Built on over 50 years of Enterprise disk storage expertise, the IBM® System Storage DS8000® series is the flagship disk storage platform within the IBM System Storage portfolio. The new IBM System Storage DS8870 represents the latest in this series of high-performance, high-capacity, flexible, and resilient disk storage systems, which are aimed at addressing the needs of the most demanding clients.

The DS8870 represents another generation leap for the DS8000 series: it offers up to three times faster performance and 20% higher energy efficiency than its direct predecessor, the DS8800. The DS8000 architecture is server-based. Powerful IBM POWER7® servers manage the cache to minimize disk I/Os to maximize performance and throughput. The DS8870 is tremendously scalable, has broad server support, and has virtualization capabilities. These features can help simplify the storage environment by consolidating multiple storage systems. The DS8870 excels in supporting the new IBM zEnterprise® EC12 and high-end IBM Power® server environments and ensures that clients are taking full advantage of the integration that is delivered by these high-end enterprise systems.

Figure 1 shows the front view of the DS8870.
Did you know?

Full Disk Encryption (FDE) drives are now standard on every DS8870 system, enabling organizations to fully protect their data at rest when combined with Tivoli Key Lifecycle Manager. FDE drives have the same performance as standard drives.

IBM Easy Tier®, a well-proven DS8000 feature, is available at no charge. It dynamically optimizes performance for multi-tiered systems. It can also rebalance data within a single tier to help maintain optimal performance for organizations that have not yet deployed solid-state drives (SSDs) or Nearline drives. The updated Easy Tier 4th generation supports FDE drives for all tiers.

A new power supply system, which is based on direct current uninterruptible power supply (DC-UPS), is much more energy efficient than the Power Distribution System of previous models. The DS8870 is designed to comply with the emerging ENERGY STAR specifications.

Product highlights

The DS8870 Model 961 and associated DS8870 Expansion Unit Model 96E can be ordered with a one-year, two-year, three-year, or four-year support period.

The IBM DS8870 Storage System is designed to meet the strongest challenges with a unique combination of high-end scalability, performance, and reliability.

Scalability and performance

The new DS8870 model features IBM POWER7 p740 server technology to help support high performance:

- Simultaneous multithreading mode, SMT4, enables the POWER7 processor to maximize the throughput of the processor core.
- The DS8870 is available with different processor options ranging from a dual 2-core system up to a total of 16 cores, covering a wide range of performance needs.
- Cache configurations are available that range from 16 GB up to 1 TB cache. The server architecture of the DS8870 with its powerful POWER7 processors makes it possible to manage large caches with small cache segments of 4 KB (and therefore large segment tables) without the need to partition the cache. The POWER7 processors have enough power to implement sophisticated caching algorithms. These algorithms and the small cache segment size optimize cache hits. Therefore, the DS8870 provides excellent I/O response times.
- Write data is always protected by maintaining a copy of write-data in non-volatile storage until the data is destaged to disks.
- The Adaptive Multi-stream Prefetching (AMP) caching algorithm can dramatically improve sequential performance, therefore reducing times for backup, processing for business intelligence, and streaming media. Sequential Adaptive Replacement Cache is a caching algorithm so that you can run different workloads, such as sequential and random workloads, without negatively affecting each other.
- Advanced Easy Tier capabilities manage the SSD storage as a large and low latency cache for the hottest data, while preserving advanced disk system functions, such as RAID protection and remote mirroring.
- I/O Priority Manager is an optional feature that provides application-level quality of service (QoS) for workloads that share a storage pool. This feature provides a way to manage QoS for I/O operations that are associated with critical workloads and gives them priority over other I/O operations that are associated with non-critical workloads. For z/OS®, the I/O Priority Manager allows increased interaction with the host side.
Peripheral Component Interconnect Express (PCI Express Generation 2) I/O improves I/O operations per second (IOPS) and sequential read/write throughput. The I/O enclosures are directly connected to the internal servers with point-to-point PCI Express cables.

8 Gbps host adapters (HAs): The DS8870 model offers enhanced connectivity with 4-port and 8-port Fibre Channel (FC)/IBM FICON® host adapters that are located in the I/O enclosures that are directly connected to the internal processor complexes. The 8 Gbps Fibre Channel/FICON adapter also supports FICON attachment to IBM System zEC12, IBM zEnterprise® 196 (z196), IBM System z114, and IBM System z10®.

Each port can be configured by the user to operate as a Fibre Channel port, a FICON port, or a Fibre Channel port that is used for mirroring.

High Performance FICON for System z® (zHPF): zHPF is the newest IBM z/OS® I/O architecture. Step-by-step, IBM converted the z/OS access methods to use the new I/O commands. zHPF is an optional feature of the DS8870. The DS8870 is at the most up-to-date support level for zHPF. Recent enhancements to zHPF include Extended Distance capability, zHPF List Pre-fetch support for IBM DB2® and utility operations, and zHPF support for sequential access methods. All DB2 I/O is now zHPF-capable.

The system scales to more than 2.3 PB gross drive capacity and supports multiple drive tiers. The DS8870 supports a broad range of disk drives, starting from very fast 400 GB SSDs, fast 146 GB 15 K RPM SAS disk drives, to high-capacity Nearline-SAS 3 TB drives.

Enhancements for System z environments are PAVs, HyperPAV, Multiple Allegiance, I/O priority queuing, I/O Priority Manager, and zHPF.

Additionally, the machine offers end-to-end I/O priorities, cooperative caching, long busy wait host tolerance, and automatic port queues.

**Availability and serviceability**

The DS8870 model is designed and implemented with component redundancy to help avoid potential single points of failure (SPOFs). The DS8870 offers high availability, multiplatform support, including System z:

- The DS8870 offers up to 128 available host adapter ports. With Model 961, a maximum of eight 8-port host adapters are available, which is equal to 64 host adapter ports. With the first expansion model, 96E, another eight host adapters are available, which is equal to an additional 64 host adapter ports.
- A nondisruptive upgrade path for the DS8870 configurations and additional Model 96E expansion frames allows processor, cache, and storage enhancements to be performed concurrently without disrupting applications. The DS8870 supports a nondisruptive upgrade from the smallest to the largest configuration.
- The Dynamic Volume Expansion simplifies management by enabling easier, online volume expansion (for Open Systems and System z) to support application data growth, and to support data center migration and consolidation to larger volumes to ease addressing constraints.
- The DS8870 features Smart Rebuild, which is a function to help reduce the possibility of secondary failures and data loss in RAID arrays. The DS8870 supports RAID 5, RAID 6, and RAID 10.
- High opportunity components are protected with redundancy and the ability to be repaired concurrently. The DS8870 offers greater-than-five-nines availability.
- For data protection and availability, the DS8870 provides full sets of Mirroring and Copy functions. Copy Services are now available for thin-provisioned volumes, as well.
- The DS8870 supports the advanced disaster recovery solution, business continuity solutions, and also Thin Provisioning.
- Large volume support: The DS8870 supports logical unit number (LUN) sizes up to 16 TB to simplify storage management tasks. In a z/OS environment, Extended Address Volumes (EAVs) with sizes up to 1 TB are supported.

- Active Volume Protection: This feature prevents the deletion of volumes that are still in use.

- Support for the T10 Data Integrity Field standard. The Data Integrity Field standard of SCSI T10 enables end-to-end data protection from the application or host HBA down to the disk drives.

- Lightweight Directory Access Protocol (LDAP) authentication support, which allows single sign-on (SSO) functionality, can simplify user management.

- The DS8870 has been certified as meeting the requirements of the IPv6 Read Logo program, indicating its implementation of IPv6 mandatory core protocols and the ability to interoperate with other IPv6 implementations. The IBM DS8000 can be configured in native IPv6 environments. The logo program provides conformance and interoperability test specifications that are based on open standards to support IPv6 deployment globally. Furthermore, the US National Institute of Standards and Technology tested IPv6 with the DS8000, thus granting it support from the USGV6 profile and testing program.

**Environmentally friendly and energy efficient**

Greater energy efficiency contributes to lower energy costs. The DS8870 provides new DC uninterruptible power supplies that improve energy efficiency and are designed to support emerging energy efficiency standards:

- The DS8870 is designed to comply with the emerging ENERGY STAR specifications.
- High-density storage enclosures offer a considerable reduction in footprint and energy consumption.
- Hot-aisle and Cold-aisle are designed to optimize airflow, cooling costs, and energy efficiency.
- The DS8870 is Restriction of Hazardous Substances (RoHS)-compliant.

**Security encryption**

Combined with the world-class business resiliency and encryption features, the DS8870 provides a unique combination of high availability, performance, and security.

To counteract the growing threat of security breaches, the DS8870 has self-encrypting drives as a standard feature. It offers security capabilities, such as broad-based access control and tamper-proof audit logging, as well as other security features that are needed to comply with regulatory authorities:

- Self-encrypted drives are a standard feature. You only need to activate encryption on the drives and consider an additional IBM Security Key Lifecycle Manager or IBM Tivoli® Key Lifecycle Manager server.
- The DS8870 is now equipped with encryption-capable disk drives or SSDs.

Disk encryption key management helps address Payment Card Industry Data Security Standard (PCI-DSS) requirements:

- Encryption deadlock recovery key option: When enabled, this option allows the user to restore access to a DS8000 when the encryption key for the storage is unavailable due to an encryption deadlock scenario.
- Dual platform key server support is important if key servers on z/OS share keys with key servers on Open Systems. The DS8000 requires an isolated key server in encryption configurations. The isolated key server that is currently defined is an IBM System x® server. Dual platform key server support allows two server platforms to host the key manager with either platform operating in either clear key or secure key mode.
• Recovery key Enabling/Disabling and Rekey data key option for the FDE feature: Both of these enhancements can help clients satisfy Payment Card Industry (PCI) security standards.

Advanced functions

The DS8870 offers these advanced functions:

• The DS8870 provides an improved DS GUI management interface to configure the DS8870 or query status information. The DS8870 DS GUI has the same look-and-feel as the GUIs of other IBM storage products, making it easier for a storage administrator to work with different IBM storage products.

• Storage Pool Striping (rotate extents) provides a mechanism to distribute a volume’s or LUN’s data across many RAID arrays and therefore across many disk drives. Storage Pool Striping helps maximize performance without special tuning and greatly reduces “hot spots” in arrays.

• Thin Provisioning: This feature allows the creation of over-provisioned devices for more efficient usage of the storage capacity for Open Systems. Copy Services are now available for Thin Provisioning.

• Quick Initialization: This feature provides very fast volume initialization (for Open Systems LUNs and count key data (CKD) volumes) and therefore allows the creation of devices, making them available as soon as the command completes.

• Support for VMware Virtual Array Integration Interface (VAAI).

• Like its predecessors, the DS8870 offers advanced Copy Services:

  o IBM FlashCopy® is an optional feature that allows the creation of volume copies (and dataset copies for z/OS) nearly instantaneously. Different options are available to create full copies, incremental copies, or copy-on-write copies. FlashCopy can be used to perform backup operations in parallel to production or to create test systems. The IBM FlashCopy SE capability enables more space-efficient utilization of capacity for copies, enabling improved cost-effectiveness.

  o Remote mirroring options: The DS8870 provides the same remote mirroring options as previous models of the DS8000 family. Synchronous remote mirroring (Metro Mirror) is supported up to 300 km. Asynchronous copy (Global Mirror) is supported for unlimited distances. Three-site options are available by combining Metro Mirror and Global Mirror. In cooperation with z/OS Data Mover, another option is available for z/OS: Global Mirror for z/OS. Another important feature for z/OS Global Mirror (2-site) and z/OS Metro/Global Mirror (3-site) is Extended Distance FICON, which can help reduce the need for channel extenders’ configurations by increasing the number of read commands in flight.

  o Metro Mirror, Global Copy, Global Mirror, Metro/Global Mirror, z/OS Global Mirror, and z/OS Metro/Global Mirror business continuity solutions are designed to provide the advanced functionality and flexibility that are needed to tailor a business continuity environment for almost any recovery point or recovery time objective (RTO).

  o The Copy Services can be managed and automated with IBM Tivoli Storage Productivity Center for Replication. For z/OS environments, IBM Geographically Dispersed Parallel Sysplex™ (GDPS®) provides an automated disaster recovery solution.

  o Remote Pair FlashCopy allows the client to establish a FlashCopy relationship where the target is a remote mirror Metro Mirror primary volume, keeping the pair in the full duplex state.

• Resource Groups: This feature is a policy-based resource scope limiting function that enables the secure use of Copy Services functions by multiple users on a DS8000 series storage subsystem. Resource Groups are used to define an aggregation of resources and policies for the configuration and management of those resources. The scope of the aggregated resources can be tailored to meet each hosted client's Copy Services requirements for any operating system platform that is supported by the DS8870.
Architecture and key components
This section provides a high-level description of the main elements of the DS8870 architecture:

- A pair of POWER7 based System Power servers, also known as the **Central Electronics Complex (CEC)**, is at the heart of the DS8870.

  The two POWER7 servers share the load of receiving and moving data between the attached hosts and the disk arrays. However, they are also redundant so that if either server fails, the system operations fail over to the remaining server and continue to run without any host interruption.

  The POWER7 processors operate at 3.55 GHz and can scale from two cores to 16 cores. Among other innovations, the POWER7 processor includes a new simultaneous multithreading mode, SMT4. It allows four instruction threads to be executed simultaneously in each processor core. The POWER7 processor also features Intelligent Threads that can vary based on the workload demand. The POWER7 multi-core architecture is matched with a wide range of related technology innovations to deliver leading throughput, efficiency, scalability, and reliability.

- The internal I/O Fabric that interconnects POWER7 servers with the I/O enclosures is based on and extends **Peripheral Component Interconnect Express (PCIe)**. PCIe is a widely used industry standard for ultra-high performance and scalability and it is built on hardware enterprise reliability. PCIe allows point-to-point interconnections between CECs and I/O enclosures.

- The **I/O enclosures** host custom intelligent adapters, which are designed for performance and reliability. Both the Host Adapter (HA) card for SAN and the Device Adapter (DA) card for disk RAID are independent compute engines. They have both multi-core high-performance RISC processors and custom storage application-specific integrated circuits (ASIC). They offer direct high-speed connection to the I/O Fabric by means of PCIe.

- Each Host Adapter card has several ports that can be configured to operate as either a Fibre Channel (FC) port or a FICON port. The adapter supports 2, 4, or 8 Gbps full data transfer over long-wave or shortwave Fibre links. HA cards are installed in pairs so that it is possible to create redundant paths to host bus adapters (HBAs) in servers that are connected to the DS8870.

- Each Device Adapter card offers four Fibre Channel Arbitrated Loop (FC-AL) ports. DA cards are configured in pairs to create redundancy in accessing disk drives. FC-AL ports are used to connect the CECs, through the I/O enclosures, to the disk enclosures. The adapter is responsible for managing, monitoring, and rebuilding the RAID arrays. DAs feature an 8 Gb Fibre Channel interconnect speed to connect with a 6 Gb serial-attached SCSI (SAS) connection to the disk drives.

- Data disk drives, which are known as **Disk Drive Modules (DDMs)**, are installed in enclosures that are called **Storage Enclosures**, or Gigapacks, which are configured in pairs.

  Each DDM in the DS8870 is attached to two Fibre Channel switches. These switches are built into the disk enclosure controller cards. Each disk has two separate connections to the backplane. Therefore, it is simultaneously attached to both FC switches. If either disk enclosure controller card is removed from the enclosure, the switch that is included in that card is also removed. However, the FC switch in the remaining controller card retains the ability to communicate with all the disks and both DAs in a pair. Equally, each DA has a path to each switch so that it also can tolerate the loss of a single path. If both paths from one DA fail, it cannot access the switches. However, the partner DA retains connection.

- The power subsystem in the DS8870 is redesigned and enhanced from previous generations of the DS8000 series family for higher energy efficiency, lower power loss, and improved reliability. The former Primary Power Supply (PPS) is replaced by a **Direct Current Uninterruptible Power Supply (DC-UPS)**. The DS8870 base frame consumes 20% less power than the DS8800.

  All power and cooling components of the power subsystem are fully redundant. DC-UPSs are duplicated in each frame so that only one DC-UPS can provide enough power to all components inside that frame.
Each DC-UPS has its own battery backup functions so the battery system provides 2N redundancy. The battery of a single DC-UPS can preserve non-volatile storage in a complete power outage.

Other key elements of the power subsystem are:

- Rack Power Control (RPC) cards manage the power subsystem, providing control, monitoring, and reporting functions. There are two RPC cards for redundancy.
- The system power control network (SPCN) is used to control the power of the attached I/O subsystem.

- Hardware Management Console (HMC) is a Linux based notebook, which allows users to interact with the DS8870 through the HMC GUI (for service purposes) or DS Storage Manager/DSCLI (for storage administration or configuration purposes).

Figure 2 displays an overview of the physical components, depicting the previously described architecture elements.

Figure 2. Base model (front and back views) of a Model 961 (Enterprise Class)
Figure 2 shows the front and back of the Model 961 base. It includes these components:

- Space for up to 10 disk enclosures (24 drives per Gigapack) or up to 15 Small Form Factor (SFF) disk "drive sets" (16 drives per disk drive set). You can also install Large Form Factor (LFF) enclosures. In a maximum configuration, the base model can hold 240 SFF disk drives [1].
- The Hardware Management Console (HMC) is located beneath the drives [2].
- The POWER7 servers [3] contain the processor and memory that drive all functions within the DS8870.
- The I/O enclosures provide connectivity between the adapters and the storage processors [4]. The adapters that are contained in the I/O enclosures can be either DAs or HAs.
- The base model contains DC-UPS power supplies [5]. The DC-UPS provides rectified AC power distribution and power switching for redundancy.
- A redundant pair of integrated Rack Power Control (RPC) cards coordinates the power management within the storage facility [6]. The RPC cards are attached to the service processors in each complex, allowing them to communicate with both the HMC and storage facility image logical partitions (LPARs). The RPC is also attached to the primary power system in each rack.

The DS8870 expansion frames, model 96E, have the same layout as the base frame model 961 but with the following differences:

- First expansion frame: It consists of a power subsystem (without RPC cards), I/O enclosures, and storage enclosures.
- Second and third expansion frames: They consist of a power subsystem (without RPC cards) and storage enclosures (there are no I/O enclosures).

Models
The DS8870 storage systems include the DS8870 Model 961 base frame and the associated DS8870 expansion frames 96E.

The DS8870 is available in the following configurations:

- **DS8870 Model 961 Business Class model**

  This configuration of the model 961 is available as a dual 2-way processor complex with storage enclosures for up to 144 DDMs and 4 FC host adapter cards. A Business Class system can be configured with either 16 GB or 32 GB of cache.

  The Business Class model is a cost-efficient way to use the DS8000 for clients with lower capacity or performance requirements that use only a small subset of the DS8870 features. However, the clients can upgrade later to the Enterprise model. The use of Copy Services or the I/O Priority Manager feature requires at least a cache size of 32 GB when using the Business Class model.

- **DS8870 Model 961 Enterprise (or standard) model**

  This model is available as either a dual 4-way, dual 8-way, or dual 16-way processor complex with storage enclosures for up to 240 DDMs and 8 FC host adapter cards. This standard model is optimized for performance and highly scalable configurations, allowing long-term growth. The cache for this model scales between 64 GB and 1 TB.

- **DS8870 Model 96E**

  This expansion frame for the 961 model includes enclosures for additional DDMs and additional FC adapter cards to allow a maximum configuration of 16 FC adapter cards. The expansion frame 96E can be attached to the 961 dual 8-way frame or dual 16-way base frame only. Up to three expansion
frames can be attached to a model 961. The additional FC adapter cards can only be installed in the first expansion frame.

Figure 3 summarizes the configuration options.

<table>
<thead>
<tr>
<th>Model</th>
<th>Processor</th>
<th>Physical Capacity (max.)</th>
<th>Disk Drives (max.)</th>
<th>Memory (GB)</th>
<th>Host Adapters (max.)</th>
<th>96E Attach</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Business Class</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>961</td>
<td>2-core</td>
<td>216 TB</td>
<td>144</td>
<td>16</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>961</td>
<td>2-core</td>
<td>216 TB</td>
<td>144</td>
<td>32</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td><strong>Enterprise Class</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>961</td>
<td>4-core</td>
<td>360 TB</td>
<td>240</td>
<td>64</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>961</td>
<td>8-core</td>
<td>1 584 TB</td>
<td>1 056</td>
<td>128</td>
<td>16</td>
<td>0–2</td>
</tr>
<tr>
<td>961</td>
<td>8-core</td>
<td>2 304 TB</td>
<td>1 536</td>
<td>256</td>
<td>16</td>
<td>0–3</td>
</tr>
<tr>
<td>961</td>
<td>16-core</td>
<td>2 304 TB</td>
<td>1 536</td>
<td>512</td>
<td>16</td>
<td>0–3</td>
</tr>
<tr>
<td>961</td>
<td>16-core</td>
<td>2 304 TB</td>
<td>1 536</td>
<td>1 024</td>
<td>16</td>
<td>0–3</td>
</tr>
<tr>
<td><strong>First Expansion Frame</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>96E</td>
<td>N/A</td>
<td>504 TB</td>
<td>336</td>
<td>N/A</td>
<td>8</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Second/Third Expansion Frame</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>96E</td>
<td>N/A</td>
<td>720 TB</td>
<td>480</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Figure 3. Configuration options for Business Class and Enterprise Class

**Specifications**
Table 1 summarizes the DS8870 specifications.
Table 1. DS8870 specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>DS8870 (961, 96E)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shared SMP processor configuration</td>
<td>POWER7 dual 2, 4, 8, or 16-core</td>
</tr>
<tr>
<td>Other major processors</td>
<td>IBM PowerPC®, ASIC</td>
</tr>
<tr>
<td>Processor memory for cache and non-volatile storage (min/max)</td>
<td>16 GB/1,024 GB</td>
</tr>
<tr>
<td>Host adapter interfaces</td>
<td>4-port and 8-port 8 Gbps Fibre Channel/FICON</td>
</tr>
<tr>
<td>Host adapters (minimum/maximum)</td>
<td>2/16</td>
</tr>
<tr>
<td>Host ports (minimum/maximum)</td>
<td>8/128</td>
</tr>
<tr>
<td>Drive interface</td>
<td>6 Gbps point-to-point switched SAS-2 connection to an 8 Gbps FC backbone</td>
</tr>
<tr>
<td>Number of disk drives (min/max)</td>
<td>8/1,536 (Small Form Factor)</td>
</tr>
<tr>
<td></td>
<td>8/768 (Large Form Factor)</td>
</tr>
<tr>
<td>Device adapters</td>
<td>Up to 16 4-port, 8 Gbps Fibre Channel</td>
</tr>
<tr>
<td>Maximum physical storage capacity</td>
<td>2,304 TB (usable capacity depends on factors such as data format, RAID level, and spare disks configured)</td>
</tr>
<tr>
<td>Disk sizes</td>
<td>400 GB SSDs</td>
</tr>
<tr>
<td></td>
<td>146 GB (15k rpm)</td>
</tr>
<tr>
<td></td>
<td>300 GB (15k rpm)</td>
</tr>
<tr>
<td></td>
<td>600 GB (10k rpm)</td>
</tr>
<tr>
<td></td>
<td>900 GB (10k rpm)</td>
</tr>
<tr>
<td></td>
<td>3 TB (7.2k rpm and 3.5 in. form factor)</td>
</tr>
<tr>
<td>RAID levels</td>
<td>5, 6, and 10</td>
</tr>
<tr>
<td>Dimensions (height × width × depth). (Applies to both 961 and 96E models)</td>
<td>193.4 cm × 84.8 cm × 122.7 cm (76 in. × 33.4 in. × 48.3 in.) per frame, up to 4 frames total</td>
</tr>
<tr>
<td>Maximum weight of fully configured base models and expansion models</td>
<td>1324 kg (2920 lb) base rack</td>
</tr>
<tr>
<td></td>
<td>1265 kg (2790 lb) first expansion</td>
</tr>
<tr>
<td></td>
<td>1310 kg (2890 lb) additional frames</td>
</tr>
<tr>
<td>Dry bulb temperature, operating</td>
<td>16° C – 32° C (60° F – 90° F)</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>20% – 80%</td>
</tr>
<tr>
<td>Power supply</td>
<td>Configurations: Single-phase or three-phase 50/60 Hz</td>
</tr>
<tr>
<td>Caloric value British thermal units per hour (BTU) (maximum)</td>
<td>20,612 (961 rack)</td>
</tr>
<tr>
<td></td>
<td>19,605 (96E rack)</td>
</tr>
<tr>
<td>Peak electrical power kVA (maximum)</td>
<td>6 (961 rack)</td>
</tr>
<tr>
<td></td>
<td>5.8 (96E rack)</td>
</tr>
</tbody>
</table>
Options
This section highlights the main features, upgrades, or options that can be requested with new DS8870 orders or installed at a later time:

- **Expansion frames**, model 96E. To see the new maximum capacities when you add expansion frames, see Table 2. DS8870 license functions on page 16.

- **Processor and Cache**. To check the options for Processor/Cache updates, see Figure 5. Processor/Cache upgrade paths on page 15.

- **Disk Drive Modules** (DDMs) can be ordered by way of disk drive sets. A disk drive set contains 16 identical disk drives, although for solid-state drives (SSDs), you can order a half drive set of eight DDMs. All DDMs are Full Disk Encrypted (FDE) capable and Small Form Factor (SFF) in size but the Nearline drives are Large Form Factor (LFF). All DDMs can be installed in both the base 961 and expansion 96E models. This list shows the available DDMs for DS8870:
  
  o 146 GB 15,000 rpm FDE SAS
  o 300 GB 15,000 rpm FDE SAS
  o 600 GB 10,000 rpm FDE SAS
  o 900 GB 10,000 rpm FDE SAS
  o 3 TB 7,200 rpm FDE Nearline SAS
  o 400 GB FDE SSD

- **Standby Capacity on Demand** (CoD) is an offering that, when ordered, allows up to six Standby CoD disk drive sets (96 disk drives) that can be factory-installed or field-installed in your system. To activate, you logically configure the disk drives for use. This nondisruptive activity does not require intervention from IBM. Upon activation of any portion of a Standby CoD disk drive set, you must place an order with IBM to initiate billing for the activated set. Only SSD disk drives cannot support CoD.

- **Device Adapter** (DA) pairs and disk enclosure pairs can be also ordered when they are needed to support requested disk drive sets.

- **Host Adapters** (HAs) can increase connectivity with host servers. HAs are available with 4 ports or 8 ports and HA ports can be configured as Fibre Channel or FICON. The 8 Gb Fibre Channel/FICON host adapter is available for long-wave and shortwave fabrics. It can auto-negotiate to either 8 Gb, 4 Gb, or 2 Gb link speeds.

- The **Extended Power Line Disturbance** (ePLD) option protects your storage unit for 50 seconds, rather than only 4 seconds, from a power line disturbance. If no ePLD option is ordered, one Battery Set Module (BSM) set per Direct Current Uninterruptible Power Supply (DC-UPS) (for both the main and expansion racks) is needed. If the ePLD option is ordered, two BSM sets per DC-UPS (for both the main and expansion racks) are needed.

- An external **Hardware Management Console** (HMC) can be ordered as a second HMC to provide continuous availability to the HMC functions. A second HMC can be useful in storage environments where the encryption capability is activated.

- If you want to use the DS8870 encryption capability, **IBM Tivoli Key Lifecycle Manager** (TKLM) servers are available for order. A TKLM server has a Linux operating system and the TKLM software preinstalled. A TKLM license is required for use with the TKLM software. The software is purchased separately from the TKLM isolated server hardware. The licensing for TKLM includes both an install license for the TKLM management software, as well as licensing for the encrypting drives.
The remote zSeries® power control setting allows one or more attached System z hosts to control the power-on and power-off sequences for your DS8870. If you use the remote zSeries power control setting, you must meet the following requirements:

- Order the remote zSeries power control feature.
- Allow up to four interfaces for remote zSeries power control.

Overhead cabling: Overhead cabling (top exit) is available for DS8870 as an alternative to the standard rear cable exit.

The shipping weight reduction option allows you to receive delivery of a DS8870 model in multiple shipments. If your site has delivery weight constraints, IBM offers a shipping weight reduction option that ensures that the maximum shipping weight of the initial model shipment does not exceed 909 kg (2,000 lb). The model weight is reduced by removing selected components, which are shipped separately. The IBM service representative installs the components that are shipped separately during the storage unit installation.

The Earthquake Resistance Kit is an optional seismic kit for stabilizing the storage unit rack so that the rack complies with IBM earthquake resistance standards. The Earthquake Resistance Kit option is available for models 961 and 96E.

Note: Miscellaneous Equipment Specification (MES) availability is December 14, 2012.

Warranty info and upgrades
DS8870 offers the Enterprise Choice warranty of 1, 2, 3, or 4 years on both the hardware and the advanced function software:

- Four years on type 2424 models
- Three years on type 2423 models
- Two years on type 2422 models
- One year on type 2421 models

Figure 4 shows a capacity comparison of resources depending on the expansion frames that are installed.
<table>
<thead>
<tr>
<th>Component</th>
<th>2-way business class base frame</th>
<th>4/8/16-way enterprise class base frame</th>
<th>8-way or 16-way, with one expansion frame</th>
<th>8-way or 16-way, with two expansion frames</th>
<th>8-way (large cache) or 16-way, with three expansion frames</th>
</tr>
</thead>
<tbody>
<tr>
<td>DA pairs</td>
<td>1 or 2</td>
<td>1 to 4</td>
<td>5 to 8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>HDDs</td>
<td>Up to 144</td>
<td>Up to 240</td>
<td>Up to 576</td>
<td>Up to 1056</td>
<td>Up to 1536</td>
</tr>
<tr>
<td>SSDs</td>
<td>N/A</td>
<td>Up to 192</td>
<td>Up to 384</td>
<td>Up to 384</td>
<td>Up to 384</td>
</tr>
<tr>
<td>Physical capacity(^a), gross 2.5'' SFF disks</td>
<td>up to 130 TB</td>
<td>up to 216 TB</td>
<td>up to 518 TB</td>
<td>up to 950 TB</td>
<td>up to 1.38 PB</td>
</tr>
<tr>
<td>Physical capacity, net RAID-5 2.5'' SFF disks</td>
<td>up to 100 TB</td>
<td>up to 164 TB</td>
<td>up to 399 TB</td>
<td>up to 755 TB</td>
<td>up to 1.11 PB</td>
</tr>
<tr>
<td>Physical capacity, gross 3.5'' LFF disks</td>
<td>up to 216 TB</td>
<td>up to 360 TB</td>
<td>up to 864 TB</td>
<td>up to 1.58 PB</td>
<td>up to 2.30 PB</td>
</tr>
<tr>
<td>Physical capacity, net RAID-6 3.5'' LFF disks</td>
<td>up to 130 TB</td>
<td>up to 213 TB</td>
<td>up to 521 TB</td>
<td>up to 1.01 PB</td>
<td>up to 1.51 PB</td>
</tr>
</tbody>
</table>

\(^a\) PB/TB definition according to ISO/IEC 80000-13

Figure 4. Capacity comparison of device adapters, DDMs, and storage capacity (2012)

Figure 5 shows all available processor/cache upgrade paths.
State of general direction. It is the current plan and direction of IBM to release a field model conversion from DS8800 to DS8870 to help customers preserve some of their investment and continue their storage partnership with IBM. IBM intends this release to be available in the first half of 2013.

Particular licensed functions
Many of the software optional licensed functions of the DS8870 need a License Key to be activated. In fact, licensed functions are enabled through a licensed function indicator feature plus a licensed function authorization feature number.

In addition, for every storage unit, an Operating Environment License (OEL) must also be ordered so that OEL licenses the operating environment and is based on the total physical capacity of the DS8870.

Licensed functions are activated and enforced within a defined License Scope. License scope refers to the type of storage, and therefore the type of servers, that the function can be used with: Fixed Block (FB), Count Key Data (CKD), or both (FB and CKD).

Each DS8870 licensed function can have its own unique way that it is ordered or activated. The Copy Services for instance are licensed by the gross amount of installed capacity. For Easy Tier, you need a license key, but because Easy Tier is no charge, it is usually configured. Encryption activation has a special procedure that is indicated in “Options”.

Functions indicators and authorization feature numbers are listed in Table 2.
## Table 2. DS8870 license functions

<table>
<thead>
<tr>
<th>Licensed function for DS8000 with Enterprise Choice warranty</th>
<th>IBM 242x indicator feature numbers</th>
<th>IBM 239x function authorization model and feature numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Environment License</td>
<td>0700 and 70xx</td>
<td>239x Model LFA, 703x /705x</td>
</tr>
<tr>
<td>FICON Attachment</td>
<td>0703 and 7091</td>
<td>239x Model LFA, 7091</td>
</tr>
<tr>
<td>Thin Provisioning</td>
<td>0707 and 7071</td>
<td>239x Model LFA, 7071</td>
</tr>
<tr>
<td>Database Protection</td>
<td>0708 and 7080</td>
<td>239x Model LFA, 7080</td>
</tr>
<tr>
<td>High Performance FICON</td>
<td>0709 and 7092</td>
<td>239x Model LFA, 7092</td>
</tr>
<tr>
<td>Easy Tier</td>
<td>0713 and 7083</td>
<td>239x Model LFA, 7083</td>
</tr>
<tr>
<td>z/OS Distributed Data Backup</td>
<td>0714 and 7094</td>
<td>239x Model LFA, 7094</td>
</tr>
<tr>
<td>FlashCopy</td>
<td>0720 and 72xx</td>
<td>239x Model LFA, 725x –726x</td>
</tr>
<tr>
<td>Space Efficient FlashCopy</td>
<td>0730 and 73xx</td>
<td>239x Model LFA, 735x –736x</td>
</tr>
<tr>
<td>Metro/Global Mirror</td>
<td>0742 and 74xx</td>
<td>239x Model LFA, 748x –749x</td>
</tr>
<tr>
<td>Metro Mirror</td>
<td>0744 and 75xx</td>
<td>239x Model LFA, 750x –751x</td>
</tr>
<tr>
<td>Global Mirror</td>
<td>0746 and 75xx</td>
<td>239x Model LFA, 752x –753x</td>
</tr>
<tr>
<td>z/OS Global Mirror</td>
<td>0760 and 76xx</td>
<td>239x Model LFA, 765x –766x</td>
</tr>
<tr>
<td>z/OS Global Mirror Incremental Resync</td>
<td>0763 and 76xx</td>
<td>239x Model LFA, 768x –769x</td>
</tr>
<tr>
<td>Parallel Access Volumes</td>
<td>0780 and 78xx</td>
<td>239x Model LFA, 782x –783x</td>
</tr>
<tr>
<td>HyperPAV</td>
<td>0782 and 7899</td>
<td>239x Model LFA, 7899</td>
</tr>
<tr>
<td>I/O Priority Manager</td>
<td>0784 and 784x</td>
<td>239x Model LFA, 784x –785x</td>
</tr>
</tbody>
</table>

For more details, see the *IBM System Storage DS8870 Introduction and Planning Guide, GC27-4209*.

### Related publications and links

For more information, see these resources:

- IBM Redbooks publication *IBM System Storage DS8870 Architecture and Implementation*, SG24-8085:  
- IBM publication *IBM System Storage DS8870 Introduction and Planning Guide*, GC27-4209
- IBM publication *IBM System Storage DS8000 242x Model 961 Installing a Storage Facility*, GA32-2236
- IBM System Storage DS8870 (Machine type 2421) Models 961 and 96E with one-year warranty - Product Announcement (October 3, 2012):  
  [http://ibm.co/127P8kG](http://ibm.co/127P8kG)
- IBM System Storage DS8870 (Machine type 2422) Models 961 and 96E with two-year warranty - Product Announcement (October 3, 2012):  
  [http://ibm.co/XbaFDE](http://ibm.co/XbaFDE)
- Planned IBM Easy Tier integration with server-based SSDs (Video): http://www.youtube.com/watch?v=SLQfNoidG3I
- IBM Assist On-Site: http://www.ibm.com/support/assistonsite/
- IBM DS8000 VPN Implementation: http://www.ibm.com/support/docview.wss?rs=1114&uid=ssg1S1002693
- DS8870 cross-reference table of code bundles: http://ibm.co/UBoMzS
- DS8870 support: http://ibm.co/UBoMzS
- IBM System Storage Interoperation Center (SSIC): http://www.ibm.com/systems/support/storage/ssic


• IBM Smarter Storage for enterprise systems: DS8870 (Video): [http://www.youtube.com/watch?v=X-CD0DgKnws](http://www.youtube.com/watch?v=X-CD0DgKnws)
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