

**Hitachi Freedom Storage™
Lightning 9900™ Series**

Taking the World by Storm

HITACHI
DATA SYSTEMS

9900

Hitachi Freedom Storage™ Lightning 9900™ Series

The first generation of intelligent storage systems

Highlights

Instant access to data around the clock

- 100% data availability guarantee
- No single point of failure
- Highly resilient multi-path fibre architecture
- Fully redundant, fault-tolerant, hot-swappable components
- Global dynamic hot sparing
- Duplexed write cache with battery backup
- Hi-Track® "call-home" maintenance system
- Non-disruptive microcode updates
- RAID-1+ and/or RAID-5 arrays within the same system
- Industry-leading business continuity solutions for rapid recovery from application failures or disasters
- Proven point-in-time software enables data backup and recovery
- Professional services to enable rapid deployment of multi-site, multi-platform, high-availability solutions
- Non-disruptive, real-time copies for backups, application testing, and data warehousing/data mining activities
- Proven support for Geographically Dispersed Parallel Sysplex™ (GDPS™), a failover and load-sharing offering from IBM®
- Open systems host failover and alternate path support

Unmatched performance and capacity

- Industry's only switched architecture
- Up to 6.4GB/sec internal system bandwidth
- Fully addressable 32GB data cache
- Hitachi FlashAccess™ provides cache speeds to frequently used volumes
- Extremely fast and intelligent cache algorithms
- Non-disruptive expansion to over 88TB raw capacity
- Simultaneous transfers from up to 32 separate hosts
- Flexible LUN support
- Automated performance tuning
- High-throughput 10,025RPM Fibre Channel disk drives with dual-segmented cache buffering and redundant pathing

Extensive connectivity and resource sharing

- Concurrent operation of UNIX®, Microsoft® Windows® 2000, Microsoft Windows NT®, Linux®, Novell® NetWare®, and S/390® hosts
- Fibre Channel, ESCON®, and FICON™ server connections
- Fibre Channel and ESCON support for Hitachi TrueCopy™ remote copy functions
- Support for NAS, SAN, Fibre Channel Switched, Fibre Channel Arbitrated Loop (FC-AL), and point-to-point configurations

Freedom Storage Software

- Copy protection for disaster recovery, rapid backup/restore, on-line data migration, tapeless data vaulting, application testing, and data warehousing/data mining applications
- Non-stop access to information
- Data exchange between UNIX, Windows 2000, Windows NT, Linux, and OS/390® platforms

Centralized storage management

HiCommand™ Management Framework—open, extensible, modular storage management software based on industry standards:

- Seamless integration of best-of-breed products
- Policy-based automation
- Manages multi-vendor storage systems from any location

Available in flexible configurations

The Lightning 9900 Series is designed to match your business and IT objectives:

- Lightning 9910 is ideal for high-reliability, high-connectivity, multi-platform, application-specific or distributed deployment
- Lightning 9960 allows nearly unlimited storage expansion for the largest enterprise applications and large-scale consolidation

Electrify Your Business with the Hitachi Freedom Storage Lightning 9900 Series Systems

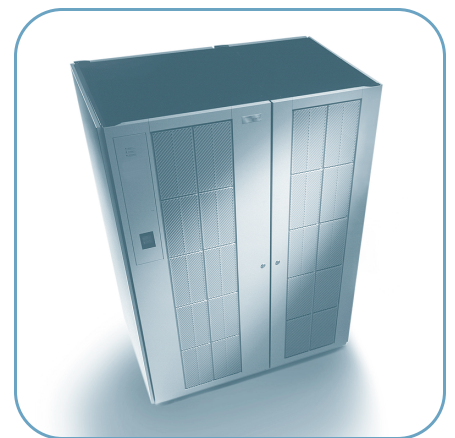
The economy is taking a new shape each day, moving faster than ever before, and presenting all of us with a world of challenges. The Internet, as a platform for sharing information, is having a powerful effect on companies. Exciting business-to-business processes and vital customer relationship management capabilities hold out the promise of new profit centers, increased revenues, and reduced costs. However, this whirlwind of opportunity is also accompanied by the use of billions of transactions and enormous amounts of text, video, graphical, and audio data which are transferred every day, and growing exponentially.

In this new climate, information, and the ability to collect, analyze, and act on it quickly, is the enabler for success. Your information infrastructure, and the technology that supports it, needs to deliver 24/7 availability and provide the scalability and performance to withstand both anticipated and unanticipated tidal waves of data. How will you ensure that your company has an intelligent information infrastructure to support the strategic initiatives that will determine your company's outcome?

The biggest problem facing IT managers today is figuring out how they can provide instant access to data from any computer, anywhere, anytime. Hitachi Data Systems answered this challenge by bringing the world's most advanced enterprise storage systems to market now—when you need them most—as you plan your infrastructure for ever-growing information. Designed with your needs in mind, the Hitachi Freedom Storage Lightning 9900 Series and the second-generation Lightning 9900 V Series actually let you conduct your business in ways you never could before.

We understand how important it is to deliver non-stop instantaneous access to mission-critical information, to manage it on a worldwide basis, and to protect it from disaster. Our no-limits storage vision enables the enterprise-wide flow of information across multiple platforms and multiple geographies. For many companies, IT is no longer a cost center—it's a revenue center. Information no longer supports your business—it *is* your business. In today's economy, the quickest return on your investment comes not from lowering the cost of goods, but rather, from lowering the cost of your business-to-business or business-to-consumer transactions. The Lightning 9900 Series offers you the only enterprise storage systems designed and built specifically to support these new demands.

We also understand that you can't afford to have your system down, disrupted, or busy for even a few seconds. You need an intelligent storage system that can dynamically adapt, scale, grow, and be there when you need it. The Lightning 9960 and Lightning 9910 won't just ramp up your enterprise, they will provide you with previously unattainable levels of efficiency and performance and scale seamlessly to accommodate future growth. With the Lightning 9900 Series, your company won't just be able to take advantage of new opportunities. It will be positioned to thrive.



In a fast-paced world, continuous data access ensures your competitive edge

Companies are shifting attention and resources to support e-business efforts and breakthrough initiatives to better position themselves for the future. Yet, as we speed ever faster toward the future, it becomes even more difficult to predict. But one thing is sure. When it comes to achieving your corporate goals, downtime is the enemy. Beyond lost revenues and customers, the reputation of your company rides on your ability to deliver a broad range of information and transactions on demand.

100% data availability—guaranteed

If a storage system can't deliver continuous data access, you're risking your bottom line. Completely redundant and fault tolerant throughout, the Lightning 9900 Series is the only line of storage in the industry to be backed by a 100% data availability guarantee. With the revolutionary **Hi-Star™** internal switched architecture that provides as many as 64 switched, internal paths, the Lightning 9960 and Lightning 9910 are also the world's first high-resiliency storage systems. There is no disruption in service because no bottlenecks occur in the event of a failed path.

We know your system can never be down, not even for a second, so we gave the Lightning 9900 Series the ability to perform all maintenance activity without disruption to your 24/7 operations. Redundant hardware components (including disk drives) can be replaced, features can be added, capacity can be expanded, and microcode can be upgraded—all without shutting down or even slowing your critical applications.

In the Lightning 9960, up to 32GB of nonvolatile cache is accessible to all disk arrays at all times. In the Lightning 9910, it's up to 16GB. In both instances, the cache protects your valuable data by automatically maintaining two copies, each of which is independently protected by its own power source and batteries. In fact, even the batteries are redundant, so data can remain in cache until power is restored. Unlike systems that wait to destage data to disk until cache is full, or a power outage occurs, the Lightning 9960 and Lightning 9910 destage to disk continuously.

The Lightning 9900 Series disk drives are designed for higher reliability than the nearest competitor. And, our unique Global Dynamic Sparing feature—permitting any hot spare to replace any drive within the entire system—saves you time and money. No other enterprise storage system offers such high levels of reliability and availability.

Volume replication for non-stop operation

Hitachi ShadowImage™ software allows you to simultaneously duplicate logical volume images (LVIs) and logical units (LUNs) without disrupting service—and without quiescing, timing out, or affecting the performance of your business-critical applications. Up to three S/390 and up to nine open systems RAID-protected duplicates can be created within a single system at hardware speeds. These point-in-time copies can be used to create backups, to test applications, and to support data mining activities.

When used in conjunction with Hitachi's remote copy software products, ShadowImage lets you maintain up to 20 copies of critical data. Usability is further enhanced through a resynchronization capability that reduces data duplication requirements while sustaining normal levels of operation. Since every second counts, ShadowImage provides a compelling value proposition to your business because it actually increases your overall efficiency and productivity as your enterprise grows.

Around-the-clock protection to keep you up and running

Maintaining accurate copies of your data is essential to ensure that your business keeps running. Our copy suite of software solutions provides unbeatable data protection for multi-platform environments, enabling comprehensive backup and rapid recovery in the event of application failures or disasters—natural or manmade. Hitachi's remote copy software accommodates all major platforms, including UNIX, Windows 2000, Windows NT, NetWare, Linux, and S/390.

We offer **TrueCopy** to continuously update and maintain reliable copies of your extremely valuable data at a secondary site. TrueCopy supports remote data movement and migration over ESCON or Fibre Channel. Hitachi-qualified Channel Extenders and Dense Wave Division Multiplexors can be used to move data any distance from primary to secondary. Lightning 9900 Series storage systems using network protocols such as IP, ATM, or Dark Fiber.

Our innovative **NanoCopy™** software, based on TrueCopy, is an industry first and can replicate data between any number of primary systems and any number of secondary systems anywhere in the world—with full data integrity. In conjunction with ShadowImage, NanoCopy maintains duplicates of critical data with full protection against rolling disasters, allowing you to initiate production at a backup location immediately following an outage.

You also can develop comprehensive disaster recovery solutions by dynamically maintaining a copy of data either locally or across long distances, using industry-standard channel extenders. And you can migrate an application from one data center to another without experiencing lengthy—and costly—outages.

Hitachi Command Control Interface (CCI) allows open systems users to manage TrueCopy and ShadowImage from their host's management station. With Hitachi CCI, storage administrators can create batch streams to automate TrueCopy or ShadowImage operations using a command line interface. Hitachi CCI functions can also be integrated with host-based failover software such as IBM's HACMP™, HP® MC/Service Guard™, and VERITAS® Cluster Server™.

Sleep tight: Keep your data safe off site

Rest assured that the Lightning 9900 Series is safeguarding your valuable data with Tantia™ Technologies' **HARBOR® Backup** software. HARBOR Backup provides the industry's most cost-effective, user-controlled backup/restore with simplified setup and installation processes. The premier backup and recovery solution for distributed environments, HARBOR Backup improves data protection and reduces operation costs.

HARBOR Backup also offers standard-setting performance levels. Its design incorporates the fastest connectivity options, including parallel backup stream support, 100MB/sec Fibre Channel speeds, and multi-threading capability. Another outstanding benefit of HARBOR Backup is its ability to recover single files without having to restore entire data volumes.



For open systems, we offer **Hitachi Multiplatform Backup/Restore (HMBR)** software, which allows you to save a significant amount of money by utilizing your already existing S/390 host, ATL environment, and established procedures to back up your open systems data. The “any-to-any” connectivity of the Lightning 9960 and Lightning 9910 systems enables S/390 systems to access Windows NT, Windows 2000, and UNIX open systems LUNs as 3390-3 or 3390-9 devices via standard utilities such as FDR.

GDPS Support

Hitachi Data Systems is the only vendor demonstrating proven remote copy support for **Geographically Dispersed Parallel Sysplex (GDPS)**, an IBM service offering for system failover, workload balancing, and data mirroring on systems spread across two or more sites up to 40 kilometers (25 miles) apart. We provide a number of services to help you plan, integrate, and deploy your GDPS environment based on Lightning 9900 Series storage systems.

Failure is not an option: Clustering support

Clustered servers provide additional support for continuous data access. The Lightning 9900 Series supports several industry-leading host failover open systems software solutions. Host failover allows a standby host to take control of a primary host's storage and network (in the event of a failure in the primary host) and restart the primary host's applications.

The path between a host and a Lightning 9960 or a Lightning 9910 is a potential single point of failure, which could result in a complete loss of data access. Hitachi's alternate path support allows a LUN to be accessed through two separate paths. In the event of a failure on the primary path, the I/O is restarted through the alternate path. Path failover software allows your hosts to recover promptly from interface failures, and provides continuous data access. **Hitachi Dynamic Link Manager™** offers failover protection and load balancing in Windows NT, IBM AIX®, Sun™ Solaris™, and HP-UX® environments. In addition, products are available from third-party suppliers to support other platforms, including VERITAS Cluster Server for Sun Solaris servers.

Hitachi Data Systems professional services: Putting it all together

Achieving continuous availability and integrating it with a cost-effective disaster recovery solution for mission-critical applications is one of the major goals of enterprise IT management. The need for better availability and recovery solutions has been magnified by the growth of Internet, intranet, and extranet services that require non-stop access to enterprise resource planning, legacy, and customer service applications. The decreasing cost of hardware has made it feasible for IT departments to develop in-house disaster recovery solutions, allowing greater control over availability, disaster recovery, and the integration between the two.

Our Data Protection Services team is trained in architectural analysis, configuration planning, and enterprise assessment. We work with structured methodologies that promote consistent results. Our industry-leading software, TrueCopy and ShadowImage based on high-performance Lightning 9900 Series systems, allows us to implement essential copy solutions. We help you perform data relocation and migration tasks and establish rock-solid backup and disaster recovery copy facilities to keep your business running. Better still, we eliminate the need for you to allocate staff for these infrequent challenges.

Superior service and support: We're there before you need us

Our world-class service is consistently recognized by our customers as the best in the industry. And our advanced service capabilities are integral to our commitment to delivering 100% data availability.

The **Hi-Track** “call-home” system is our unique predictive maintenance system and is designed to ensure maximum availability. Hi-Track continuously monitors the Lightning 9900 Series systems and automatically transmits collected hardware status information to a Hitachi Data Systems support center. The center analyzes the information and proactively takes corrective action in order to avoid problems that could impact system throughput or availability. Most maintenance activities are quickly performed remotely from one of our support centers without disrupting your 24/7 operations.

Scalable capacity and performance that grow as you go—key to business agility

No doubt about it. The biggest threat to your business—bricks or clicks—is your own success. Users, partners, suppliers, and customers all promise to push your storage infrastructure to its limits. Your next storage system should allow you to add capacity without compromising performance. You need to partner with a storage company that understands this and can help you prepare your infrastructure for unprecedented growth and exponential demand.



A bottleneck-free architecture maximizes capacity and performance scalability

If your business is like most, you have to move text, graphics, sound, and video to thousands of users worldwide. At the same time, you must account for backups, restores, application development, application testing, transaction traffic, and multiple time-consuming data mining queries in your data-intensive environment.

All of this activity can create bottlenecks that slow down critical applications, including your Web site. Research shows that the average customer will leave a Web site if it takes more than four seconds to download. You hate to wait when you click on an Internet site, and so do your customers, partners, and vendors when they click on yours. In the context of today's economy, performance and availability go hand-in-hand—when your system is busy, it is unavailable to those trying to access it. Your lost opportunities become your competitors' gains. Behind every great Web site is a storage system that can weather both the high tide and unexpected deluge of demand.

Greater agility for the dynamic, expanding enterprise

You need an enterprise storage system designed to handle heavy loads and capacity upgrades without affecting performance. The Lightning 9900 Series' highly sophisticated Hi-Star architecture easily handles the most demanding I/O loads your users, customers, partners, and vendors can throw at it. Unlike traditional shared-bus architectures, standard in previous generations of storage systems, Hi-Star incorporates an advanced, point-to-point, crossbar-switched fabric that interconnects disks, cache, and server interfaces. With this architecture, the internal bandwidth of the Lightning 9900 Series actually increases as more array controllers and front-end channel adapters are added—in the Lightning 9910, up to 3.2GB/sec. In the Lightning 9960—up to 6.4GB/sec!

This technological breakthrough makes the Lightning 9900 Series the first truly bottleneck-free enterprise storage systems; high-speed, switched, point-to-point data paths mean no costly service disruptions due to a busy system. The Lightning 9900 Series systems will pump data at speeds you never thought possible.

Moreover, the efficiency of Lightning 9900 Series' sophisticated cache management and RAID algorithms combines with its standard-setting bandwidth capability to sustain a data transfer rate that is more than six times that of any competing storage system. The Lightning 9900 Series uses the industry's most intelligent caching algorithms to dramatically improve system performance. Record and Logical Block Address level caching is available, along with an Intelligent Learning Algorithm that monitors data access patterns and dynamically alters staging criteria to ensure the highest possible hit ratios for randomly accessed data.

**Sizzle not fizzle:
raise your ROI by lowering
your transaction costs**

In the past, profitability was realized by lowering the cost of goods. Today, your competitors have access to the same low cost of goods. Profitability is realized by lowering the cost per transaction. And this is where the Lightning 9900 Series really shines.

Competitive systems bog down from increased overhead when capacity is increased. Not the Lightning 9960—the more users it supports, the faster it gets. Adding options and components only increases the system's available bandwidth. For example, you can leverage multiple Web-based applications to provide your customers, business partners, and vendors with the instant access to data they require.

**Unsurpassed flexibility:
the perfect configuration for your
unique business**

Powered by the Hi-Star architecture, the Lightning 9900 Series provides the highest bandwidth and the highest level of resiliency, delivering speed, flexibility, and cost-savings that will let you take your market by storm. The Lightning 9960 enables you to avoid the future shock of a weak e-infrastructure with up to 88TB of highly scalable raw storage, 32GB of cache memory, and 32 Fibre Channel, ESCON, or FICON connections in a multi-cabinet configuration.

Based on the same flexible, high-speed architecture, the Lightning 9910 gives you the capacity you need for sustained growth and the reliability to handle disaster protection responsibilities—in one small enterprise footprint. The Lightning 9910 can ramp to meet storage requirements to over 9TB of raw capacity in a single cabinet. This provides for the enterprise growth you foresee as well as for an incredibly fault-tolerant, always-up platform to protect your critical data.

**Stretch your investment
with intermixed RAID and drives**

The Lightning 9900 Series offers three high-performance drive options—18GB, 73GB, and 181GB—for high capacity applications such as imaging and deep archiving, all of which can be intermixed within a system to meet your individual requirements. These hard disks are the most reliable and highest performing in the world. Each of these active dual-ported Fibre Channel drives has an onboard dual-segmented cache buffer which contributes to the Lightning 9900 Series' extremely fast back-end performance.

What's more, the Lightning 9900 Series permits you to mix RAID-1+ and RAID-5 within a system to meet your application requirements. This, in turn, allows you to maximize protection and performance for individual applications. For example, our RAID-5 implementation provides the equivalent performance of competitive RAID-1 offerings at two-thirds of the cost.

Both open systems and S/390 customers can intermix 18GB, 73GB, and 181GB drives within the same Lightning 9900 storage system. And S/390 LVIs and open systems LUNs can be intermixed behind the same Array Control Processor (ACP) pair, providing unparalleled configuration flexibility.



Managing your data's growth and performance

Successful companies know that to dramatically decrease time to market and get to targeted customers fast, they have to significantly increase the amount and type of data they collect, analyze, and transfer. These companies also know that they have to take more care than ever before in planning their storage initiatives. One mistake can cost millions of dollars. With the Lightning 9960 system as an integral part of your infrastructure, you'll be able to manage multitudes of terabytes for years to come. And with the Lightning 9910, you'll be readied to provide managed growth and an array of essential distributed strategies.

Direct attach, SAN, or NAS: the Lightning 9960 is the world's first truly consolidated storage solution

The Lightning 9900 Series removes the downtime and bottleneck risks normally associated with typical consolidated storage approaches. Unlike the Lightning 9960, competitive storage systems claim to be enterprise-ready, yet actually slow down with each additional host. The performance and scalability of the Lightning 9960 enables you to consolidate vast amounts of storage across open systems and mainframe servers, as has been traditionally done with platform-independent storage systems. You can also replace three to five of the previous generation's bus-bound storage systems with one Lightning 9960. In either case, the Lightning 9960 dramatically lowers your IT costs, and extends your capital investment by consolidating storage resources and sharing information across disparate platforms. Plus with attachment of our **Hitachi Freedom NAS™** file server, the Lightning 9900 Series systems can do double-duty as networked storage—SAN (Storage Area Network) and NAS (Network Attached Storage) within the same system, providing a centralized storage pool.

With 32 Fibre Channel, ESCON, or FICON host connections, the Lightning 9960 not only easily performs fast simultaneous transfers between any combination of UNIX, Windows 2000, Windows NT, Linux, NetWare, and S/390 hosts, but it also scales to maintain the levels of performance your customers demand. And for even greater performance, you have a choice of 1Gb/sec or 2Gb/sec.

Your SAN-optimized storage backbone, also ready for NAS

SANs provide lasting benefits ranging from shared pooling and better utilization of storage resources to improved performance, better security, and higher availability. SANs also place new demands on storage systems: switches allow more hosts, possibly hundreds of hosts, to access storage ports; I/O rates increase as access becomes more dispersed; and cache hit rates decrease, leading to more data being retrieved directly from disk.

From the Lightning 9900 Series' Hi-Star architecture and its all-fibre, multiple-looped FC-AL back-end and disks, to its support for World Wide Names, and SAN security, the Lightning 9900 Series storage is ready to support the largest SANs, including our own **Hitachi Freedom SAN™**. The Lightning 9960 provides 32 Fibre ports, both 1Gb/sec or 2Gb/sec.

Because the Lightning 9960 was specifically designed to handle data from hundreds of SAN-enabled hosts, it can handle far more simultaneous "hits" than traditional direct-connect storage systems. Now you can seamlessly add critical business-to-business applications to your infrastructure to ensure your success and out-manuever your competitors.

Superior by design, the Lightning 9910 is a key piece of the enterprise infrastructure

The Lightning 9910, with its open system and S/390 robust channel connectivity, has all the high-speed, high-availability characteristics of the Lightning 9900 Series. This enables the Lightning 9910 and its 9TB hot-swappable component design to play an important position in your SAN environment. Assign the Lightning 9910 to a typical storage role for sustained growth. Or, enact your essential distributed strategies for ensuring data replication, disaster recovery, and information sharing.

With 24 Fibre Channel, ESCON, or FICON interfaces and lightning-fast fibre back-end bandwidth, the Lightning 9910 performs at speeds every business requires to support success. The Lightning 9910's RAID-1+ delivers unequalled protection and performance. Its cache architecture allows for duplicate writes, separate power and service boundaries, and 48-hour battery data backup, providing dedicated and duplicated control.

Lower storage management costs: Freedom Storage Software

Simplified and Optimized Storage Management

Open and extensible, the HiCommand™ Management Framework is based on industry standards, including the Common Information Model (CIM), the Simple Object Access Protocol (SOAP), and eXtensible Markup Language. Adherence to these standards enables the snap-in of software developed by Hitachi or complementary independent software vendor offerings. As a result, HiCommand is customizable and easily integrates with existing infrastructures to optimize storage management. Beginning with the HiCommand Device Manager module, the HiCommand Management Framework will expand to provide a full suite of storage management applications.

The Device Manager module enables you to configure, monitor, manage, and tune Lightning 9900 V Series, Lightning 9900 Series, Thunder 9200™, Sun StorEdge™ 9900 Series, and Sun StorEdge T3 systems, via a single graphical user interface (GUI) over an IP connection device. Working at the logical or physical level, Device Manager simplifies storage management complexities, allowing existing IT resources to be more productive.

A triumph over current storage management processes, HiCommand Management Framework positions you to:

- **lower TCO**
reduces the complexity and effort needed to perform storage management tasks
- **simplify storage management**
single-screen, intuitive GUI requires less training and expertise than dispersed tool sets, thereby improving productivity
- **enable seamless integration**
integrates the best-of-breed third-party software. Open APIs allow ISV products to seamlessly integrate into the HiCommand Management Framework, giving you more freedom to choose how you manage your storage assets.

Utilizing World Wide Names, **Hitachi SANTinel™** controls host access to Lightning 9900 Series LUNs in open systems, multi-platform, or SAN environments. This enables you to restrict server access to specific LUNs and protect your data from unauthorized access.

Hitachi Resource Manager™ software allows storage managers to display system configuration, create user name/password security for administrators, set up RAID groups, allocate LUNs, expand LUNs, and format storage. Users can monitor and manage their storage systems through a graphical user interface, while Resource Manager optimizes performance by providing valuable resource utilization information, such as I/O activity, cache usage, and availability status/event notification.

Hitachi RapidXchange™ eliminates many of the constraints associated with sharing or moving data between heterogeneous systems. RapidXchange is ideal for data warehouses because it moves vast amounts of data quickly from mainframe to UNIX, Windows 2000, or Windows NT environments without tying up networking resources or intermediate tape media. When used with FlashAccess, RapidXchange delivers lightning-fast data transfer speeds.

The Lightning 9900 Series sets a new standard for high-speed data transfer with **HARBOR File Transfer (HFT)**, another proven, cost-effective, and flexible solution from Tantia Technologies, Inc. Part of the exchange solution, HFT facilitates the quick, reliable transfer of data files between OS/390 mainframes and open systems servers. Hitachi Multiplatform Resource Sharing allows the Lightning 9960—and the Lightning 9910—to be shared between UNIX-, Windows 2000-, Windows NT-, or Linux-based servers and S/390-compatible mainframe platforms.

Hitachi Graph-Track™ provides the ultimate in reliable, easy-to-use hardware performance monitoring, and is available for open systems and S/390 environments. Graph-Track displays real-time or historical hardware performance data in a user-friendly Windows 98, Windows NT, or Windows 2000 PC attached to the Lightning 9900 Series system.

Supercharge your data: Decrease those bottlenecks

Scarce technical resources often prevent proactive tuning of storage systems.

Hitachi CruiseControl™ solves this problem by providing automatic performance tuning for the Lightning 9960 and Lightning 9910. Utilizing their many high-speed internal paths to optimize data placement, CruiseControl monitors, analyzes, and moves logical volumes to eliminate “hot-spots,” provides load balancing, and maintains predetermined performance levels. Independent of host type or attachment, CruiseControl makes recommendations for administrator approval in either automatic or assisted mode. CruiseControl replaces the time-consuming, and sometimes error-prone, manual load balancing with simple automated procedures, ensuring long-range optimal performance and reduced cost of ownership.

Bringing lightning-fast speed to Lightning 9960 and Lightning 9910 environments, **FlashAccess** “locks” Lightning 9900 Series data into cache in real time. Read and write functions are performed at cache speeds without any delays. FlashAccess can be used in conjunction with RapidXchange to dramatically increase data transfer speeds.

The Lightning 9900 Series supports IBM’s **Transaction Processing Facility/Multi-Path Lock Facility (TPF/MPLF)** in either native mode or under VM. Providing record-level locking,

the Lightning 9960 and Lightning 9910 enable high levels of concurrent data access across multiple channel paths. RAID-1+, RAID-5, 3390-3 and 3390-9 LVIs are supported as well.

Hitachi Parallel Access Volumes and Multiple Allegiance reduce batch windows and response times in S/390 environments

The Lightning 9900 Series supports **Hitachi Parallel Access Volumes (HPAV)**, a feature which enables multiple applications running on an S/390 server to simultaneously access the same information. Multiple Allegiance (MA) extends this concept to applications running on different S/390 servers.

Together, HPAV and MA reduce queuing, which results in significantly reduced batch times and lightning-fast response times in high-transaction environments, enabling you to meet the peak demands of your business applications.

Managing LUNs and LVIs

In addition to unsurpassed RAID and drive flexibility, the Lightning 9900 Series offers LUN and LVI Manager products to provide you with the granular levels of agility you need to adapt to your ever-evolving application requirements. In open systems environments, the flexible logical unit size supports 1.9GB to 36GB LUNs for operating systems that can handle file sizes greater than 4GB. **Hitachi LUN Manager** provides multiple virtual LUNs in place of an actual LUN to address any user requirement and significantly improves efficiency when handling very large databases.

Simplifying configuration management, Hitachi LUN Manager lets you define, configure, add, delete, resize, and assign LUNs to specific paths, and maintain open systems LUNs on your own, without vendor intervention. Because Hitachi LUN Manager can assign multiple paths to a single LUN, you gain the necessary infrastructure to support alternate path failover, path load balancing, and clustered systems (when supported by the respective server platform).

In S/390 environments, **Hitachi Virtual Logical Volume Image (VLVI) Manager** permits users to configure logical volumes with capacities as small as a single cylinder and as large as a full 3390-9 image. Volume size is determined in cylinder increments, and when deployed in conjunction with FlashAccess, VLVI Manager provides optimum performance and agility.

Comprehensive professional services and responsive support ensure a lasting infrastructure

As new technologies gain acceptance, companies must decide on long-term plans and implementation schedules that cause the least disruption to business. It takes time to implement any large-scale technological change. The transition to new network topologies will see the coexistence of distributed and legacy systems, and SCSI and Fibre Channel on SANs, ESCON, and FICON. Hitachi Freedom Storage provides the comprehensive connectivity, management, and availability capabilities needed to handle this transition. These built-in strengths are bolstered by Hitachi Data Systems' professional services and service and support organizations, which team with you to ensure the optimal operation of hardware, software, and middleware.

Professional services for enterprise solutions

Hitachi Data Systems professional services specializes in infrastructure and storage management services that provide a vendor-independent view of IT architecture, focusing on ways to streamline operations, costs, and interoperability. They also excel at helping customers chart both the strategies and timelines necessary to remain productive and competitive. Whether you need assistance with SANs, performance/capacity issues, migration planning, decisions about platforms and architectures, or maximization of IT investments, Hitachi Data Systems has the expertise and the resources to guide you toward the best solution for your business. A few of the many Hitachi Data Systems service offerings are highlighted here.

SAN services

Controlling explosive data growth and the subsequent increases in storage costs is a daunting task. Storage area networks can help you achieve the increased scalability, availability, and reliability you need to meet this challenge. As you begin to explore options for your future storage plans, you can take advantage of the broad suite of SAN services delivered by Hitachi Data Systems' highly experienced team of SAN specialists. These offerings range from infrastructure assessment, planning, and tactical/strategic design, to project management, installation, and implementation.

Data Protection Services

The **Hitachi Data Protection Services** helps you migrate data from your existing systems to newly installed systems while minimizing the impact on your mission-critical applications. The team applies a four-phase approach that includes assessment, planning, migration, and post-migration support. The strength of this service lies in the combination of Hitachi Data Systems professional services methodology/procedure skills, TrueCopy software, and the outstanding reliability of the Lightning 9900 Series. You gain the benefits of unprecedented levels of data protection and integrity through a complete solution that moves terabytes of data quickly and efficiently.

In S/390 environments, terabytes of data can be migrated between Lightning 9900 Series systems and other industry-standard systems in a matter of hours—while applications are on-line. Hitachi Data Protection Services provides the utmost in availability, allowing users to access data continuously throughout the migration process, and reduces migration times dramatically, saving you considerable expense.

Hitachi SplitSecond™ Solution Services

Made for database operations, this comprehensive service for business applies the SplitSecond Rapid Recovery Solution. Hitachi SplitSecond for Microsoft SQL Server 7.0 and SQL Server 2000 is

designed for use with Lightning 9900 Series systems and ShadowImage to enable rapid recovery of Microsoft SQL databases. ShadowImage works seamlessly with a simplified backup and restore process—Point in Time (PiT) copies—and, for SQL Server 2000, provides an added transaction roll-forward capability. This service is designed to facilitate the high-speed Hitachi Freedom Storage backup and restore capability within large, complex, enterprise-level database applications that carry mission-critical data.

Enterprise storage and availability management services

Hitachi Data Systems offers a variety of consulting services to help extend the life of your storage investment and define ways to achieve greater information functionality throughout your enterprise. These storage services cover storage management, availability, disk utilization, performance and timing, data center cabling and configuration, and design/installation of fibre optic components. Hitachi Data Systems' services help you take full advantage of your IT resources, and enhance the continuous availability and integrity of your mission-critical applications.

In addition, our professional services consultants can work with your business continuity planners on exploiting the capabilities of the Lightning 9900 Series. Our **Cost of Reliability Analysis (CORA)** methodology, a component of our Infrastructure Suite (iSuite) of consulting services, can help to identify the cost, benefit, and ROI in your computing infrastructure to reduce outage windows and the impact of an outage. Our findings and recommendations will be in accordance with your business drivers and in terms that you can take to your executive team.

Superlative Service and Support—Ranked Number One

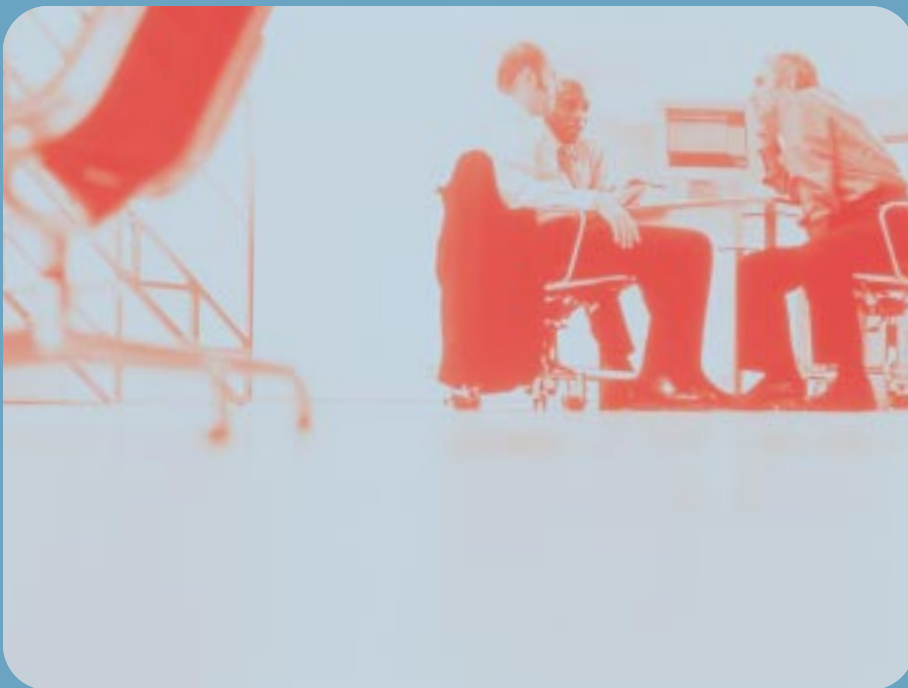
When you partner with Hitachi Data Systems, we're with you every step of the way. Our storage experts provide experienced consultation—backed by comprehensive assessment, planning, and implementation services—to help you develop your enterprise information strategies and deploy your systems. In fact, respondents to a recent survey by FIND/SVP placed Hitachi Data Systems *Number One in overall service and support as well as technical performance.*

Are You Ready to Succeed ?

You'll be ready for success with the Lightning 9900 Series, the most advanced enterprise storage systems available. Specifically designed to meet emerging challenges, the Lightning 9900 Series won't just prepare you to satisfy customer demand, it will have you conducting business in ways you had previously only dreamed possible.

As your workloads continue to rapidly evolve and expand, so will your need for around-the-clock instantaneous data access. With an information infrastructure based on the Lightning 9900 Series, you can manage the data deluge and provide continuous availability. And you have a choice of storage systems. The Lightning 9960's highly sophisticated, exponentially scalable, and inherently flexible architecture will allow you to accommodate today's data flow and be ready for unpredictable future growth. And the Lightning 9910 will help you address smaller capacity applications and critical data protection strategies for which a fast, scalable single unit is clearly the best answer. These choices make way for happy customers *and* an exceptionally high ROI.

Does your current information infrastructure give you a competitive edge? If not, with the Lightning 9900 Series as a foundation, your company will be more efficient, more productive, and more nimble than ever before—now and for years to come.



Lightning 9900 Series—Technical Specifications

System Capacity			Lightning 9960	Lightning 9910	Array Frame		Lightning 9960	Lightning 9910
Number of disk drives (with spares)	5 to 512	5 to 48			Array frames per system	up to 6	N/A	
Hot spares (maximum)	16	4			Spare drives per system (standard)	1 per drive capacity installed	1 per drive capacity installed	
Disk capacity (GB)					Spare drives per system (maximum)	16	4	
3.0 inch (10,025RPM)	18, 73	18, 73			Physical Specifications			
3.0 inch (7,200RPM)	181	181						
Total raw capacity per system	88.3TB	8.3TB			Control Frame		Integrated Control & Array Frame	
Maximum usable capacity for RAID-5					Height	1,790mm (70.5 in.)	1,790mm (70.5 in.)	
Open Systems	64.3TB	5.6TB			Width (with two side panels)	750mm (29.5 in.)	700mm (27.6 in.)	
S/390-compatible	34.87TB	5.6TB			Depth	800mm (31.5 in.)	800mm (31.5 in.)	
Maximum usable capacity for RAID-1+					Weight	451kg (992 lbs)*	524kg (1,153 lbs)**	
Open Systems	34.87TB	3.7TB			Heat	1.5kW*	3.1kW**	
S/390-compatible	41.3TB	3.7TB			Power	1.6kVA*	3.3kVA**	
Maximum number of RAID groups/system	Up to 126	11			Array Frame (one to six)			
Data Cache					Height	1,790mm (70.5 in.)		
Maximum	32GB	16GB			Width (with two side panels)	600mm (23.6 in.)		
Minimum	2GB	1GB			Depth	800mm (31.5 in.)		
Increments	2GB	1GB			Weight	469kg (1,031 lbs)**		
Control Memory	Up to 1.5GB	Up to 1.5GB			Heat	3.4 kW (1-4); 2.6kW (5-6)**		
Logical Device Support	Up to 4,096	Up to 4,096			Power	3.7 kVA (1-4); 2.9 kVA (5-6)**		
Control Frame					Hard Disk Drives			
Client-Host Interface Processors (CHIPs)					GMR (Giant Magnetoresistive) Head Technology			
Number of CHIP pairs	Up to 4	Up to 3				18.46GB	72.91GB	181GB
Simultaneous data transfers per CHIP pair	4 or 8	4 or 8			Rotation Speed	10,025RPM	10,025RPM	7,200RPM
Physical interfaces per CHIP pair	4 or 8	4 or 8			Form Factor	3.0 in./LP	3.0 in./LP	3.0 in./HH
Physical Interfaces per System					Actuator	Recoilless rotary	Recoilless rotary	Recoilless rotary
Maximum	32	24			Servo System	Digital	Digital	Digital
FICON	0, 4, 8, 12, 16	0, 4, 8, 12			Interface	FC-AL	FC-AL	FC-AL
Extended Serial Adapters***	0, 4, 8, 12, 16, 20, 24, 28, or 32	0, 4, 8, 12, 16, 20, or 24			Internal Transfer Rate			
Fibre Channel (fiber-optic cable)	0, 4, 8, 12, 16, 20, 24, 28, or 32	0, 4, 8, 12, 16, 20, or 24			Inner Zone	30.2MB/sec	33.6MB/sec	28.2MB/sec
Interface Speed	1 Gb/sec or 2 Gb/sec	1 Gb/sec or 2 Gb/sec			Outer Zone	45.6MB/sec	56.6MB/sec	50.8MB/sec
Logical Paths per System					Average Seek Time			
Extended Serial Adapters	Up to 8,192	Up to 6,144			Read	5.2ms	5.7ms	7.4ms
Array Control Processor (ACP)					Write	6.0ms	6.5ms	8.2ms
Number of ACP pairs per system	Up to 4	1						
Physical array paths per ACP pair	8	8						
Maximum disks per array path	32	12						
Simultaneous transfers per ACP pair								
To cache	8	4						
To disk array	8	8						
Transfer rate								
Per disk array path	Up to 100MB/sec	Up to 100MB/sec						
Per ACP pair (to cache)	Up to 800MB/sec	Up to 800MB/sec						
Hi-Star switched-fabric architecture maximum internal bandwidth	6.4GB/sec	3.2GB/sec						

* Extended Serial Adapters are compatible with ESCON protocol.

* One controller, 16GB cache, 2 ACP pairs, 16 Fibre Channel ports.

** One disk array frame, 96 disk drives, 6,999GB raw capacity using 73GB hard disk drives.

*** One full system, 16GB cache, 1 ACP pair, 24 Fibre Channel ports, and 48 disks.

Freedom Storage Software

Copy, Disaster Recovery, Backup/Restore

Hitachi TrueCopy
Hitachi Extended Remote Copy
Hitachi Multiplatform Backup/Restore
Hitachi Dynamic Link Manager
Hitachi ShadowImage
HARBOR Backup
NanoCopy

Information Sharing and Exchange

Hitachi RapidXchange
HARBOR File Transfer

Management

Hitachi Resource Manager
Hitachi FlashAccess
Hitachi Graph-Track
Hitachi LUN Manager
Hitachi Virtual Logical Volume Image Manager
Hitachi CruiseControl
LDEV Security
LUN Size Expansion (LUSE)
Hitachi SANtinel
Hitachi Parallel Access Volumes (HPAV)
Multiple Allegiance (MA)

Operating System Support

Open systems

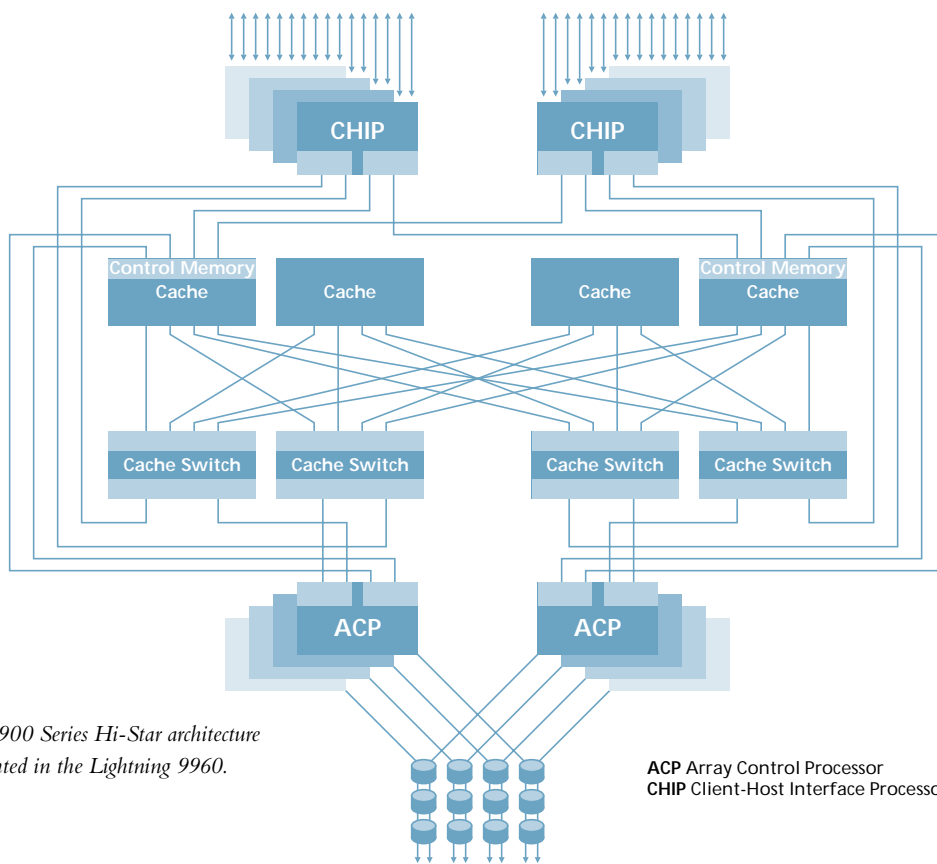
HP (Compaq®) Tru64™ UNIX
HP-UX
IBM AIX
Novell NetWare
Red Hat® Linux
IBM (Sequent®) DYNIX/PTX®
SGI™ IRIX®
Sun Solaris
Windows 2000
Windows NT
OpenVMS™

S/390

OS/390
MVS/ESA®
MVS/XA®
TPF/MPLF
VM/ESA™
VM/XA
VM/HPO
VSE/ESA®
VSE/SP (4.1)

Host Failover and Alternate Path Support

	Host Failover	Alternate Path
HP-UX	MC/ServiceGuard	HP-UX/Logical Volume Manager
Sun Solaris	VERITAS Cluster Server	VERITAS VxVM Hitachi Dynamic Link Manager
AIX	HACMP™	Hitachi Dynamic Link Manager
Windows NT/2000	MSCS	Hitachi Dynamic Link Manager
HP (Compaq) Tru64 UNIX TruCluster		LMS
Sequent	ATAP	Sequent proprietary software

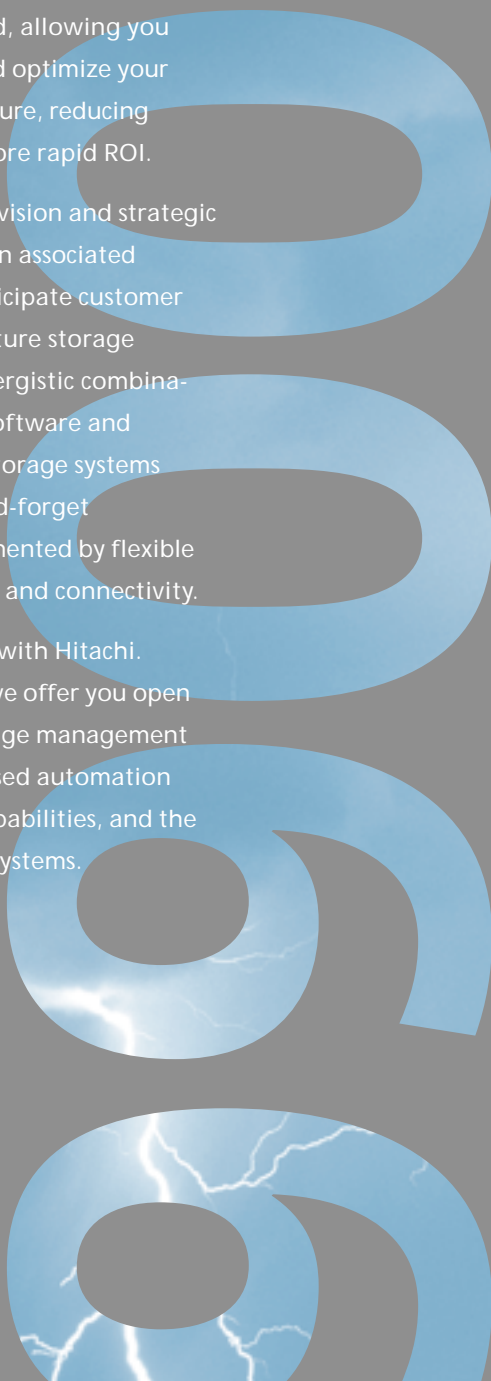


Hitachi TrueNorth™— the Direction You Can Trust

Information and knowledge are fundamental determinants for success in the global economy. Thus, the standards for storage infrastructure availability, performance, scalability, and manageability continue to rise. Hitachi TrueNorth™ is our response to the ensuing demand, allowing you to simplify, protect, and optimize your information infrastructure, reducing TCO and ensuring a more rapid ROI.

The Hitachi TrueNorth vision and strategic direction, along with an associated product road map, anticipate customer needs. We view the future storage infrastructure as a synergistic combination of management software and powerful, intelligent storage systems that will deliver set-and-forget management, complemented by flexible capacity, performance, and connectivity.

Prepare for the future with Hitachi. As we move forward, we offer you open and collaborative storage management frameworks, policy-based automation tools, virtualization capabilities, and the world's finest storage systems.



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