframe systems. For storage hardware, capacity reclamation, which relates to a significant variance in the amount of allocated versus used capacity for both disk and tape in most IT environments, has gained significant focus.

The current downturn in the global economy has ramifications on the way businesses and storage suppliers operate.
Economic Trends and Issues

The current downturn in the global economy has ramifications on the way businesses and storage suppliers operate. Economic downturns typically touch off budget cuts and if IT buyers have not felt the squeeze yet, they most likely will. Regardless of how long the economy struggles, reduced IT spending will likely be the norm for the near future. As a result, some promising new storage technologies may face an uphill battle in terms of adoption, and others may be shelved altogether. Savvy storage vendors are investing more time with user groups, web-briefings and open forums than in recent years when marketing activities were often downplayed, listening to their clients to hear what they like and do not like about their IT environment.

Some businesses cut staff, curtail education and minimize travel to save cash, but many of these storage environments are already understaffed. Cutting staff often takes money out of one bucket and puts it in another by reducing operating expenses while increasing capital expenditures. Continuing economic pressures may have the effect of encouraging a return to one-stop shopping, buying more from fewer vendors that can offer strong volume discounts. This may press vendors in a specialized product niche market to partner and bundle solutions in order to remain competitive.
Energy Concerns Mount

The emphasis on energy friendly solutions from storage companies will continue to escalate dramatically in the coming years. Virtualization, thin provisioning, MAID (Massive Arrays of Idle Disks) or spin-up spin-down disks, data deduplication, are all helpful technologies to increase storage utilization and thereby reduce energy consumption. These technologies, if applied in the right places, will improve storage utilization and reduce energy consumption, though rarely reduce the energy bill as continual price increases from energy providers offset short-term savings and the energy bill continues to increase.

To reduce the energy consumption, organizations must begin to address the root cause of the problem which is having too many underutilized storage and server resources. To help green initiatives, businesses are improving data management by classifying, migrating, and archiving or deleting less frequently used information by placing this data on tier 3 technologies. To reduce the energy bill, organizations should channel a larger portion of their price cutting efforts toward energy providers, rebates and other opportunities for cost reduction, rather than solely rely on storage providers to solve the IT energy consumption problem. Utility companies need to be pressed to lower energy prices by passing along economies of scale as do storage vendors, improving efficiencies and implementing carbon neutral initiatives. For businesses, data that isn’t accessed shouldn’t consume energy.

Recently Google said that the cost of powering its systems was going to exceed the capital costs of those systems over their useful life. The storage industry is at the cusp of a new awareness in the relationship between energy, heat, power, system design and data center design which will play out over the next several years. The financial ramifications of not being an energy-efficient data center will mount given spiraling energy costs. Some businesses have appointed an “energy czar” to get control of the problem. Reducing energy consumption is easy; reducing the energy bill is difficult.

Continued Shifting of Focus from Capex to Opex

The IT industry has repositioned itself emphasizing several new areas. These include a new value system for IT where, at last, the real value proposition is becoming more important than the acquisition costs. For years, users perceived the hardware purchase price as their primary financial acquisition criterion. This has become increasingly misleading and reflects the now old and out-of-date viewpoint that the value of the IT infrastructure exists in hardware. The impact on the storage industry of this shift in focus from Capex (capital expense), which declines in price per unit, to Opex (operating expense) which is increasing, will have lasting effects on the way the value of any storage and IT solution is viewed.

Data Protection and Security

Challenges are mounting when it comes to disaster recovery planning. Traditional problems, including human-induced errors that can crash a system to an increasing number of natural disasters like fire, hurricanes, floods and earthquakes, cause businesses to get serious about protecting their digital assets. New concerns ranging from widespread loss of electrical power to the growing intrusion threats from hackers to employee sabotage add to the security challenge. The overall need for improved operational efficiencies is increasing for both security and storage with the traditional roles needing revision based on compliance, encryption and key management. This also furthers the need for mainframe solutions that address these areas more automatically because of the retiring work force from key areas such as storage and security.

In the past five years, both disk and tape storage devices have become increasingly more reliable, making intrusion into the porous Internet possibly the biggest threat to attaining high levels of IT availability. Terrorists and hackers, identity theft, scam artists and predators, intrusion, and compliance requirements have mandated that companies implement dramatic improvements to the generally insecure Internet security systems. The average cost of a data breach in 2007 was $6.3 million. Storage vendors offer a wide range of storage security functions including features like WORM and encryption for stored data. An estimated 80 percent of all Internet traffic is now classified as unwanted material and the number of malicious e-mails is growing. Businesses must address the widening variety of security issues to avoid lawsuits and ultimately stay in business.
Storage and Data Management

The growing amount of digital data is constantly stressing the capabilities of many storage systems. As the amount of installed disk space has exploded from gigabytes to terabytes and petabytes, the storage administrators who must install, provision and manage those storage resources are faced with mounting challenges. The biggest problem with today’s disk proliferation is wasted space as average non-mainframe storage platforms usually run at less than 45 percent utilization. This means that additional storage capacity is often purchased without optimizing the existing space.

Beyond mainframes, Unix, Windows and Linux operating systems are hosting more and more critical, data-intensive applications. The storage services provided by these systems remain fairly weak by comparison to the mainframe. When they were first delivered, no one knew that these non-mainframe computing systems would one day be asked to do the work of a mainframe. Dynamic provisioning and countless virtualization capabilities that simplify storage management, increase utilization and improve application service levels are gradually becoming main stream for these systems.

The total revenue for Windows server applications in 2007 was $110 billion while it was $64 billion for Unix and $32 billion for Linux as these markets experience unprecedented growth.

Self-healing systems that can fix themselves before a permanent failure occurs have great appeal. With progress in all aspects of embedded microprocessor and multi-core chip development, expect self-healing systems to one day become a reality. The new z10 mainframe processor is the first computer to drive past five 9s availability, or 30 seconds of downtime per year, as the march to 100 percent IT uptime continues.

Bottom Line

The storage industry is headed on a new course, leaving behind many of the principles that defined the way business has been conducted for the last 30 years. Nonetheless, expect to see ultra-high availability solutions, libraries of low energy-consuming disks, flash and non-volatile RAM chips, and object-based storage, along with a variety of miniaturized nanotechnologies as potential breakthroughs in the years ahead.

Simply reacting to an unfamiliar landscape when change comes is not an option; advanced planning, then setting a course for the future is your best bet to assess the wide spectrum of choices that lies ahead and to anticipate its many exciting challenges. Past events have signaled that the IT industry ahead will be quite different and will require changes in order to survive. New storage strategies are emerging that identify the pathway to success and these will often have little or no resemblance to their predecessors.

Storage Panorama presents a consolidation of the latest knowledge and insights into the key strategies, architectures and technologies that are emerging within the storage industry. Use Storage Panorama as a strategic planning guide, to help build the case for the justification of ways to improve your IT environment, or as a quick reference. In any case, it the intent of this book to help you get to the next level, whatever that may be. Enjoy the journey.
The future drivers of the storage industry will be different than those of the past; a new game with new rules is well under way.

The storage industry is showing respectable signs of growth even though the global economic situation has declined and impacted IT spending in certain markets. Worldwide, new and original content is presently growing as much as 45 percent annually, depending on the business, and the value of digital data increases every day, demanding bullet-proof security systems from the data center to mobile appliances.

An emerging high-performance storage tier, called tier 0, based on flash memory, is making its presence felt. More complex storage requirements are beginning to appear with compliance, fixed-content and long-term archival applications emerging as the biggest drivers of storage demand and clearly defining tier 3 storage requirements.

Much of this data growth will be addressed by the tiered storage model that includes a variety of innovative disk solutions along with advanced magnetic tape technologies providing effective storage management and data protection strategies for the useful lifetime of data.

Energy concerns are mounting for data centers as they search for ways to lower total costs, while energy providers show little interest in lowering their rate structures. The future drivers of the storage industry will be different than those of the past; a new game with new rules is well under way.
Key Storage Initiatives

Top Business Storage Objectives

Server and storage consolidation to lower costs and complexity
Virtualization of servers and storage systems continues aggressive trend
Network disk storage growth accelerating from NAS and iSCSI SANs

Top Vendor Storage Initiatives

Tape and disk drive/array encryption
Disk and flash hybrid combinations — solid state disks re-emerge (tier 0)
Thin provisioning gets new life on non-mainframe systems (OS/360 – 1965)
Data classification and tiered storage solutions, tape aiming at tier 3

Energy Conservation — Green Storage Initiatives Everywhere (right focus?)

Power and cooling — systems and data centers
  Disk striping usually minimizes benefits of green mode for disk?
Energy costs now out of control — rising 20 – 30% annually
Energy providers still get a “Free Pass,” no pressure or effort for achieving cost-efficiencies, rate reductions and rebates

Source: Horison Information Strategies

Server and storage consolidation head the list of top IT initiatives as pressure to lower costs and complexity rapidly increases. A key ingredient to consolidate resources successfully is based on server and storage systems virtualization. There is a growing and aggressive trend toward network disk storage growth resulting from NAS and widespread iSCSI SAN implementations.

Vendors are delivering several storage security initiatives including encryption at the tape and disk drive level. New solid state disk and flash drives are appearing as we witness the possible re-birth of the high-performance storage segment commonly referred to as tier 0 storage. Original mainframe concepts like thin provisioning, which originally appeared as part of OS/360 in 1965, are adding improved disk utilization capabilities to non-mainframe systems. This capability is long overdue for non-mainframe systems that historically under-utilize storage resources. Storage suppliers are developing more sophisticated data classification and tiered storage solutions as legal ramifications and compliance pressures mount. Tape suppliers are now aiming at tier 3 as the new growth opportunity given that the backup market is increasingly being served by disk-based tier 2 solutions.

Out-of-control energy costs, now rising at 20 to 30 percent annually, have raised energy conservation awareness in many IT businesses. Green storage initiatives are appearing everywhere but are they focused properly? Storage isn’t the biggest energy user in the data center as support gear such as UPS, chillers and air conditioners can consume over half of all IT energy. Disk suppliers have offered a green mode for disk, but this is usually minimized by disk striping as data is spread evenly across multiple actuators eliminating the likelihood of an idle disk.

Bottom Line

Several new storage initiatives have gained significant momentum and they all provide varying degrees of improvement. They should be evaluated carefully and quickly. Energy providers still get a “free pass” with little or no pressure or effort on their part for achieving cost efficiencies and passing them on to businesses as the storage providers do. Press energy providers for rate reductions and rebates. They can help lower energy costs more than anyone.
Many of the advanced storage functions present in mainframes for the past 20 years have yet to arrive for non-mainframe systems.

The mainframe was the predominant computing platform from its introduction in the mid-1960s until the early 1980s. With the advent of distributed and client-server computing, the mainframe began to lose visibility as a server platform and seemed relegated to only the largest data centers.

Today’s mainframe operates on a new level extending its reach to handle the workload of 1,500 Intel servers and run z/OS, Linux or a variety of Unix systems while pushing availability to nearly the six 9s level. Many of the advanced storage functions present in mainframes for the past 20 years have yet to arrive for non-mainframe systems.

On February 26, 2008, IBM announced the most powerful mainframe yet, the System z10. This announcement has extended the life of mainframe architecture at least a decade. Given this scenario, many companies are rethinking their mainframe strategies. Resurgence in the mainframe is under way.
The revenue lost from an IT outage can exceed $5 million per hour in certain businesses making the ability to quickly recover possibly the single most critical storage management requirement. We are beginning to see the next generation of backup and recovery solutions appear as the time consuming backup and recovery processes of the past are becoming obsolete. In addition, the time available for the traditional backup window to complete has steadily decreased. Today’s IT environments are demanding a more comprehensive strategy for data protection, security and high-availability than ever before based on numerous causes of data loss.

Data recovery options must align with application, database and business requirements in order to yield the highest availability. Providing data and application availability while increasing the probability for a business to survive most types of outages mandates an effective recovery management strategy. This is increasingly critical since most businesses in the modern world can no longer survive without their IT function. Making the IT infrastructure resilient to machine failures, intrusions, natural disasters, human mistakes, and accidents makes implementing the best possible recovery management solution a high priority.

Mission critical applications prevalent on mainframe — up to 60% of all applications
Outages can exceed $5M per hour
Recovery management is a set of processes and integrated technologies
Unites business continuity, availability and disaster recovery practices
Strategy is key to managing disaster recovery and to ensure rapid resumption of IT services

**Bottom Line**
Given the growing value of the IT infrastructure and its availability to most businesses worldwide, implementing a data protection, backup and recovery strategy has become one of the most critical IT disciplines. Thorough and comprehensive recovery management tools exist for the mainframe. Businesses should carefully evaluate and choose the optimal suite of recovery management solutions that best meets their needs and quickly implement if a solution is not in place.

*Source: Horison Information Strategies*
Disk storage continues to contain the vast majority of the world’s mission-critical, high-performance, high-availability data.

The worldwide disk market has just passed its first 50 years and is now a mature market, but continues to be transformed by the way disk is used. Expectations are that disk drive shipments will stay at or above the 50 percent annual growth level for the next three to four years. Approximately 25 percent of the annual shipments are for replacement of aging technology, not for new demand.

Disk diameters have steadily shrunk below 2.5 inches in diameter to a 0.85-inch and to 1-inch diameter designs fueled by a greater trend to mobile storage appliances. However, the rapid advances of flash memory may spell the end of all sub 2.5-inch drives. The largest disk drives now contain 375 gigabytes on a single 3.5-inch diameter platter yielding a 1.5 terabyte disk drive.

Disk storage continues to contain the vast majority of the world’s mission-critical, high-performance, high-availability data. Overall unit shipments for disk storage in 2007 grew more than 15.3 percent over 2006 and price erosion remained very aggressive with a 20 to 25 percent annual drop in price per gigabyte.

The capacity of a single disk drive has now grown 300,000 times since the first 24-inch diameter, 50 platter and 5-megabyte capacity RAMAC disk drive in 1956. The usage of low-cost SATA disks continues to penetrate deeper into the data center, creating several new and appealing growth opportunities. Native drive capacities are expected to reach 3 to 4 terabyte capacity levels over the next three years.
Key Disk Demand Drivers

Magnetic disk storage is taking applications from tape and, at the same time, has essentially moved optical disc out of the data center leaving it as the preferred media for personal and entertainment data. Traditional tape and optical markets including backup/recovery, data protection and a variety of security systems are moving toward disk implementations. Personal appliances are proliferating as iPODs, digital cameras, camcorders, DVRs, and multi-function cell phone technology are all driving demand for small disks and especially for flash memory based disks. Given that over 20 percent of today’s IT workforce is now mobile, many new and complex security challenges are being presented.

New disk architectures and functions are gaining momentum including deduplication, virtual tape, iSCSI SANs, CDP, storage grids and clustered storage for web-based applications. Internet applications, known as “Cloud Computing” in Web 2.0, are appearing everywhere with an estimated 1.4 billion Internet users worldwide. The fastest growing storage category is classified as tier 3 storage which includes the high-growth fixed content, compliance and archive applications. Tier 3 storage demands are exploding on mainframe and non-mainframe systems growing at over 60 percent annually.

As disk drive capacities continue to increase much faster than drive performance, expect the disk drive industry to divide into two distinct segments consisting of smaller-capacity, high-performance drives and larger-capacity, lower-performing drives. This ever increasing capacity growth trend is referred to as the access density challenge. It is becoming more of a concern for end-users as drive allocation levels often are intentionally constrained to maintain acceptable I/O performance levels. However, poor utilization leads to increased operating expenses and wasted capacity.

**Bottom Line**

The emergence of two classes of disk drives is under way with one for performance and another for high-capacity lower-activity applications. Shipments of high-capacity terabyte-plus disk drives are expected to account for nearly two-thirds of the entire disk capacity shipped by 2011. The performance storage market will be assisted by the presence of a variety of flash and potentially other memory technologies. Average storage capacities are nearing 250 gigabytes in desktops and 150 gigabytes for mobile PCs with no end in sight. Expect demand for disk shipments to stay on a record pace.
Cartridge capacities continue on an unprecedented growth pace and compressed cartridge capacities have now reached 2.0 terabytes.

The 56-year-old magnetic tape industry continues to evolve since the first successful tape drive appeared in 1952. Markets are shifting as disk encroaches on tape’s traditional backup/recovery market while tape is positioning itself for the exploding tier 3 applications.

In 2007, annual tape industry revenues total just over $4 billion including all drives, robotic libraries and media compared to a $26 billion magnetic disk drive industry. Annual tape revenue has ranged from $4 – 4.3 billion since 2001. In recent years tape has been relegated to the enterprise-class data center, and the middle to high end of the SMB (Small to Medium Business) market with decreasing penetration below this level from the incumbent low-end tape drives.

These developments include much longer media life, improved drive reliability, higher duty cycles and much faster data rates than any previous tape drives.

The tape industry currently has five major recording formats and over a dozen automated tape library suppliers. Native capacities are predicted to approach 50 terabytes in the next 10 years. Nearly 20 companies now offer virtual tape arrays or integrated virtual tape library architectures as virtualized tape environments yield multiple benefits. Security features such as tape WORM (write-once-read-many) and encryption are becoming increasingly important as tape prepares itself as the primary technology for tier 3 applications.
Tape Key Issues

A primary tape storage market shift is well under way to tier 3 storage applications as over 60 percent of digital data is optimally suited for tier 3 storage based on required capacity and data access characteristics. Disks are attacking tape from all directions. Virtual tape, disk arrays that look like a tape library to the operating system, have gained momentum and coupled with deduplication offer a cost-effective backup alternative for non-mainframe systems. Integrated Virtual Tape Solutions, which include a robotic tape library integrated with the disk array, add significant value by combining tier 2 and tier 3 solutions into a single architecture. The adoption rate of the LTO tape media and the LTO – 4 cartridge providing 800 gigabytes native capacity with a 120 MB/second data rate makes it the dominant midrange tape technology as it captured over 90 percent of tape library shipments in 2007.

As tape storage surpasses petabyte-plus capacities, adding value to the enormous tier 3 data repositories will push tape suppliers to deliver indices, naming conventions, hi-speed retrieval and advanced search engine capabilities. Therefore, future tape roadmaps must offer more than just capacity and data rate increases signaling that smarter tape systems must evolve to meet accessibility requirements. To ensure tape viability, the average selling price per gigabyte must continue to drop faster than disk pricing and this is expected to happen. Disks that spin up and spin down such as MAID (Massive Arrays of Idle Disks) are also taking aim on the tier 3 opportunity.

**Bottom Line**
Tape won’t go away, but its role is expanding from a pure backup solution to that of a premier long-term storage technology. In recent years, many customer perceptions of tape have become outdated and do not reflect the latest developments and improvements in the tape industry. These developments include much longer media life, improved drive reliability, higher duty cycles and much faster data rates than any previous tape drives. Which vendor will become the primary driver and innovator of the tape industry going forward?

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**Source:** Horison Information Strategies
It is time for non-mainframe computers to provide comparable mainframe-like storage management functions as they now control many critical business applications.

The requirement for a centralized, end-to-end data and storage management solution that supports heterogeneous operating systems could not be greater! Some powerful mainframe storage capabilities are slowly finding their way into non-mainframe systems. Concepts such as HSM, CDP, snapshot copy, data classification, tiered storage, thin provisioning and virtual tape have been well-established for 10 to 25 years or more in mainframe architecture.

Many of the storage management services provided by Unix, Windows and Linux today are basically the same ones that arrived with the original systems years ago. No one knew then that these distributed computing systems would one day be asked to do the work of a mainframe and to access as much data as their mainframe counterparts, if not more.

Since the operating systems don’t provide rich storage and data management services, the task is being addressed by numerous ISVs (Independent Software Vendors) who have to deal with interoperability issues. Unix, Linux and Windows systems account for over 90 percent of all magnetic disk capacity shipped annually. It is time for non-mainframe computers to provide comparable mainframe-like storage management functions as they now control many critical business applications. Why is it taking so long for non-mainframe systems to catch up?
Mainframe computer systems have a higher ratio of data on tape compared to disk than non-mainframe systems making tape management requirements for these petabyte-class tier 3 environments increasingly important. These files contain large amounts of potentially valuable corporate information that must be protected and managed throughout its lifecycle. The role of tape management is to enable a higher level of integrity for data residing on tape and to automate and streamline the process of tape data protection. An ideal tape management solution must be both scalable and extensible to encompass tape management across the enterprise.

Typical z/OS organizations can easily process thousands of tape files daily and move tape data offsite either electronically or by truck to remote locations. Key requirements for tape management solutions include automated tape lifecycle management and flexible retention periods as the need to retain data for long periods grows. High-availability requirements encourage either extensive remote vaulting capability with the capability to efficiently cycle tapes to and from multiple off-site locations. Integrity checking ensures complete tape data protection when tape data is written only when intended, preventing tapes from being accidentally overwritten.

**Bottom Line**
Mainframe tape usage is more intensive than in non-mainframe systems. As a result, mainframe requirements include a complete tape library inventory and audit tracking, support for any off-site vaulting systems and utilities for controlling tape and catalog maintenance activities.
The importance of data protection, security and disaster recovery has made them the most critical disciplines facing the IT industry today. Planned downtime gives a business the opportunity to minimize the disruption, while unplanned downtime usually results in some degree of negative business impact. Clearly, the damages from natural disasters and terrorist activity add to the list of IT infrastructure failures that can impact the survival of most businesses. In addition, malicious insider attacks are on the rise and pose an increasing threat to IT security.

Though determining the actual value of data remains difficult and varies widely based on the business, determining the relative value of data is becoming a more common practice and enables selection of the most appropriate high-availability strategy for its storage infrastructure. Understanding the list of options available to implement a high-availability storage strategy is essential, but has many tradeoffs. A successful data-protection implementation can significantly improve the likelihood of surviving a disaster and ultimately saving the business.

Few issues own the mind of the IT executives more than whether the organization can recover from an IT disaster. Stored data is everywhere in the modern business making all data at risk whether it is in a large enterprise data center, on a midrange server, attached to a storage area network or on a mobile personal appliance sitting in an airport.
Enterprise security management is an integral storage discipline. For storage, it is the group of parameters and policies that make storage resources available only to authorized users and trusted networks — and unavailable to all other entities. These parameters can apply to hardware, programming, communications protocols, and organizational policy. Clearly, developing a data security strategy is a key piece of the overall high-availability plan.

An effective security strategy enables integrity and security of critical information assets by detecting and analyzing changes to the operating system, application programs, and data files. It includes software that provides important information about system security, integrity and access control mechanisms. Key components include gathering and displaying system hardware and software information, analyzing system customization variables, reviewing executables, program inspection, monitoring file usage, offering suggestions, and having the ability to answer most questions via "Help" screens.

Most companies today use the Internet to extend their business reach, both to partners and directly to consumers. The porous Internet brings with it tremendous security exposures from hackers, scams, viruses and malicious attacks, further raising the bar for a security strategy. No matter what the business need, security is paramount as users move from site to site and hand over sensitive information to conduct business. This seamless movement between partner sites requires secure back-end solutions to create and manage user identities, their accounts and access entitlements, and to enforce access policies across the ecosystem. Identity-management tools are suddenly gaining importance as they enable a business to create new accounts and allow secure sign-in to multiple networks that will let business partners and consumers alike conduct secure transactions.

**Bottom Line**

Security management will improve business-to-business partnerships and further strengthen customer relationships; however, don’t expect to immediately measure its value on the bottom line as it is difficult to measure security as a return on investment. Instead, think of security as an insurance policy for IT.

### $6.3 million — the average cost of a data breach in 2007

**Develop a security strategy**
- Identify vulnerabilities
- Protect critical applications, data and systems from unauthorized access
- Manage the identities and access rights of internal and external personnel
- Provide defensible and continuous regulatory compliance

**Ensure integrity of backup data**

**Corporate IT budgets**
- 7 to 8% spent on security
- Up to 5% spent on compliance

**E-mail virus accounts for 68% of attacks**

**Mobile data encryption is critical**

Source: Ponemon Institute, Horison Information Strategies

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The summit of Wilson Peak 14,017’. With his ascent of Wilson Peak, Fred has now summited all 54 Colorado peaks over 14,000 feet.

Fred Moore

In 1998, Fred Moore founded Horison Information Strategies, a data storage industry consulting firm in Boulder, Colorado, that specializes in executive briefings, marketing strategy, research reports and business development for storage suppliers and end-users. Fred began his 21-year career at StorageTek as the first systems engineer and concluded as corporate vice president of Strategic Planning and Marketing.

Fred served as Editor of Storage for Computer Technology Review magazine and has written numerous books, articles and reports for the storage industry. He is a 1989 recipient of the Distinguished Alumnus Award and a 2004 recipient of the Arts and Science Scholar-In-Residence Award at the University of Missouri where he received a bachelor’s degree in mathematics and a master’s degree in computer applications in physical geography. He is a principal contributor to the new Storage Wiki project.

A sought-after motivator and IT speaker worldwide, Fred completed the Berkeley Executive Program in 1997. He currently serves on a few select boards in the storage networking industry.

This Book is Sponsored by CA

Today’s modern mainframe represents the pinnacle of business and government IT, boasting an architecture many years ahead of anything else available. Mainframes provide the strongest business-focused methodologies to deliver enterprise-class IT needs at the highest levels of reliability, security, compliance and cost effectiveness.

For more than 30 years, mainframe data centers around the globe have relied upon — and continue to rely upon — CA’s mainframe storage management expertise to manage, protect, and optimize their storage environments. CA’s proven and trusted technologies are delivered as integrated, automated and easy-to-use mainframe solutions that are uniquely aligned with global business strategies. CA is committed to being your valued partner and trusted advisor today and into the future.

CA is proud to sponsor the publishing of the 2008 Storage Panorama reference book created by Fred Moore of Horison Information Strategies. This reference guide contains updated storage statistics and perspectives that are valued by storage management professionals worldwide. We hope you enjoy the book, discover some new things, and spark your interest to learn more about CA storage management solutions. Our strategy is to help our customers obtain value today from their CA mainframe solutions, while ensuring that our solutions also remain essential tomorrow.