The Silicon Image Steel Vine architecture tm

A Storage Appliance Architecture for the 21st Century

Reliable, scalable storage for mass-market consumption

Enterprise Class Storage Benefits for Small- and Medium-Sized Business

For small- and medium-sized businesses (SMB) the world of data storage has not changed significantly in 20 years. Despite advances in network attached storage (NAS), storage area networks (SAN), and high-end disk arrays, storage for the SMB is still too expensive, too complicated, and too troublesome to support.

Facing dramatic growth in demand for storage capacity, SMB firms are now in desperate need of the technology gains that have benefited the storage environments of large enterprise IT organizations. But, without the financial resources of the enterprise, SMB buyers have limited access to gains vendors have made in performance, scalability, availability, and storage management. In addition, the complex installation and management requirements of top tier storage solutions can quickly overtax the limited capabilities of the SMB.

The Serial ATA (SATA) Steel Vine ^{tm} architecture from Silicon Image leverages the cost advantages of SATA hard disk drives, to bring enterprise-class storage features within reach of every business, regardless of size. Supporting plug-and-play RAID configurations – no drivers or BIOS administration to worry about – and up to five high-speed, high-capacity disk drives, the Steel Vine ^{tm} architecture offers uncompromising reliability, performance, and ease of use, at a price that will not break the SMB budget.

An Introduction to Serial ATA Technology

Faster, cheaper, better is common advanced billing for new technologies but few developments promise to live up to this mantra like those using the new SATA storage interface. Chipsets containing native SATA connectors are now a standard component of server and desktop systems, replacing the old Parallel ATA interface – also known as IDE.

The SATA standard offers backward compatibility with older IDE hardware, but the revolutionary improvements come from devices built specifically for SATA connectivity. The new devices allow integrated circuit vendors to pursue advancements in fine lithography that will lead to better and faster chipsets. And, pin and cabling improvements also bode well for more efficient system designs, as bulky IDE cable and connectors are replaced to improve airflow and cooling within the chassis of the computer system. For end-users, however, the most significant advantages of SATA are bigger, faster, and more affordable hard drives.

SATA Reliability

IDE devices have been a mainstay of desktop and laptop computer configurations, but server and workstation applications have traditionally opted for drives that use the small computer systems interface (SCSI) protocol. The SATA standard is prompting system vendors to rethink this strategy.

With built-in cyclical redundancy checks (CRCs) for commands and data, SATA significantly improves data transfer reliability. The growing use of redundant arrays of inexpensive disk (RAID), across a wide range of system and application environments, is further boosting the reliability argument in favor of SATA. RAID configurations use multiple hard drives to provide redundancy in case a single disk fails. The cost and capacity advantages of SATA make it an attractive choice for RAID configurations. SATA drives are now being deployed in workstations, servers, and networked external RAID storage

subsystems that require bulletproof reliability. In addition, cumulative mean time between failure (MTBF) comparisons of SATA and SCSI are producing interesting results.

MTBF is a standard metric used to indicate a hard drive's anticipated lifespan. Although MTBF for individual SCSI drives is high, the significantly greater capacity of SATA drives, and the need to deploy fewer of these devices for a given application, increases the cumulative MTBF of a SATA configuration – see sidebar – making SATA the reliability choice.

SATA Performance

Communicating at data rates of 150 megabytes per second (MBps), first generation SATA devices offer superior performance to IDE. And, with a roadmap that anticipates 300 Mbps and 600 Mbps data rates, the SATA standard meets the growing demand for greater storage bandwidth.

SATA is a point-to-point protocol: Each SATA device is able to use the full capacity of the communication link. This eliminates the bandwidth-restricting necessity to share the communications link resources with other devices. IDE disk drives are affected by this restriction and it has limited their deployment in servers and workstations.

In addition to protocol-based performance advantages, SATA also improves data access speed by adding queuing support for tagged and native commands. This, and non-zero offset support, helps to mitigate disk drive rotational latency.

Comparing SATA to USB2.0 and FireWire (IEEE1394)			
	SATA	USB	FireWire
Raw Interface Speed	1500 Mbps	480 Mbps	400 Mbps
Benchmark Comparison	32.4 MB/sec	22.3 MB/sec	24.6 MB/sec

Figure 1. Comparing SATA to USB and FireWire

SATA Cost

Perhaps the most significant feature of devices built to the SATA standard is the dramatic lowering of dollar-per-gigabyte ($/GB) storage costs. With digital content continually pushing demand for greater capacity, storage resource costs are under constant scrutiny. SATA devices offer a 5:1 cost-saving compared to the $/GB of SCSI. This makes SATA hard drives an attractive option for resource hungry applications like email and databases.

Storage Outside-the-Box

Direct-attached external storage has, historically, required expensive SCSI or Fibre Channel connectivity between a disk array and the server or workstation. The USB 2.0 and FireWire specifications have enabled vendors to deliver low-cost direct-attached storage (DAS) devices, but the performance of these protocols cannot compare to SATA. And, unlike SATA, USB and FireWire steal CPU cycles from the host processor.

Addressing the need for low-cost, high-performance DAS solutions, the SATA Working Group recently released the external SATA specification, giving the industry the standards needed to develop a new class of external storage. The Silicon Image Steel Vine architecture leverages these new specifications to deliver a break through in high-capacity, high-reliability, high-performance, self-maintaining storage for SMB applications.

The Silicon Image Steel Vine ᵗᵐ Architecture

Designed to dramatically simplify the addition of storage capacity to any system, the Steel Vine architecture ᵗᵐ from Silicon Image delivers reliable, high-capacity, high-performance storage, at a price that will not break the SMB IT budget. A direct-attached storage switch, the Steel Vine architecture ᵗᵐ today supports up to five high-capacity SATA hard drives.

Developed for plug-and-play connectivity, and incorporating sophisticated on-chip management capabilities, the Steel Vine ᵗᵐ storage architecture eliminates many time-consuming and error prone storage maintenance tasks. Automated RAID configuration, dynamic disk rebuild and disk copy, and hot spare capabilities ease the burden of storage management on SMB IT staff. And, unlike software-based RAID solutions, the Steel Vine architecture ᵗᵐ does not require BIOS changes or ongoing management of drivers and software on the application server.

Providing enterprise-class reliability, high-speed connectivity, and the extreme capacity advantages of SATA, the Steel Vine architecture ᵗᵐ reduces the capital and maintenance costs of storage ownership.

The Ultimate Low TCO, Zero-Admin Storage

As enterprise IT planners have discovered, the cost of storage management significantly outpaces the cost of storage equipment as capacity increases. Curbing management costs is essential if the storage total cost of ownership (TCO) is to be contained.

The Silicon Image Steel Vine architecture ᵗᵐ delivers sophisticated enterprise-class storage management functionality. With appliance-like simplicity, the Steel Vine architecture ᵗᵐ reduces the overhead of storage ownership. Exploiting on-chip automation, the switch eliminates the need for technical specialists while providing complex storage management functions, such as RAID. Using an intelligent user interface, operators are able to tailor the storage environment to the specific needs of business applications. With one mouse-click an operator selects between a fast (RAID 1) or safe (RAID 10) storage configuration. Features and functions, previously managed in the BIOS of the application server or RAID adapter card are automatically configured at the storage device. This eliminates the need to install and maintain hardware and drivers at the application server.

In addition to automated RAID configuration, the Steel Vine architecture ᵗᵐ features built-in disk-to-disk copy, disk-rebuild, and hot-spare drive capabilities. The hot spare allows failed disks to be dynamically recovered with minimal impact on end-users. In addition, built-in

disk virtualization technology enables the five hard drives in each switch enclosure to be concatenated or sub-divided according to the specific reliability, performance, and capacity needs of end-user applications.

Greater Reliability Improves Productivity

Today's increasingly digital workflows correlate employee productivity directly with efficient access to business applications. Unanticipated downtime is costly and can lead to lost sales opportunities, disgruntled customers, and expensive project delays. High-reliability storage configurations help to safeguard against outages, but these solutions are frequently costly and can require complex manual setup by a technical specialist.

The Steel Vine architecture [tm] supports RAID 1 and RAID 10 configurations to safeguard application data against loss. An optional hot-spare disk allows for immediate resumption of full RAID data protection should a primary drive fail. If a failure occurs, the hot-spare drive takes the place of the failed drive, restoring the quorum of RAID disks. When the defective disk is replaced it becomes the new hot spare.

In addition, the Steel Vine architecture [tm] supports self-monitoring analysis and reporting technology (SMART), allowing rapid detection of drives that are in immanent danger of failing. If a faulty drive is detected it can be swapped with the hot spare after performing a disk-to-disk copy. This ensures the ongoing safety of production data. The failing drive can then be replaced with minimal disruption to end-users and no loss of business data.

Protecting the Storage Investment Through Scalability

With demand for storage capacity showing no signs of slowing, scalability is now an essential requirement if IT buyers are to be protected from a rapidly eroding storage investment. The Silicon Image Steel Vine architecture [tm] addresses the dilemma of investment protection with built-in in functionality that enables buyers to instantly leverage advancements in the size and speed of SATA hard drives.

The SATA standard frees disk drive manufacturers to bring to market hard drives in sizes unimaginable with SCSI and IDE interfaces. Depending on the chosen configuration, a Silicon Image Steel Vine architecture [tm] switch, deployed with five 250 GB SATA drives, provides anywhere from 500 GB (RAID 1 with hot spare) to 1,250 GB (no RAID, no spare) of storage capacity. Although sufficient for today's needs, saturation with data is inevitable, and the search for more space will continue. The Steel Vine architecture [tm] rises to the occasion with seamless expandability.

As end-user demand for capacity grows, built-in support for 48-bit LBAs allows administrators to dynamically upgrade the switch with larger hard drives. The internal virtualization engine provides the mechanism that allows older drives to be swapped for larger drives, with minimal disruption to end-users. In addition, the Steel Vine architecture [tm] supports 3 gigabits per second (Gbps) data rates, allowing users to upgrade to faster 3 Gbps hard drives as they become available. This furthers user investment protection by anticipating the storage industry's next performance advances. With no apparent limits on the size of a SATA hard drive, the Steel Vine architecture [tm] promises indefinite extendibility.

High-Performance Access to Application Data

Whether serving web pages across the Internet, email to users throughout the organization, or database information to mission critical applications, high-speed access to data is essential. The SATA standard offers dedicated, point-to-point connectivity at data rates of 1.5 Gbps, with a roadmap that will deliver access rates of 6 Gbps. SATA provides unsurpassed data access performance.

In addition to native SATA speed advantages, the Steel Vine architecture ^{tm} supports two forms of RAID striping that improve performance by spreading the load of I/O processing across available disks. RAID 0 performs striping across all configured disks to evenly balance the I/O processing load. This configuration does not provide parity or mirroring. RAID 10 performs striping across the available disk drives with mirroring and parity checks. This gives the I/O load balancing features of RAID 0 and the added reliability of mirrored data.

Unlike RAID storage solutions that use the USB or FireWire standard, the Steel Vine architecture ^{tm} does not piggyback on the processor resources of the application server. This means no performance degradation to applications from choosing sophisticated storage solutions such as RAID.

High-Performance, High-Reliability, Low-Cost Storage for the SMB

The SATA interface brings the technology gains in storage performance, reliability, and cost within reach of SMB organizations. The Silicon Image Steel Vine architecture ^{tm} leverages the advantages of SATA to offer high-capacity, high-speed storage with appliance-like management simplicity. Significantly easing the burden of storage management, the Steel Vine architecture ^{tm} delivers intelligent, affordable storage priced for the SMB budget.