



IBM System Storage DS8870 (Machine type 2424) Models 961 and 96E with four-year warranty

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At a glance

New capabilities for IBM® System Storage® DS8870 models offer greater choices in price and performance, including:

- IBM System Storage DS8870 high-performance flagship Model 961 and Model 96E Expansion Unit
- IBM POWER7® based processors
- Improved rack power system
- Scalable system memory and scalable process cores in the controllers
- Available business class configuration
- Full disk encryption (FDE) drives are now standard
- Limited VMware VAAI support
- Nondisruptive upgrade path for DS8870 Model 961 and additional Model 96E expansion frames
- Value-based licensing

For ordering, contact your IBM representative, an IBM Business Partner, or IBM Americas Call Centers at 800-IBM-CALL (Reference: YE001).

Overview

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. With the enterprise choice warranty option, these high-performance flagship models (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 (by ordering the appropriate machine type), which covers both hardware and advanced function software.

This product is provided with four years of standard warranty. Additional years of extended warranty services are available to make these flexible offerings the best support option to address business and financial needs. Clients should consult with their financial personnel on the appropriate financial treatment for this offering.

The DS8870 is also designed to provide new hardware features for the combination of price and efficiency that is right for all application needs. It delivers cutting edge technology, improved efficiency, and increased performance. The DS8870 excels in supporting the new IBM zEnterprise® EC12 and high-end IBM Power®

server environments and ensures clients are taking full advantage of the integration delivered by these high-end enterprise systems. New hardware features include:

IBM POWER7 processor technology

The DS8870 high-performance flagship model features IBM POWER7 server technology to help support high performance. The DS8870 model delivers up to three times performance improvement in I/O operations per second in transaction processing workload environments as the prior model. Compared to the performance of the previous DS8000 system, DS8800, this new processor aids the DS8870 in improving the performance of both sequential read and sequential write throughputs by over 60%.

The DS8870 provides a nondisruptive upgrade from the smallest to the largest configuration. This includes adding cache and processors for increased performance, adding host ports for increased connectivity, adding HDDs and SSDs and additional model 96E frames to the base 961 frame for increased capacity, and adding advanced function software features.

Memory support

DS8870 provides from 16 GB to 1 TB of processor memory and continues to be managed in 4 KB segments for optimal cache efficiency. Total memory support has increased by 266% compared to DS8800.

Improved rack power system

The DS8870 provides dc uninterrupted power supplies to replace the primary power supplies the current DS8800 is using. These new power supplies improve energy efficiency and are designed to support emerging energy efficiency standards.

Business class configuration options

The DS8870 provides a business class configuration option in addition to the enterprise class. The business class option allows a system to be configured with up to 144 drives in a single frame with limited features and support, helping to reduce configuration costs. The 16 GB cache business class configuration has certain limitations as well, including no copy services and no I/O Priority Manager support. The business class configuration can be upgraded to the enterprise class model. This is a fully concurrent MES upgrade.

Drive support

- 146 GB 15,000 rpm FDE SAS
- 300 GB 15,000 rpm FDE SAS
- 600 GB 10,000 rpm FDE SAS
- 900 GB 10,000 rpm FDE SAS
- 3 TB 7,200 rpm FDE nearline SAS
- 400 GB FDE SSD

All drives offered on the DS8870 are FDE capable.

VMware vStorage API for Array Integration (VAAI) support

DS8870 will provide support for the following functions:

- Atomic test and set (ATS) or VMware hardware-assisted locking
- XCOPY or full copy

The VAAI API offloads storage processing functions from the server hardware to the DS8870, reducing the workload on the host server hardware for improved performance on both the network and host servers.

Value based pricing and licensing

Operating environment licenses will be priced based on the performance, capacity, speed, and other characteristics that provide value in customer environments.

Key prerequisites

All announced features and functions are supported on the IBM System Storage DS8000 series, and require DS8000 Licensed Machine Code (LMC) 7.7.xxx.xx (bundle version 87.0.xxx.xx), or later.

Planned availability date

General availability is October 19, 2012.

Field (MES) availability is December 14, 2012.

Refer to the [Description](#) section for more information.

Description

The new capabilities for IBM System Storage DS8870 models offer greater choices in price and performance.

High performance, reliability, and enhanced connectivity

IBM System Storage DS8870 models feature the following hardware and technology improvements intended to enhance performance, connectivity, and reliability:

IBM POWER7 processor technology

The DS8870 high-performance flagship model features IBM POWER7 server technology to help support high performance. Compared to prior models, the DS8870 is designed to deliver up to three times performance improvement in I/O operations per second in transaction processing workload environments. The POWER7 processor delivers improved performance of both sequential read and sequential write throughputs by up to 60% and can enable up to 170% performance improvement in I/O operations per second in open and CKD volumes as prior models.

The DS8870 offers a single socket 2-core processor complex and up to a dual socket 16-core processor complex per controller.

The DS8870 delivers up to three times the performance of the DS8800 and provides new leadership in Storage Performance Council (SPC) benchmarks.

Refer to the SPC website for complete information on the SPC-1 and SPC-2 results at

<http://www.storageperformance.org/results/>

Nondisruptive upgrade path

The DS8870 also supports a nondisruptive upgrade from the smallest to the largest configuration. This includes adding cache and processors for increased performance, adding host ports for increased connectivity, adding HDDs and SSDs and additional model 96E frames to the base 961 frame for increased capacity, and adding advanced function software features.

Business class configuration options

The DS8870 provides a business class configuration option in addition to the enterprise class. The business class option allows a system to be configured with up to 144 drives in a single frame, helping to reduce configuration costs. The 16 GB cache business class configuration has certain limitations as well, including no copy services and no I/O Priority Manager support. Refer to the Sales Manual for full configuration details.

Business class configuration is intended for environments where the price and capabilities of a smaller DS8870 configuration are preferred. Enterprise class is targeted for performance and highly scalable configurations with large long term growth.

The DS8870 business class configuration can be upgraded concurrently to an enterprise class configuration and is available for customers who need better performance and more capacity on demand.

Industry-standard disk drives

The DS8870 offers a selection of disk drives, including 2.5-inch form factor for increased density and performance per frame and 3.5-inch nearline SAS drives which offer larger capacities. All of the drives are Serial Attached SCSI second generation drives (SAS-2) that communicate using a 6 Gbps interface.

- 146 GB 15,000 rpm FDE SAS
- 300 GB 15,000 rpm FDE SAS
- 600 GB 10,000 rpm FDE SAS
- 900 GB 10,000 rpm FDE SAS
- 3 TB 7,200 rpm FDE nearline SAS
- 400 GB FDE SSD

Encryption support

- 1750 Encrypted drive set activation indicator
- 1754 Encrypted drive deactivation indicator

All drives offered in the DS8870 are full disk encryption capable to secure critical data. The DS8870 will also have the ability to disable the encryption function using optional feature number 1754.

Processor memory offerings

The DS8870 model with 2-core configuration offers up to 32 GB of processor memory, with 4-core configuration it offers up to 64 GB, with 8-core configuration it offers up to 256 GB, and with 16-core configuration it offers up to 1,024 GB. The write cache scales according to the processor memory size selected to help optimize performance.

Improved rack power system

DS8870 provides dc uninterrupted power supplies to replace the current primary DS8800 power supplies. The new power supplies will improve energy efficiency.

High availability

The DS8870 model is designed and implemented with component redundancy to help avoid many potential single points of failure.

Logical Unit Number (LUN) and volume management

Nondisruptive LUN and volume creation and deletion are supported. When a LUN or volume is deleted, the capacity can be reformatted and reused.

LUNs and volumes can be configured to span arrays, therefore the size of the volume or LUN is not constrained by the size of the array. LUNs up to 16 TB are supported. CKD volumes up to 1 TB (1,182,006 cylinders) are supported.

Dynamic Volume Expansion supporting application data growth

The IBM System Storage DS8000 series supports Dynamic Volume Expansion, allowing the size of a logical volume to be increased while it is online to a host system. This capability can simplify management by enabling easier online volume expansion to support application data growth. The maximum volume size is limited to the currently supported maximum size for DS8000 :

- Open Systems (Fixed Block - FB) volumes - 16 TB
- System z® (CKD) volumes - 1 TB (1,182,006 cylinders)

Volumes that are expanded can be online during and after the execution of the function. Volumes may not be in copy services relationships (Point-in-Time Copy, FlashCopy® SE, Metro Mirror, Global Mirror, Metro/Global Mirror, and z/OS® Global Mirror functions) while expansion is taking place. The function can be managed and configured via the DS Storage Manager, DS CLI, and DS Open API. IBM System z and System p® servers support and recognize the expanded volumes within the DS8000 .

All other servers may require additional steps to be put into place in order to support and recognize the expanded volumes within the DS8000 . The Dynamic Volume Expansion capability is provided with the DS8000 series at no additional charge.

Addressing capabilities

Support for logical subsystems, logical devices, and logical paths defined as:

- Up to 256 logical subsystems
- Up to 65,280 logical devices
- Up to 130,560 FICON® logical paths (1,280 logical paths per control unit image)
- Up to 8,000 process logins (509 per SCSI-FCP port)

Simplified storage management for System z with z/OS

For System z and z/OS environments, DS8870 models can support 1 TB (1,182,006 cylinders) 3390 volumes. It can help relieve addressing constraints, improve disk resource utilization, and improve storage administrator productivity by providing the ability to consolidate multiple disk volumes into a single address.

Administration and management

- Online configuration capability features a web-based GUI designed to offer increased ease of use
- A single command line interface (CLI) supports both logical configuration and copy services
- Capabilities such as remote code distribution and email notification of link failures can also improve availability

Choice of models and features

DS8870 has similar scalability as previous DS8000 and DS8800 systems. With a 2, 4, 8, or 16-core processor complex, the DS8870 Model 961 supports up to 240 2.5-inch disk drives for a maximum capacity of up to 216 TB. It also supports up to 1 TB of processor memory with up to 8 Fibre Channel/FICON adapters. With an optional expansion unit (DS8870 Model 96E), it scales as follows:

- With one DS8870 Model 96E Expansion Unit, the DS8870 Model 961 (8 or 16-core) supports up to 576 disk drives, providing up to 518 TB of physical capacity with 900 GB SAS disk drives, up to 288 drives providing up to 864 TB of physical

capacity with 3 TB nearline SAS disk drives, and up to 16 Fibre Channel/FICON adapters

- With two DS8870 Model 96E Expansion Units, the DS8870 Model 961 (8 or 16-core) supports up to 1,056 disk drives, providing up to 950 TB of physical capacity with 900 GB SAS disk drives, up to 528 drives providing up to 1.6 PB of physical capacity with 3 TB nearline SAS disk drives, and up to 16 Fibre Channel/FICON adapters
- With a third DS8870 Model 96E Expansion Unit, the DS8870 Model 961 (8-core with 256 GB cache or 16-core) supports up to 1,536 disk drives, providing up to 1.4 PB of physical capacity with 900 GB SAS disk drives, up to 768 drives providing up to 2.3 PB of physical capacity with 3 TB nearline SAS disk drives, and up to 16 Fibre Channel/FICON adapters

To meet performance and configuration needs, DS8870 Model 961 offers a 2, 4, 8, or 16-core processor complex. Refer to the following table for more detail on supported drive and adapter counts with the two available configuration options.

Per frame maximum configuration table:

Model number	Processor	Physical capacity	Disk drives	Processor memory	Host adapters	9xE attach
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Enterprise class configuration:

961	4-core	216 TB	240	64 GB	8	0
961	8-core	1.4 PB	1,536	256 GB	16	1 to 3
961	16-core	1.4 PB	1,536	1 TB	16	1 to 3

Business class configuration:

961	2-core	129 TB	144	32 GB	4	0
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Model number	Processor	Physical capacity	Disk drives	Processor memory	Host adapters	9xE attach
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Enterprise class configuration first expansion:

96E	N/A	302 TB	336	N/A	8	961
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Enterprise class configuration second/third expansions:

96E	N/A	432 TB	480	N/A	0	961
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Variety of configuration options

Price, performance, and capacity flexibility to help address specific application and business requirements is provided through drive intermix support.

Physical capacity for the DS8000 series is purchased via disk drive sets. A disk drive set contains 16 identical disk drives with the same capacity and rpm. Disk drive sets are available in many types as shown in the following table. For additional flexibility, feature conversions are available to exchange existing disk drive sets when purchasing new disk drive sets with higher capacity.

Size	Drive type	Drive speed	Encryption drive	RAID support	Field supported
400 GB	SSD	N/A	Yes	5	Yes
146 GB	SAS	15K rpm	Yes	5, 6, 10	Yes
300 GB	SAS	15K rpm	Yes	5, 6, 10	Yes
600 GB	SAS	10K rpm	Yes	5, 6, 10	Yes
900 GB	SAS	10K rpm	Yes	5, 6, 10	Yes
3 TB	SAS	7.2K rpm	Yes	6, 10	Yes

nearline

IBM Standby Capacity on Demand (CoD) offering

IBM Standby CoD solutions are designed to address the changing storage needs of rapidly growing businesses. IBM Standby CoD for the DS8000 offering allows inactive disk drives to be installed and easily activated as business needs require.

Standby CoD provides the ability to tap into additional storage and is particularly attractive for rapid or unpredictable growth, or just for the knowledge that extra storage will be there when needed.

With this offering, up to six Standby CoD disk drive sets (96 disk drives) can be factory or field installed into the system. For activation, the disk drives should be logically configured. This is a nondisruptive activity that does not require intervention from IBM . Upon activation of any portion of a Standby CoD disk drive set, an order should be placed with IBM to initiate billing for the activated set. At that time, replacement Standby CoD disk drive sets may also be ordered.

This offering allows licensed functions to be purchased based upon the machine's physical capacity, excluding unconfigured Standby CoD capacity.

This offering does not have an offering fee premium. A Standby CoD disk drive set must be activated within a 12-month period from the date of installation and all activation is permanent. Contact your IBM representative to obtain additional information regarding Standby CoD offering terms and conditions.

Full disk encryption

IBM recognizes the requirement for data protection, not only from hardware or software failures, but also from physical relocation of hardware, theft, and retasking of existing hardware. Full disk encryption drive sets allow data encryption at rest on a DS8000 series storage controller, helping to mitigate the threat of theft, mismanagement, or loss of business critical data.

The DS8000 series allows encryption using any of the available drives with key management services supported by Tivoli® Key Lifecycle Manager software. Enabling encryption is optional, and may be activated using feature number 1750.

The full disk encryption support feature is available for plant and field orders. Field configured, nonencryption supporting systems will be allowed to activate encryption drives installed at an existing location. The entire subsystem must either be all encrypted by activating encryption with activation indicator feature number 1750 or all nonencrypted by ordering encryption deactivation indicator feature number 1754. The encrypted drive activation indicator feature number 1750 and the corresponding DS8000 series Function Authorization (2396-LFA feature number 1750) are available for ordering.

Additionally, an environment verification process must be completed to support best practice configuration of the encryption solution. This verification can be requested from IBM Lab Based Services (recommended), or completed by the customer, but is a prerequisite of the encryption solution activation process.

z/OS support of disk encryption is available on z/OS V1.10, or later.

Disable recovery key

On a DS8870, if you have a security administrator, you can configure or disable a recovery key for the DS8000 storage facility image before an encryption group is created. You can disable a recovery key within a secure key environment. The state of the recovery key must be *unconfigured* in order to disable the recovery key. Be aware that if you disable a recovery key, this allows an encryption group to be configured, but with no recovery alternative. If for some reason you do not want a recovery key, you should disable it.

Encryption deadlock recovery key supports the ability for administrators to restore access to a DS8870 when the encryption key for the storage is unavailable due to an encryption deadlock scenario. If clients disable the recovery key they do so at their own risk. Refer to the white paper *IBM Encrypted Storage Overview V1.2* for best practices for prevention of the deadlock situation.

Rekey data keys of an encryption group

With security administrator access, users can rekey the data keys of their encryption group. With the encryption group rekey function, users can concurrently migrate a single platform key server configuration to a dual platform key server configuration to leverage changes in key management infrastructure. Both of these enhancements can help clients satisfy PCI security standards.

Solid state drives (SSD)

To improve data transfer rate (IOPS) and response time, IBM DS8000 series provides support for SSDs. SSDs support improved I/O transaction-based performance over traditional platter-based drives. IBM DS8870 will initially offer SSDs in 400 GB capacities with enhanced response time performance. SSDs are a high-IOPS class enterprise storage device targeted at Tier 0 applications that can use a high level of fast-access storage. SSDs offer a number of potential benefits over hard disk drives, including better IOPS performance, lower power consumption, less heat generation, and lower acoustical noise. The SSDs are optional to the DS8000 series and are available with feature numbers 6xxx.

SSDs will be limited to 384 drives per DS8870 system. Additionally, RAID-6 and RAID-10 are not supported for SSD arrays.

Eight drive install groups of SSD

Additional physical capacity for the DS8870 can be purchased via disk drive sets. A disk drive set contains sixteen identical disk drives (same capacity and rpm). IBM System Storage DS8870 offers the support of eight drive install groups of SSD (half disk drive sets), providing additional price/performance and capacity options to address specific application and business requirements. This support is in addition to the already supported sixteen drive install groups of SSD (a disk drive set). The 400 GB SSD half disk drive sets are supported.

IBM FlashCopy SE offers price and efficiency options

The DS8000 Point-in-Time Copy (IBM FlashCopy) function requires space to be set aside equal to the size of the volumes that are to be copied. The IBM System Storage DS8000 series provides support for IBM FlashCopy SE (space efficient snapshot capability) which is intended to use only the amount of storage needed by the copy. This capability can lower the amount of storage needed by many DS8000 clients today, and help lower costs by significantly reducing disk capacity needed for copies. Reducing capacity in the DS8000 can also mean fewer drives and less power required for the overall system.

IBM FlashCopy SE can be managed and configured via the DS Storage Manager, DS CLI, and DS Open API. All host systems supported by the DS8000 today are supported with FlashCopy SE (IBM System z servers require z/OS 1.10, or later, for this support). For more information on implementation of this function, refer to the *IBM System Storage DS8000 FlashCopy SE Implementation Considerations and Recommendations* document located at

<http://www.ibm.com/support/techdocs/atmastr.nsf/WebIndex/FLASH10617>

IBM FlashCopy SE is an optional feature on the DS8000 series, available with the SE indicator feature numbers 0730 and 735x-736x and corresponding DS8000 series Function Authorization (2399-LFA SE feature numbers 735x-736x).

Remote Pair FlashCopy

The IBM DS8870 provides Remote Pair FlashCopy with the capability to allow a FlashCopy (Point-in-Time Copy) relationship where the FlashCopy target device is a Metro Mirror primary device. This can significantly reduce the recovery time that exists when a FlashCopy background copy and Metro Mirror Resync are in progress. The Remote Pair FlashCopy provides a solution for data replication, data migration, remote copy, and disaster recovery tasks.

For business continuity, the Remote Pair FlashCopy operations are nondisruptive, allowing the primary device of each FlashCopy pair to remain available to all hosts for both read and write I/O operations. Once established, Remote Pair FlashCopy operations continue unattended to support continuous data backup to the secondary device.

z/OS support of Remote Pair FlashCopy is available on z/OS V1.10, or later, using the name FlashCopy Preserve Mirror.

Flexibility with support for RAID-5, RAID-6, and RAID-10

Physical capacity on the DS8000 series can be configured as RAID-5, RAID-6, RAID-10, or a combination of the three. RAID-5 can offer excellent performance for most applications, while RAID-10 can offer better performance for selected applications, in particular for high random write content applications in an open systems environment.

The decision to configure capacity as RAID-5, RAID-6, or RAID-10, as well as the amount of capacity to configure for each type, can be made at any time. RAID-5, RAID-6, and RAID-10 arrays can be intermixed within a single system and the physical capacity can be logically reconfigured at a later date (for example, RAID-6 arrays can be reconfigured into RAID-5 arrays).

Connectivity with Fibre Channel/FICON host adapters

The DS8000 series is designed to offer enhanced connectivity with the availability of four-port or eight-port Fibre Channel/FICON host adapters. The 8 Gb Fibre Channel/FICON host adapters, offered in longwave and shortwave, auto-negotiate to either 8 Gb, 4 Gb, or 2 Gb link speeds. This flexibility enables exploitation of the potential benefits offered by the higher performance, 8 Gb SAN-based solutions, while also maintaining compatibility with existing 2 Gb and 4 Gb infrastructures. In addition, the individual ports on the adapter can be configured with Fibre Channel Protocol (FCP) or FICON. This can help protect investment in Fibre Channel adapters and increase the ability to migrate to new servers. A DS8870 Model 961 can support up to a maximum of 16 host adapters, which equates to a maximum of 128 Fibre Channel ports.

DS8870 models offer extensive connectivity support, including Fibre Channel or FICON, across a broad range of server environments, such as IBM System z, System p, System i®, and System x® servers, as well as servers from Sun, Hewlett-Packard, and non-IBM Intel-based servers. This rich support of heterogeneous environments and attachments, along with the flexibility to easily partition the DS8000 series storage capacity among the attached environments, can help support storage consolidation requirements and dynamic, changing environments.

Improved performance with storage pool striping (rotate extents)

The storage pool striping (rotate extents) function, by default, stripes new volumes across all ranks of an extent pool to help reduce the administration required to balance system loads. With multiple rank allocation support, the system can automatically perform close to its highest efficiency, requiring little or no performance administration. The effectiveness of performance management is enhanced as imbalances tend to occur as isolated problems. The storage pool striping function can help automate hotspot avoidance for improved performance and response time without special tuning.

This function can be managed and configured via the DS Storage Manager, DS CLI, and DS Open API. All host systems supported by the DS8000 today are supported with storage pool striping. The storage pool striping function is provided with the DS8000 series at no additional charge.

Rich set of business continuance solutions

DS8870 models support a rich set of copy service functions and management tools that can be used to build solutions to help address business continuance requirements.

Point-in-time copy solutions

The FlashCopy advanced function is designed to provide a point-in-time copy capability for logical volumes. The FlashCopy function creates a physical point-in-time copy of the data, with minimal interruption to applications, and makes it possible to access both the source and target copies immediately.

FlashCopy supports many advanced capabilities, including:

- Data Set FlashCopy - Allows a FlashCopy of a data set in a System z environment.
- Multiple Relationship FlashCopy - Allows a source to have FlashCopy relationships with multiple targets simultaneously. This flexibility allows you to initiate up to twelve FlashCopy establishes on a given LUN, volume, or data set without needing to first wait for or cause a previous relationship to end.
- Incremental FlashCopy - Provides the capability to refresh a LUN or volume involved in a FlashCopy relationship. When a subsequent FlashCopy Establish is initiated, only the data required to bring the target current to the source's newly established point-in-time is copied. The direction of the refresh can also be reversed, in which case the LUN or volume previously defined as the target becomes the source for the LUN or volume previously defined as the source (and now defined as the target).
- Remote Mirror Primary FlashCopy - Allows a FlashCopy relationship to be established where the target is also a remote mirror primary volume. This enables a full or incremental point-in-time copy to be created at a local site, and then use remote mirroring commands to copy the data to the remote site.
- Consistency Group Commands - Allows DS8870 model systems to hold off I/O activity to a LUN or volume until the FlashCopy Consistency Group command is issued. Consistency groups can be used to help create a consistent point-in-time copy across multiple LUNs or volumes, and even across multiple DS8870s.
- Inband commands over remote mirror link - A remote mirror environment allows commands to manage FlashCopy at the remote site to be issued from the local or intermediate site and transmitted over the remote mirror Fibre Channel links. This helps eliminate the need for a network connection to the remote site solely for the management of FlashCopy . FlashCopy is an optional feature of the DS8870 models, and is available with the point-in-time indicator feature numbers 72xx and 0720 and corresponding DS8000 series Function Authorization (2399-LFA feature number 72xx).

IBM FlashCopy SE price and efficiency options

The DS8000 Point-in-Time Copy (IBM FlashCopy) function requires space to be set aside equal to the size of the volumes that are to be copied. The IBM System Storage DS8000 series provides support for IBM FlashCopy SE (space efficient snapshot capability) which is intended to use only the amount of storage needed by the copy. This capability can lower the amount of storage needed by many DS8000 clients today, and help lower costs by significantly reducing disk capacity needed for copies. Reducing capacity in the DS8000 can also mean fewer drives and less power required for the overall system.

IBM FlashCopy SE can be managed and configured via the DS Storage Manager, DS CLI, and DS Open API. All host systems supported by the DS8000 today are supported with FlashCopy SE (IBM System z servers require z/OS 1.10, or later, for this support). For more information on implementation of this function, please refer to the *IBM System Storage DS8000 FlashCopy SE Implementation Considerations and Recommendations* document located at

<http://www.ibm.com/support/techdocs/atmastr.nsf/WebIndex/FLASH10617>

IBM FlashCopy SE is an optional feature on the DS8000 series, available with the SE indicator feature numbers 0730 and 735x-736x and corresponding DS8000 series Function Authorization (2399-LFA SE feature numbers 735x-736x).

Remote mirror and copy solutions

DS8870 models support several hardware-based remote mirror and copy solutions:

- IBM System Storage Metro Mirror - This solution is designed to provide real-time mirroring of logical volumes between two systems that can be located up to 300 km from each other. It is a synchronous copy solution where write operations are completed on both copies (local and remote site) before they are considered to be done.
- IBM System Storage Global Copy - This is a nonsynchronous long-distance copy option for data migration and backup.
- IBM System Storage Global Mirror - Global Mirror is a long-distance remote copy solution across two sites using asynchronous technology, and is designed to provide the following:
 - Support for virtually unlimited distance between the local and remote sites, with the distance typically limited only by the capabilities of the network and channel extension technology being used. This can better enable you to choose your remote site location based on business needs and enables site separation to add protection from localized disasters.
 - A consistent and restartable copy of the data at the remote site, created with little impact to applications at the local site.
 - Data currency where, for many environments, the remote site lags behind the local site as little as 3 to 5 seconds, helping to reduce the amount of data exposure in the event of an unplanned outage. The actual lag in data currency experienced will depend upon a number of factors, including specific workload characteristics and bandwidth between the local and remote sites.
 - Dynamic selection of the desired Recovery Point Objective (RPO) based upon business requirements and optimization of available bandwidth.
 - Session support whereby data consistency at the remote site is internally managed across up to eight systems located across the local and remote sites.
 - Efficient synchronization of the local and remote sites with support for failover and failback modes, helping to reduce the time required to switch back to the local site after a planned or unplanned outage.

Interoperability with existing and previous generations of DS8000 series

All of the above remote mirroring solutions use Fibre Channel as the communications link between the primary and secondary machines. The Fibre Channel ports used for remote mirror and copy can be configured as either a dedicated remote mirror link or as a shared port between remote mirroring and Fibre Channel Protocol (FCP) data traffic.

The remote mirror and copy solutions listed above are optional capabilities and are compatible with previous generations of DS8000 . They are available as follows:

- Metro Mirror indicator feature numbers 75xx and 0744 and corresponding DS8000 series Function Authorization (2399-LFA MM feature numbers 75xx).
- Global Mirror indicator feature numbers 75xx and 0746 and corresponding DS8000 series Function Authorization (2399-LFA GM feature numbers 75xx).

DS8000 series systems can also participate in global copy solutions with the IBM TotalStorage ESS Model 750, IBM TotalStorage ESS Model 800, and IBM System Storage DS6000™ series systems for data migration. For more information on data migration and migration services contact IBM or a Business Partner representative.

Global Copy is a nonsynchronous long-distance copy option for data migration and backup, and is available under Metro Mirror and Global Mirror licenses or Remote Mirror and Copy license on older DS8000 , ESS, or DS6000 systems.

Three-site Metro/Global Mirror

The DS8000 series supports three-site Metro/Global Mirror configurations. The Metro Mirror and Global Mirror functions utilize synchronous mirroring (Metro Mirror) from a local A-site to a metro-distance B-site, and asynchronous mirroring (Global Mirror) from an intermediate B-site to a remote C-site. This function, referred to as Metro/Global Mirror, is designed to provide planned and unplanned outage three-site enterprise disk data replication to help address rigorous three-site business resiliency needs of the enterprise data center. Metro/Global Mirror can support synchronous replication at distances up to 303 km using IBM System Storage Metro Mirror, and can maintain the asynchronous third site for out of region recovery, at a data currency that can be within 3 to 5 seconds (bandwidth permitting) using IBM System Storage Global Mirror.

Metro/Global Mirror is designed to provide:

- Fast failover/failback to any site
- Fast re-establishment of three-site recovery without production outages
- Quick resynchronization to any site with incremental changes only

Metro/Global Mirror supports planned and unplanned switches from a local A-site to a remote B-site. With the cascading nature of Metro/Global Mirror, during and after the metro-distance switch, this function can provide continuous asynchronous disaster recovery protection to the out of region remote C-site without the necessity of additional reconfiguration. In the event of a loss of access to the B-site, Metro/Global Mirror is designed to provide incremental resynchronization from the local A-site to the remote C-site. The B-site can be brought back into the three-site configuration without a production outage, and with full failover and failback.

The Metro/Global Mirror solution uses Fibre Channel as the communications link between the primary, secondary, and tertiary machines. The Fibre Channel ports used for remote mirror and copy can be configured as either a dedicated remote mirror link or as a shared port between remote mirroring and FCP data traffic.

The Metro/Global Mirror solution is an optional capability of the DS8000 series and is available with the Metro/Global Mirror indicator feature numbers 74xx and 0742 and corresponding DS8000 series Function Authorization (2399-LFA MGM feature numbers 74xx).

Quick initialization

IBM now supports quick initialization as an enhancement to device provisioning technology on DS8870 platforms. Quick initialization improves initialization speeds up to 2.6 times over previous versions and allows a copy services relationship to be established after a device is created, while the provisioning of storage is in progress. These improvements can help users to create an enterprise storage environment, quickly provision new logical devices, and move the devices into production while utilizing the new thin provisioning technology in less time than ever before on DS8000 systems.

Quick initialization is currently available on fixed block logical volumes and is also supported on CKD logical volumes.

IBM System Storage DS8870 Thin Provisioning

The DS8870 also offers thin provisioning to allow users to over-commit storage to specific devices and throughout the system in general. This has several potential benefits. First, users can now allocate larger logical devices without having to provision the entire device, allowing storage to be allocated on the DS8870 without repeated device resizing as would be required today. The level of over-commitment can be decided by the user, but as the system consumes physical storage, administrators will be notified of physical allocations as it reaches user-specified limits. Once all of the physical storage is in use, no further virtual storage can be allocated, so action must be taken before this condition occurs.

Thinly provisioned devices can be increased in size as needed if the logical size of the device becomes constrained. If the physical storage approaches full allocation within a given extent pool, then users can add additional physical capacity (via drive sets) to increase the size of the extent pool.

Users may see a reduction in operating costs by being able to deploy fewer physical disks to provision a given set of logical devices that are underutilized. Thin provisioned devices offer performance that is comparable to standard, fully allocated, logical devices, and are effective in reducing capacity allocations. The ability to overconfigure logical device capacities may also help to reduce operational costs related to expanding storage allocations for host system software components such as logical volume managers, file systems, and databases.

For the initial release, the IBM System Storage DS8000 thin provisioning feature is available only for open systems, excluding System i . Support for IBM System Storage DS8870 thin provisioning is an optional feature of the DS8870 Model 961, and is available with the thin provisioning licensed feature indicator feature numbers 7071 and 0707 and corresponding DS8870 Function Authorization (239x-LFA) Thin Provisioning feature number 7071.

Thin provisioning support for Copy Services function (open systems)

The FlashCopy advanced function is designed to provide a point-in-time copy capability for logical volumes. The FlashCopy function creates a physical point-in-time copy of the data, with minimal interruption to applications, and makes it possible to access both the source and target copies immediately.

Metro Mirror offers a synchronous, long-distance copy option that constantly updates a secondary copy of a volume to match changes made to a source volume. Global Mirror provides a long-distance remote copy solution across two sites using asynchronous technology. Metro Global Mirror is a three-site, high-availability disaster recovery solution, which uses synchronous replication to mirror data between a local site and an intermediate site, and asynchronous replication to mirror data from an intermediate site to a remote site.

The Copy Services function has extended the support of mixing thin provisioning volumes and logical volumes.

With this enhancement, existing customers that have thin provisioning volumes on the system and want to use the Copy Services function do not need any reconfiguration.

IBM System Storage Easy Tier®

IBM System Storage Easy Tier is designed to help automate data placement throughout the DS8870 disk pool (including multiple drive tiers) to intelligently align the system with current workload requirements. This includes the ability for the system to automatically and nondisruptively relocate data (at the extent level) across drive tiers, and the ability to manually relocate full volumes. The potential benefit is to align performance of the system with the appropriate application workloads.

- Automated relocation - Manages volumes in an extent pool with SSD and HDD by automatically moving *hot* extents to SSD and cold extents to HDD.
- Volume migration - Enables the manual relocation of volumes between extent pools, as well as the restriping of volumes within an extent pool, and the ability to merge existing extent pools.

Automated relocation

While SSDs can provide higher performance for most workloads, they do so at a significantly higher cost than traditional spinning drives. Even with recent improvements in the cost of SSDs, they remain an expensive option for many workloads, especially those requiring large amounts of storage. Based on those higher costs, it is often not realistic to replace all spinning drives with SSDs for a given application or workload. In order to improve performance of SSDs and reduce

overall system cost, infrequently accessed (cold) data can and should reside on lower cost HDDs while frequently accessed (hot) data should be moved to the SSDs. The mix of SSDs and HDDs should be used to strike a proper balance between performance and cost.

IBM System Storage DS8870 introduces this capability with IBM System Storage Easy Tier . Easy Tier provides the ability to manage data placement between two tiers of storage, SSD and either Fibre Channel or SATA drives. Using a learning algorithm developed with the IBM Research organization, Easy Tier is designed to eliminate the complexity of manual data placement among tiers, while providing the value and flexibility of sub-volume or sub-LUN data placement. This supports improved performance cost options and is an improvement over traditional tiering methods that require manual intervention to move data between tiers, or ones that do not work at a granular level, requiring too much data to be moved to see any benefit. The IBM System Storage Easy Tier feature can determine the appropriate tier of storage based on data access requirements and then automatically move the data to the appropriate tier. This allows the manual effort involved to be reduced, if not eliminated. In this new dynamic environment, data movement is maintained to the host application regardless of the storage tier on which the data resides.

The IBM System Storage Easy Tier feature is designed to provide granularity in identifying and moving hot data at the sub-volume or sub-LUN (extent) level to SSDs. Easy Tier requires the use of a hybrid extent pool which contains both SSD and HDD drives. Sub-volume or sub-LUN (extent) from HDDs can be moved dynamically within a hybrid pool to SSD drives. Data movement done by the DS8870 is designed to be dynamic and transparent to the host server and application use of the data. The Easy Tier algorithm will assign *heat* values to each extent in a storage device. These heat values, hot or cold, will indicate what tier the data should reside on, and migration will take place automatically. Sub-volume or sub-LUN data movement is extremely important compared to full volume movement as not all data at the volume/LUN level will be hot data. Since for any given workload there is a distribution of data considered *hot* or *cold* , there is significant overhead associated with moving entire volumes between tiers. For example, if a volume is 1 TB, you would not have to move entire 1 TB volumes if the heat map generated indicates only 10 GB is considered *hot* . The DS8870 extent size is 1 GB, requiring only 10 extents to move to optimize the workload in this example, versus 1,000 extents for a less tuned method. This capability makes improved use of the SSD technology's higher performance while reducing the number of drives needed to improved that performance. In addition, depending on the workload and environment, it may be possible to combine Easy Tier , SSDs, and larger capacity drives and receive equivalent or better performance than traditional high-performance configurations (using small spinning disks) while providing smaller footprints and lower environmental costs.

Volume migration

Users can

- Relocate logical volumes between extent pools or within an extent pool
- Change the extent allocation algorithm (EAM) of a logical volume (for example, rotate extents within the target extent pool)
- Merge two existing extent pools
 - Combine existing extent pools with homogeneous disks
 - Merge two extent pools with heterogeneous disks to use automated relocation
 - Change volume/rank to extent pool relationship without moving data

Volume migration implementation:

- Offers transparent migration to attached hosts
- Allows any supported volume to be queued for migration
- Actively migrates a number of extents per CEC concurrently
- Delivers overheads comparable to FlashCopy with background copy

The DS8870 has been enhanced to include performance monitoring capabilities, regardless of whether you have installed and activated the Easy Tier license feature on your DS8870. The monitoring capability of the DS8870 enables it to monitor the usage of storage at the volume extent level. Monitoring statistics are gathered and analyzed every 24 hours. In an Easy Tier managed extent pool, the analysis is used to form an extent relocation plan for the extent pool, which provides a recommendation for relocating extents on a volume to the most appropriate storage device. The results of this data is summarized in a summary report which you can download.

The DS8870 offers a reporting tool called IBM System Storage DS8870 Storage Tier Advisor, hereafter referred to as advisor tool. The advisor tool is a Microsoft™ Windows™ application that provides a graphical representation of performance data collected by the Easy Tier over a 24-hour operational cycle. Volume performance statistics are included in a summary binary file that is transformed to a readable statistical report that you can download to a directory you specify on your Windows workstation from which you are accessing the DS8870. The advisor tool is the application that allows you to view the data when you point your browser to the file. You can access the advisor tool with any supported web browser and view the information displayed by the advisor tool to analyze workload statistics and evaluate which logical volumes might be candidates for Easy Tier management. If you have not installed and enabled the Easy Tier feature, you can use the performance statistics gathered by the monitoring process to help you determine whether to use Easy Tier to enable potential performance improvements in your storage environment.

The value propositions of IBM System Storage Easy Tier are:

- Manage storage performance within an enterprise storage system to improve dynamic application demand or dynamic system configuration
- Improve performance costs by taking advantage of the spectrum of storage drives available
- Improved throughput performance or a significant latency reduction can be achieved for the total workload with a small percentage of data relocation from tier 1 or 2 to tier 0
- Moving small amounts of frequently accessed data to SSDs can result in a better response time or increased throughput, depending on customer workload and environment
- Enables customers to develop new insights into application workloads on their storage infrastructure and develop new optimization strategies

Support for IBM System Storage Easy Tier is an optional feature of the DS8870 Model 961 and is available with the IBM System Storage Easy Tier licensed feature indicator feature numbers 7083 and 0713 and corresponding DS8870 Function Authorization (239x-LFA) IBM System Storage Easy Tier feature number 7083.

IBM System Storage Easy Tier enhancements

IBM delivers the second generation of IBM System Storage Easy Tier , designed to balance system resources to address application performance objectives by automating data placement across SSDs (tier 0), enterprise-class (tier 1), and nearline (tier 2) drives, as well as among the ranks of the same tier. This includes the ability for the system to automatically and nondisruptively relocate data (at the extent level) across drive tiers, and the ability to manually relocate full volumes. The benefit is to align performance of the system with the appropriate application workloads.

This enhancement can help to improve storage utilization and address performance requirements for multi-tier systems that are not yet deploying SSDs. Depending on the workload, up to 50% or more of tier one application data can be migrated to nearline (tier 2) without impacting application performance.

Effective automated tiering between enterprise-class and nearline drives can help reduce overall footprint and provide more cost-effective capacity, while addressing performance requirements.

The extended capabilities of Easy Tier version 2 are designed to support:

- Cold demotion - Inactive *cold* data stored on an enterprise performance tier is demoted to a more appropriate tier.
- Warm demotion - When a specific rank in the higher tier exceeds its optimal performance level, selected extents are moved to other ranks to eliminate the growing hotspot.
- Auto-rebalance - Automatically relocates extents among the ranks within the tiers to remove workload skews on the ranks.
- Automated relocation - Now supporting migration between any two classes of drives.
- Volume migration - Enables the manual relocation of volumes between extent pools, the restriping of volumes within an extent pool, and the ability to merge existing extent pools into a single extent pool. Intra-pool restriping is now available to rebalance the volume across the available ranks, with a general bias toward providing pure striping, without requiring pre-allocation of all extents.
- Rank depopulation - Allows clients to nondisruptively relocate extents away from selected ranks and stop using the ranks.

Cold demotion

Cold demotion is designed to automatically recognize and demote inactive (*cold*) extents that are stored on a higher performance tier to an appropriate lower cost tier.

Cold demotion occurs when Easy Tier version 2 detects any of the following scenarios:

- Segments in a storage pool become inactive over time, while other data remains active. This action can free up segments on the enterprise tier before the segments on the lower tier become *hot*, helping the system be more responsive to new data.
- All the segments in a storage pool become inactive simultaneously due to either a planned or unplanned outage. In this situation, Easy Tier disables cold demote when storage pools are inactive between 15.5 and 24 hours. Disabling cold demote assists the user in scheduling extended outages or experiencing the outage without affecting the segment placement.

Warm demotion

The warm demote operation demotes *hot* extents in SSDs to HDDs, or from Enterprise FC to SATA drives to protect the drive performance on the system. In the enhanced Easy Tier version 2, warm demotion is rank-based and target rank is randomly selected from the lower tier. This function is triggered when bandwidth or IOPS thresholds are exceeded in the higher tier.

Auto-rebalance

In any tier, placing highly active (*hot*) data on the same physical rank can cause the drives or the associated device adapter (DA) to become a performance bottleneck. Over time, skews can appear within a single tier that cannot be addressed by migrating data to a faster tier alone, and requires some degree of workload rebalancing within the same tier. Auto-rebalance addresses these issues within a tier. It also helps the system respond in a more timely, appropriate manner to overloading skews and any under-utilization that might occur from the addition or deletion of hardware, migration of extents between tiers, changes in the underlying volume configurations, and variations in the workload. Auto-rebalance adjusts the system in order to continuously provide good performance by balancing the load on the ranks and on DA pairs.

Easy Tier enhancements provide extended and improved capabilities to support the automatic functions of auto-rebalance, warm demotion, and cold demotion, and will be made available on previous DS8700 Model 941, DS8800 Model 951, and the current DS8870 Model 961.

Rank depopulation

In the situation of drive technology upgrades, storage reconfigurations, and tearing down hybrid pools, rank depopulation allows users to relocate in-use extents away to the other ranks in the same pool and unassign the ranks from the pool. When ranks of a tier are depopulated from the hybrid pool, the pool is automatically treated as a traditionally managed pool, without dynamic optimization. After the depopulation, the ranks can be deleted or reconfigured to another pool.

IBM System Storage Easy Tier third generation

IBM System Storage Easy Tier third generation is designed to help automate data placement throughout the DS8000 disk pool between SSD drives (tier 1), enterprise class drives (tier 2), and nearline (tier 3) drives to intelligently align the system with current workload requirements. This includes the ability for the system to automatically and nondisruptively relocate data (at the extent level) across any three tiers of storage and within any tier. Relocation within tiers automatically rebalances workloads across available ranks, including ranks that are added to disk pools, to maximize the performance of each tier. Pools may be configured with one, two, or three tiers. The benefit is to align performance of the system with the appropriate application workloads. In addition, Easy Tier allows you to manually migrate logical volumes between extent pools, merge extent pools, or redistribute logical volumes across the available ranks within an unmanaged extent pool.

This enhancement can help clients improve storage utilization and address performance requirements for multitier systems that are not yet deploying SSDs. They can incrementally add SSDs to these traditional configurations for performance and nearline drives for cost savings depending on requirements. The DS8000 system performance can be automatically balanced across the new drives within the managed pool.

The extended capabilities of Easy Tier third generation support

- **Managed extent pools** - Enables extended support for one tier and three tier environments, with management for provisioned volumes.
- **Volume migration** - Enables the manual relocation of logical volumes between extent pools, restriping of logical volumes within an unmanaged extent pool, and the ability to merge existing extent pools. Easy Tier third generation has extended the support for thin provisioning volume migration and merging of extent pools that both contain thin provisioned volumes.
- **Auto-rebalance** - Relocates extents among the ranks within a tier to remove workload skews on the ranks in a managed extent pool. Easy Tier third generation has extended the support for thin provisioning volumes and allows action on single tier and three tier pools to remove skews automatically, including cases where ranks are added to a managed extent pool.
- **Rank depopulation** - Allows customers to nondisruptively relocate extents away from selected ranks and stop using the ranks. Easy Tier third generation has extended the support for thin provisioning volumes in addition to the standard volumes.

Remote mirror and copy solutions for z/OS

The following are three remote mirror and copy solutions for the z/OS environment for DS8870 models:

- **IBM System Storage z/OS Global Mirror:** This is a combined hardware and software business continuance solution for the System z environment providing asynchronous mirroring between systems at two sites located global distances apart. z/OS Global Mirror is an optional capability of the DS8000 series and is available with the remote mirror for z/OS indicator feature numbers 76xx and

0760 and corresponding DS8000 series Function Authorization (2399-LFA RMZ feature numbers 76xx). z/OS Global Mirror also requires the purchase of the FICON attachment licensed feature.

- **z/OS Metro/Global Mirror (three-site z/OS Global Mirror and Metro Mirror):** This mirroring capability utilizes z/OS Global Mirror to mirror primary site data to a location that is a long distance away and also uses Metro Mirror to mirror primary site data to a location within the metropolitan area. This enables a three-site, high availability and disaster recovery z/OS solution for even greater protection from unplanned outages. z/OS Metro/Global Mirror is an optional capability of the DS8000 series and is available with the remote mirror for z/OS indicator feature numbers 76xx and 0760 and corresponding DS8000 series Function Authorization (2399-LFA RMZ feature numbers 76xx) Mirror and Global Mirror features. z/OS Metro/Global Mirror also requires the purchase of a FICON attachment licensed feature.
- **Three-site z/OS Metro/Global Mirror Incremental Resync:** This capability can eliminate the need for a full copy after a HyperSwap® situation in three-site z/OS Metro/Global Mirror configurations. The z/OS Metro/Global Mirror Incremental Resync capability is intended to enhance Remote Mirror for z/OS by enabling resynchronization of data between sites using only the changed data from the Metro Mirror target to the z/OS Global Mirror target after a GDPS® HyperSwap . This can significantly reduce the amount of data to be copied after a HyperSwap situation and improve the resilience of an overall three-site disaster recovery solution by reducing resync times. z/OS Metro/Global Mirror Incremental Resync is an optional feature of the DS8870 Model 961 and is available with the RMZ resync licensed feature indicator feature numbers 0763 and 76xx and DS8000 series Function Authorization (2399-LFA RMZ resync feature numbers 76xx). z/OS Metro/Global Mirror also requires the purchase of the FICON attachment licensed feature.

z/OS Distributed Data Backup

This provides the capability to perform reliable backup of open systems data from distributed server platforms via a System z host. The open systems data will be transferred to the System z host via the fixed block command set used for the 3880 control unit, allowing backup of open data on distributed servers that are not formatted for mainframe System z I/O commands. Currently, clients are not able to effectively use System z I/O commands to backup open data along with their mainframe data. This will provide a multi-platform backup capability from System z .

The Innovation Data Processing application will issue commands from z/OS to read/write data to LUNs. Support for IBM z/OS Distributed Data Backup is an optional feature of the DS8870 Model 961. It is available with the z/OS Distributed Data Backup licensed feature indicator, feature numbers 7094 and 0714, and corresponding DS8870 Function Authorization (239x-LFA) z/OS Distributed Data Backup feature number 7094.

IBM performance innovations for System z environments

FICON extends the ability of the DS8000 series system to help deliver high bandwidth potential to the logical volumes needing it, when they need it. Older technologies are limited by the bandwidth of a single disk drive, but FICON , working together with other DS8000 series functions, provides a high-speed pipe supporting multiplexed operation.

Support for FICON attachment is an optional feature of DS8870 Model 961 and is available with the FICON attachment licensed feature indicator feature numbers 7091 and 0703 and corresponding DS8000 series Function Authorization (2399-LFA FICON attachment feature number 7091).

Parallel Access Volumes (PAV) enable a single System z server to simultaneously process multiple I/O operations to the same logical volume to significantly reduce device queue delays by defining multiple addresses per volume. With Dynamic PAV, the assignment of addresses to volumes can be automatically managed to help meet performance objectives and reduce overall queuing. PAV is an optional feature on the DS8000 series and is available with the PAV indicator feature numbers 78xx

and 0780 and corresponding DS8000 series Function Authorization (2399-LFAPAV feature numbers 78xx). PAV also requires the purchase of the FICON attachment licensed feature.

HyperPAV allows an alias address to be used to access any base on the same control unit image per I/O base. This capability also allows different HyperPAV hosts to use one alias to access different bases, reducing the number of alias addresses required to support a set of bases in a System z environment with no latency in targeting an alias to a base. This functionality is designed to enable applications to achieve equal or better performance than possible with the original PAV feature alone while using the same or fewer z/OS resources.

HyperPAV is an optional feature on the DS8000 series and is available with the HyperPAV indicator feature numbers 7899 and 0782 and corresponding DS8000 series Function Authorization (2399-LFA HyperPAV feature number 7899). HyperPAV also requires the purchase of PAV licensed features and the FICON attachment licensed feature.

Performance improvements to High Performance FICON for System z (zHPF) for:

- QSAM, BPAM, and BSAM access methods: With zHPF with z/OS V1.13, zEnterprise servers and IBM System Storage has been designed to deliver significant I/O performance improvements for certain I/O transfers for workloads using QSAM, BPAM, and BSAM access methods. Significant I/O performance improvements are expected without the need for application changes. This builds upon existing zHPF support for VSAM, Extended Format sequential, zFS, and PDSE data sets, and provides support for these data set types when a new parameter is specified in the IGDSMSxx member of parmlib:
 - Basic nonextended format physical sequential data sets
 - Basic and large format sequential data sets

The zHPF function without the most recent enhancements is supported on DS8000 series systems running on IBM zEnterprise servers with all supported FICON features (CHPID type FC) and z/OS V1.11, or later.

- Format writes: zHPF has also been enhanced to support format writes. This capability applies to all of the same data set types that were originally supported by the Modified Indirect Data Address Word (MIDAW) facility and zHPF, in addition to QSAM, BPAM, and BSAM data sets described above. The performance value of these enhancements are highest for small records, which are typically used for databases.

DB2® utilities use format writes. Those utilities that load or restore data into a table space or index with a 4K page size are expected to experience the most benefit.

The zHPF enhancement for format writes is supported on the DS8000 series systems running on IBM zEnterprise servers with all supported FICON features (CHPID type FC) and z/OS V1.11, or later.

- DB2 List Prefetch: zHPF has also been enhanced to provide improvements for DB2 List Prefetch processing when using 4K pages. zHPF list prefetch is supported by the FICON Express4 and FICON Express8 features. However, those features limit the number of discontinuities that a single zHPF channel program can have to 22. If the number exceeds 22, z/OS splits the pages into two I/Os. This applies to 4K pages, since DB2 for z/OS typically reads 32x4K pages. The FICON Express® 8S features remove this limitation. The result is fewer I/Os than when using FICON Express4 or FICON Express features.

The function is supported on DS8000 series systems running on IBM zEnterprise servers with FICON Express8S features (CHPID type FC) and z/OS V1.11, or later.

HyperSwap (GDPS) support

HyperSwap support is designed to enhance and improve recovery in HyperSwap-enabled configurations. This support is intended to mitigate the impact of recovery scenarios and is targeted for GDPS/PPRC IBM System Storage DS8700, DS8800, or later series clients.

The DS8000 implements a new event reporting mechanism for events that greatly reduce the impact on host operating systems. This support is targeted to GDPS and PPRC clients with DS8000 disk and is intended to mitigate the impact of various, primary PPRC DS8000 recovery scenarios on host processing. The DS8000 will notify GDPS and PPRC of any recovery processing that will impact host I/Os for an extended period. GDPS and PPRC, based upon the DS8000 notification, will initiate an unplanned hot swap.

The function is supported on DS8000 series systems running on IBM System z servers with z/OS V1.13, or later, and GDPS V3.8, or later.

IBM Extended Address Volumes (EAV) for System z environments

The EAV function provides support for volumes that can scale up to approximately 1 TB (1,182,006 cylinders), helping to relieve address constraints to support large storage capacity needs in System z environments. Larger devices can help simplify storage management by managing fewer large volumes as opposed to many small volumes. The HyperPAV function complements EAV by allowing scaling of I/O rates against a single, larger volume. Dynamic Volume Expansion allows nondisruptive migration to the larger volume sizes now available. The function is supported on DS8000 series systems running on IBM System z servers with z/OS V1.10, or later. The EAV capability is provided with the DS8000 series at no additional charge.

Multiple allegiance expands the simultaneous logical volume access capability across multiple System z servers. This function, along with PAV, enables the DS8000 series to process more I/Os in parallel, helping to improve performance and enable greater use of large volumes.

z/OS Global Mirror Multiple Reader (enhanced reader) allows automatic load balancing over multiple readers in a z/OS Global Mirror (XRC) environment. This function provides increased parallelism through multiple SDM readers and improved throughput for z/OS remote mirroring configurations. z/OS Global Mirror can also help maintain constant data consistency between mirrored sites and enable achievement of lower recovery point objectives. The function is supported on DS8000 series systems running on IBM System z servers with z/OS 1.10, or later.

z/OS Global Mirror Multiple Reader requires the purchase of z/OS Global Mirror which is an optional capability of the DS8000 series (RMZ indicator feature numbers 0760 and 76xx and corresponding DS8000 series Function Authorization - 2399-LFA feature numbers 76xx). z/OS Global Mirror also requires the purchase of the FICON attachment feature. The z/OS Global Mirror Multiple Reader function has no additional charge beyond the z/OS Global Mirror and FICON attachment feature charges.

High performance FICON multi-track for System z improves performance

Previously, FICON working together with other DS8000 series functions provided a high-speed connection supporting multiplexed operation. High Performance FICON takes advantage of the hardware available today with enhancements that are designed to reduce the overhead associated with supported commands. Enhancements have been made to the z/Architecture® and the FICON interface architecture to deliver improvements for online transaction processing workloads. zHPF is designed to help reduce overhead and improve performance when exploited by the FICON channel, the z/OS operating system, and the control unit. Additionally, the changes to the architectures offer end-to-end system enhancements to improve reliability, availability, and serviceability. Existing adapters will be able to handle an intermix of transactions using FCP, FICON, and High Performance FICON protocols.

High Performance FICON can support more than one track's worth of data in a single transfer. Applications using Media Manager for I/O with large data transfers are expected to benefit those using zFS, HFS, PDSE, and striped extended format data sets. This function is available on z/OS V1.9 and z/OS V1.10 with the PTFs for APARs OA26084 and OA29017.

This function is a modification to the FICON I/O architecture and is being worked on for inclusion into the Fibre Channel Standard by the INCITS Fibre Channel (T11) Technical Committee's FC-SB-4 project.

Support for High Performance FICON multi-track is an optional feature of DS8870 Model 961 and is available with the High Performance FICON licensed feature indicator feature numbers 7092 and 0709 and corresponding DS8000 series Function Authorization (2399-LFA HighPerformance FICON feature number 7092).

z/HPF extended distance

Reduces the impact associated with supported commands on current adapter hardware, thereby improving FICON throughput on the DS8870 I/O ports.

I/O priority queuing

I/O priority queuing allows the DS8000 series to use I/O priority information provided by the z/OS Workload Manager to manage the processing sequence of I/O operations.

DS8000 I/O Priority Manager

The DS8000 now features I/O Priority Manager which enables more effective storage consolidation and performance management with the ability to align quality of service levels to separate workloads in the system. This capability is exclusive to the DS8000 and System z systems.

Users define performance goals based on priority of high, medium, or low to any volume and the system will prioritize access to system resources to achieve the volume's desired quality of service. I/O Priority Manager is designed to constantly monitor and balance system resources to help applications meet their performance targets automatically, without operator intervention.

The DS8000 I/O Priority Manager feature is available for open systems and System z . Support for DS8000 I/O Priority Manager is an optional feature for DS8870 Model 961, is available with the I/O priority Manager licensed feature indicator DS8000 Function Authorization (239x-LFA) I/O Priority Manager feature numbers 784x and 0784 and corresponding DS8000 Function Authorization (239x-LFA) I/O Priority Manager feature numbers 784x.

Copy Services Scope Management

This release also provides enhanced data protection for multitenancy environments that use copy services. With Copy Services Scope Management, copy service relationships can be limited to the domain of a set of user specified resources. Additionally, user IDs can be configured to limit a given user ID to issuing copy services requests to a specific domain. This capability allows specific resources to be managed for copy services by a specific user and prevents any host or user from initiating a copy services operation that would cross any domain boundaries. The Copy Services Scope Management capability is available for any host type on any volume type (CKD or FB). In addition to this multitenant capability, copy services domains can also provide general purpose partitioning to isolate heterogeneous environments from each other.

DS8000 Storage Manager GUI

An updated GUI now enables easier, more effective management of the system and its advanced features. The enhanced design was inspired by the IBM System Storage XIV® GUI and includes more intuitive navigation panels and streamlined configuration processes, as well as embedded links to relevant videos for quick

access to useful DS8000 information. These changes were based on newer GUI technology and the common UI elements across the storage portfolio. This common GUI supports DS8000 , Storwize® V7000, and SAN Volume Controller (SVC) by having a common look and feel, as well as common terminology and icons to greatly simplify management of the various systems that use this common GUI, and significantly reduce the costs associated with administrator training.

GUI support for resource groups

An updated GUI now enables easier, more effective management of the resource groups configurations. This DS8000 GUI allows users to create, modify, and delete Logical Volume and Logical Subsystems (CKD/FB), and display the resource group attribute.

This GUI can greatly simplify configurations and management of the resource groups that use this GUI and significantly reduce the costs associated with administrator training.

DS8000 Storage Manager enhancement

Enhancements were added to the DS Storage Manager (GUI) for the DS8870 for easier and more efficient storage management. The DS Storage Manager is installed as a GUI for the Windows and Linux™ operating systems. In addition to using IBM Tivoli Storage Productivity Center, the GUI can be accessed from any location that has network access using a web browser.

Supported browsers include:

- Microsoft Internet Explorer 8 or 9
- Mozilla Firefox 10 ESR

Security enhancements

Users logging onto the DS8000 storage system have to be compliant to ITSC104 password requirements. Storage administrators have the ability to determine which users are currently logged into the DS8000 and disconnect users who may no longer be authorized to access the DS8000 with their current authorization roles or resource scopes.

IPv6 support

The DS8000 has been qualified as meeting the requirements of the IPv6 Ready Logo program, indicating its implementation of IPv6 mandatory core protocols and the ability to interoperate with other IPv6 implementations. DS8000 systems can be configured in native IPv6 environments.

Licensing capabilities for copy functions

With DS8870 models, licensing options are available for users of FlashCopy (point-in-time copy indicator feature), Metro Mirror, and Global Mirror indicator features as follows:

- If the function is used with open systems data only, a license is required for only the total physical capacity configured as fixed block (FB).
- If the function will be used with System z data only, a license is required for only the total physical capacity configured as count key data (CKD).
- If the function is used with both open systems and System z data, a license is required for the total physical capacity of DS8000 series system.

In addition, the license scope (FB, CKD, or entire machine) client is managed through an IBM web-based application to change the license scope on a given machine as business requirements change.

Additional DS8000 functions

- **End-to-end I/O priorities:** The DS8000 series host adapter allows preferential treatment to higher priority I/O and provides improved response time in the overall system operation while running in IBM System p AIX® and DB2 operating environments.
- **Cooperative caching:** The storage facility uses a cache hint to manage the retention period of cached data and provides improved overall system performance through more efficient use of the aggregate memory resources while running in IBM System p AIX and DB2 operating environments.
- **Intelligent write caching:** Write caches using fast, nonvolatile storage are now widely used in modern storage controllers since they help reduce latency on writes. Intelligent write caching utilizes a newly developed algorithm for write management to boost performance through improving utilization of both temporal locality (data most recently modified) and spatial locality (data located physically together). To increase aggregate throughput and reduce aggregate response times, the IBM DS8000 series now provides enterprise storage controllers utilizing the intelligent write caching algorithm.
- **Long busy wait host tolerance:** Host tolerance delivers a new protocol that allows a target to specify that it is busy and how long the initiator should wait before retrying. This avoids initiator failure of I/O after numerous retries and receiving busy responses, and avoids the initiator retrying too soon while running in the IBM System p AIX operating environments.
- **Audit logging:** DS8000 supports audit logging and viewing of an exported log file. The DS8000 audit logging capability includes information such as a list of users who have logged in and what the user did during their session. A separate log entry is added each time a resource is created, deleted, or modified providing enhanced administrator ease-of-use and additional security.

Concurrent code load improvements

The current DS8870 code load process combines multiple phases of code load into one step. Because of this, code loads are perceived to be unnecessarily long. Splitting the phases into two allows for one phase (distribution) to be done ahead of time without any loss of access or quiescing of any resource (no loss of redundancy). This would leave the other phase (activation) to be much shorter and could be scheduled during off-peak periods. This will allow for a less than 2-hour activation phase of the main components of the DS8870. Once installed, this capability will be enabled when moving forward to future levels of code.

Prevent deletion of CKD and FB volumes in use

The DS8870 supports additional measures to prevent online devices from deletion. *Online* devices have a specific meaning based on volume type. For CKD volumes, the volume is *online* if it is participating in any Copy Services relationship, or if it is *grouped dynamic-pathing state*. FB volumes are *online* if they are in a Copy Services relationship. The DSCLI will now always check for online status before completing a deletion command.

Smart Rebuild is designed to help reduce the possibility of secondary failures and data loss in RAID Arrays. The array rebuild process has been designed to read data from as few drives in the array as possible. This can help reduce the amount of time required to rebuild the data in the array, as well reducing the exposure to a second drive failure during the rebuild process.

The above functions are provided with the DS8000 series at no additional charge.

Management tools and utilities for administrator productivity

The DS8000 series models support the following management tools and utilities:

- **IBM System Storage management console:** The management console is the focal point for maintenance activities and is a dedicated laptop that is physically located (installed) inside your DS8870 and can proactively monitor the state of your system, notifying you and IBM when service is required. It

can also be connected to your network to enable centralized management of your system using the IBM System Storage DS® Command Line Interface or storage management software utilizing the IBM System Storage DS Open API. An external Management Console is available as an optional feature and can be used as a redundant management console for environments with high availability requirements.

- **IBM Tivoli Storage Productivity Center:** IBM Tivoli Storage Productivity Center is a storage resource management application available for DS8000 management. It is designed to provide centralized, automated, and simplified management of complex and heterogeneous storage environments.
 - **IBM Tivoli Storage Productivity Center 5.1** provides a wealth of storage resource management tools. It extends existing management of a single storage system, providing capabilities such as storage reporting, monitoring, and policy-based management. Additionally, it provides storage device configuration, performance monitoring, and management of storage area network (SAN) attached devices. It provides over 400 enterprise-wide reports, monitoring alerts, policy-based action, and file-system capacity utilization information in a heterogeneous environment. IBM Tivoli Storage Productivity Center is designed to help improve capacity utilization of storage systems, adding intelligence to data protection and retention practices. IBM Tivoli Storage Productivity Center 5.1 now includes replication management capabilities designed to support hundreds of replication sessions across thousands of data volumes and supports both open and z/OS-attached volumes.
 - **IBM Tivoli Storage Productivity Center for replication for System z** offers the same capabilities and support that are provided by the IBM Tivoli Storage Productivity Center for Replication, but for the System z environment. It supports:
 - FlashCopy
 - Metro Mirror
 - Metro Mirror with HyperSwap
 - Metro Mirror Open HyperSwap
 - Global Mirror
 - IBM System Storage DS8000 Metro Global Mirror
 - Basic HyperSwap
 - IBM System Storage DS8000 Metro Global Mirror with HyperSwap

Supported operating environments for IBM Tivoli Storage Productivity Center include, but are not limited to, Windows , Linux , AIX , System i , and System p .

- **IBM System Storage DS command line interface (CLI)** is a single CLI that has the ability to perform a wide range of commands for both configuration and copy services activities. The application has three modes of execution:
 - Single shot mode will connect, issue a single command, and then return to the user.
 - Script mode will connect, execute a predefined customer script, and then return to the user.
 - Interactive mode will place the user in a shell environment with a static connection to the storage subsystem so the user can execute multiple commands.

The CLI has the ability to dynamically invoke copy services functions. This can help enhance your productivity since it eliminates the previous requirement for you to create and save a task using the GUI. The DS CLI can also issue copy services commands to an ESS Model 750, ESS Model 800, or DS6000 series system. The DS CLI is available with the DS8870 models at no additional charge. The DS CLI client is available for the AIX , HP-UX, Linux , Novell NetWare, Sun Solaris, and Microsoft Windows operating system environments.

- **IBM System Storage DS open API** supports routine LUN management activities, such as LUN creation, mapping and masking, and the management

of point-in-time copy and remote mirroring. It supports these activities through the use of a standard interface as defined by the Storage Networking Industry Association (SNIA) Storage Management Initiative Specification (SMI-S). DS Open API is implemented through the IBM System Storage Common Information Model Agent (CIM Agent) for the DS Open API, a middleware application designed to provide a CIM-compliant interface. The interface is designed to allow Tivoli and third-party CIM-compliant software management tools to discover, monitor, and control DS8000 series systems. The DS Open API and CIM Agent are provided with the DS8870 models at no additional charge.

- **IBM System Storage multi-path subsystem device driver (SDD)** is designed to provide load balancing and enhanced data availability capability in configurations with more than one I/O path between the host server and the DS8000 series system. Load balancing can help reduce or eliminate I/O bottlenecks that occur when many I/O operations are directed to common devices via the same I/O path. SDD also helps eliminate a potential single point of failure by automatically rerouting I/O operations when a path failure occurs, thereby supporting enhanced data availability capability. SDD is provided with the DS8870 models at no additional charge.

General availability is October 19, 2012, for the following:

- DS8800 Models 961 and 96E
- Model 9xE position indicators
- Cache and processor options
- HD disk enclosure
- PCIe I/O enclosure pair
- PCIe HD cable groups
- 8 Gbps PCIe based host adapters
- 8 Gbps device adapters
- Encryption disk drive sets
- Encryption SSD disk drive sets
- Initial system capacity indicators
- Value based pricing and licensing
- Advanced Function tiers
- DS8000 LMC R7.0

Field (MES) availability is December 14, 2012, for the following:

- Field install Model 96E
- Model 9xE position indicators
- Field merge of expansion frames
- Cache and processor options
- HD disk enclosure
- PCIe I/O enclosure pair
- PCIe HD cable groups
- 8 Gbps device adapters
- Encryption disk drive sets
- Encryption SSD disk drive sets

Accessibility by people with disabilities

A U.S. Section 508 Voluntary Product Accessibility Template (VPAT) containing details on accessibility compliance can be requested at

http://www.ibm.com/able/product_accessibility/index.html

Section 508 of the US Rehabilitation Act

The IBM System Storage DS8870 and IBM System Storage DS8870 Expansion Unit are capable, as of October 19, 2012, when used in accordance with IBM's associated documentation, of satisfying the applicable requirements of Section 508 of the Rehabilitation Act, provided that any assistive technology used with the product properly interoperates with it. A US Section 508 Voluntary Product Accessibility Template (VPAT) can be requested at

http://www.ibm.com/able/product_accessibility/index.html

Statement of general direction

It is IBM's current plan and direction 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.

IBM's statements regarding its plans, directions, and intent are subject to change or withdrawal without notice at IBM's sole discretion. Information regarding potential future products is intended to outline our general product direction and it should not be relied on in making a purchasing decision. The information mentioned regarding potential future products is not a commitment, promise, or legal obligation to deliver any material, code, or functionality. Information about potential future products may not be incorporated into any contract. The development, release, and timing of any future features or functionality described for our products remains at our sole discretion.

Reference information

For more information, refer to the following announcements:

- Hardware Announcement [110-213](#), dated October 07, 2010 , IBM System Storage DS8000 series (Machine type 2424) high-performance Flagship high-end disk, four-year warranty model addresses your business and financial needs.
- Hardware Announcement [110-216](#), dated October 07, 2010 , IBM System Storage DS8000 series - (Machine type 239x) high-performance Flagship - Function Authorizations.

For IBM statement on compliance with European Union Directive on Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment (2002/95/EC) (RoHS), visit

<http://www.ibm.com/ibm/environment/products/rohs.shtml>

Product number

Description	Machine	Model	Feature
DS8870	2424	961	
Model 9xE merge indicators: - 9xE factory merge			0001
DoD indicator			0020
JEMT indicator			0021
Generic cover and packaging - for OEM only			0168

Shipping weight reduction 0200

Model 9xE position indicators:

- 961 - 96E position 1 0361
- 961 - 96E position 2 0362
- 961 - 96E position 3 0363

Licensed Function indicators:

- OEL indicator 0700
- FICON attach indicator 0703
- Thin Provisioning indicator 0707
- DB protection indicator 0708
- High Performance FICON indicator 0709
- Easy Tier indicator 0713
- z/OS Distributed Data Backup indicator 0714
- PTC indicator 0720
- SE indicator 0730
- MGM indicator 0742
- MM indicator 0744
- GM indicator 0746
- RMZ indicator 0760
- RMZ resync indicator 0763
- PAV indicator 0780
- HyperPAV indicator 0782
- I/O Priority Manager 0784

Initial system capacity:

- Up to 2.0 TB capacity 0800
- 2.1 to 5.0 TB capacity 0802
- 5.1 to 10.0 TB capacity 0805
- 10.1 to 25.0 TB capacity 0810
- 25.1 to 50.0 TB capacity 0815
- 50.1 to 75.0 TB capacity 0820
- 75.1 to 100.0 TB capacity 0825
- 100.1 to 150.0 TB capacity 0830
- 150.1 to 200.0 TB capacity 0835
- 200.1 to 250.0 TB capacity 0840
- 250.1 to 300.0 TB capacity 0845
- 300.1 to 350.0 TB capacity 0850
- 350.1 to 400.0 TB capacity 0855
- 400.1 to 450.0 TB capacity 0860
- 450.1 to 500.0 TB capacity 0865
- 500.1 to 550.0 TB capacity 0870
- 550.1 to 600.0 TB capacity 0871
- 600.1 to 700.0 TB capacity 0872
- 700.1 to 800.0 TB capacity 0873
- 800.1 to 900.0 TB capacity 0874
- 900.1 to 1000.0 TB capacity 0875
- 1000.1 to 1100.0 TB capacity 0876
- 1100.1 to 1200.0 TB capacity 0877
- 1200.1 to 1300.0 TB capacity 0878
- 1300.1 to 1400.0 TB capacity 0879
- 1400.1 to 1500.0 TB capacity 0880
- 1500.1 to 1600.0 TB capacity 0881
- 1600.1 to 1700.0 TB capacity 0882
- 1700.1 to 1800.0 TB capacity 0883
- 1800.1 to 1900.0 TB capacity 0884
- 1900.1 to 2000.0 TB capacity 0885
- 2000.1 to 2200.0 TB capacity 0886
- 2200.1 to 2400.0 TB capacity 0887
- 2400.1 to 2600.0 TB capacity 0888
- 2600.1 to 2800.0 TB capacity 0889
- 2800.1 to 3000.0 TB capacity 0890

Standby CoD indicators:

- Non-Standby CoD 0900
- Standby CoD indicator 0901
- Standby CoD indicator 0902
- Standby CoD indicator 0903
- Standby CoD indicator 0904

Attachment indicators:

- IBM/Openwave alliance indicator 0930

- IBM System i indicator	0931
- IBM System p indicator	0932
- IBM System x indicator	0933
- IBM System z indicator	0934
- IBM System z B/C indicator	0935
- Linux indicator	0940
- Global Mirror indicator	0950
- IBM System Storage PROTECTIER® indicator	0960
- IBM Storwize v7000 indicator	0961
- IBM System Storage N series indicator	0962
- IBM System Storage SAN Volume Controller indicator	0963
- IBM/EPIC attachment indicator	0964
- VMware VAAI indicator	0965
Power:	
- Remote power control	1000
- Battery assembly	1051
- Extended PLD	1055
Single phase line cords:	
- SPP cord, 200-240V, 60A, 3-pin connector	1061
- SPP cord, 200-240V, 63A, no connector	1068
- Top exit SPP, 200-240V, 60A, 3-pin connector	1072
- Top exit SPP, 200-240V, 63A, no connector	1073
Three phase line cords:	
- Three phase wye, 380-440V, 32A, no connector	1081
- Three phase delta, 200-240V, 60A, 4-pin connector	1082
- Top exit three phase wye, 380-440V, 32A, no connector	1083
- Top exit three phase delta, 200-240V, 60A, 4-pin connector	1084
Special tool:	
- Universal ladder	1101
Management consoles:	
- Mgmt console - English laptop internal	1120
- Mgmt console - English laptop external	1130
External management console - line cords:	
- MC line cord standard rack	1170
- MC line cord group 1	1171
- MC line cord group 2	1172
Disk drive enclosures:	
- HD disk enclosure pair	1241
- HD STD enclosure indicator	1242
- 3.5" disk enclosure indicator	1244
- 400 GB SSD enclosure indicator	1245
Disk drive cables:	
- HD disk drive cable group 1	1246
I/O enclosure pair PCIe	1301
I/O cables:	
- PCIe cable group 1	1320
- PCIe cable group 2	1321
Top exit bracket:	
- Top exit bracket for Fibre cable	1400
Fibre Channel/FICON cables:	
- 50 um Fibre cable (LC)	1410
- 50 um Fibre cable (LC/SC)	1411
- 50 um Fibre cable (Jumper)	1412
- 9 um Fibre cable (LC)	1420
- 9 um Fibre cable (LC/SC)	1421
- 9 um Fibre cable (Jumper)	1422
DS8000 Licensed Machine Code:	
- DS8000 LMC R7.0	1731
Encryption support:	
- Encrypted drive set activation indicator	1750

- Encrypted drive deactivation indicator	1754
- TKLM isolated key server	1760
Earthquake kit	1906
Hardware installation MES	1999
Disk enclosure filler sets:	
- 3.5" disk enclosure filler set	2997
- Disk enclosure half filler set	2998
- Disk enclosure filler set	2999
Device adapters:	
- Device adapter pair I	3053
Host adapters:	
- 8 Gb 4 port SW FCP/FICON adapter PCIe	3153
- 8 Gb 8 port SW FCP/FICON adapter PCIe	3157
- 8 Gb 4 port LW FCP/FICON adapter PCIe	3253
- 8 Gb 8 port LW FCP/FICON adapter PCIe	3257
Processor memory:	
- 16 GB Processor memory (2-core BC only)	4311
- 32 GB Processor memory (2-core BC only)	4312
- 64 GB Processor memory (4-core only)	4313
- 128 GB Processor memory (8-core only)	4314
- 256 GB Processor memory (8-core only)	4315
- 512 GB Processor memory (16-core only)	4316
- 1 TB Processor memory (16-core only)	4317
Processor License feature indicators:	
- 2-core Processor indicator	4401
- 4-core Processor indicator	4402
- 8-core Processor indicator	4403
- 16-core Processor indicator	4404
Encryption disk drive sets:	
- 146 GB 15K FDE drive set	5108
- 300 GB 15K FDE drive set	5308
- 600 GB 10k FDE drive Set	5708
- 900 GB 10K FDE drive set	5758
- 3 TB 7.2K FDE half drive set	5858
Encryption Standby CoD disk drive sets:	
- 146 GB 15K FDE CoD drive set	5209
- 300 GB 15K FDE CoD drive set	5309
- 600 GB 10k FDE CoD drive Set	5709
- 900 GB 10K FDE CoD drive set	5759
- 3 TB 7.2K FDE CoD half drive set	5859
Encryption SSD half drive sets:	
- 400 GB SSD FDE half drive set	6156
Encryption SSD drive sets:	
- 400 GB SSD FDE drive set	6158
Function Authorization indicators:	
- OEL - inactive	7030
- OEL - 1 TB unit	7031
- OEL - 5 TB unit	7032
- OEL - 10 TB unit	7033
- OEL - 25 TB unit	7034
- OEL - 50 TB unit	7035
- OEL - 100 TB unit	7040
- OEL - 200 TB unit	7045
- OEL - Value Unit inactive	7050
- OEL - 1 Value Unit	7051
- OEL - 5 Value Unit	7052
- OEL - 10 Value Unit	7053
- OEL - 25 Value Unit	7054
- OEL - 50 Value Unit	7055
- OEL - 100 Value Unit	7060
- OEL - 200 Value Unit	7065

- Thin Provisioning indicator	7071
- DB protection indicator	7080
- Easy Tier indicator	7083
- FICON indicator	7091
- zHPF indicator	7092
- z/OS Distributed Data Backup indicator	7094
- PTC - inactive indicator	7250
- PTC - 1 TB indicator	7251
- PTC - 5 TB indicator	7252
- PTC - 10 TB indicator	7253
- PTC - 25 TB indicator	7254
- PTC - 50 TB indicator	7255
- PTC - 100 TB indicator	7260
- SE - inactive indicator	7350
- SE - 1 TB indicator	7351
- SE - 5 TB indicator	7352
- SE - 10 TB indicator	7353
- SE - 25 TB indicator	7354
- SE - 50 TB indicator	7355
- SE - 100 TB indicator	7360
- MGM - inactive indicator	7480
- MGM - 1 TB indicator	7481
- MGM - 5 TB indicator	7482
- MGM - 10 TB indicator	7483
- MGM - 25 TB indicator	7484
- MGM - 50 TB indicator	7485
- MGM - 100 TB indicator	7490
- MM - inactive indicator	7500
- MM - 1 TB indicator	7501
- MM - 5 TB indicator	7502
- MM - 10 TB indicator	7503
- MM - 25 TB indicator	7504
- MM - 50 TB indicator	7505
- MM - 100 TB indicator	7510
- GM - inactive indicator	7520
- GM - 1 TB indicator	7521
- GM - 5 TB indicator	7522
- GM - 10 TB indicator	7523
- GM - 25 TB indicator	7524
- GM - 50 TB indicator	7525
- GM - 100 TB indicator	7530
- RMZ - inactive indicator	7650
- RMZ - 1 TB indicator	7651
- RMZ - 5 TB indicator	7652
- RMZ - 10 TB indicator	7653
- RMZ - 25 TB indicator	7654
- RMZ - 50 TB indicator	7655
- RMZ - 100 TB indicator	7660
- RMZ resync - inactive indicator	7680
- RMZ resync - 1 TB indicator	7681
- RMZ resync - 5 TB indicator	7682
- RMZ resync - 10 TB indicator	7683
- RMZ resync - 25 TB indicator	7684
- RMZ resync - 50 TB indicator	7685
- RMZ resync - 100 TB indicator	7690
- PAV - inactive indicator	7820
- PAV - 1 TB indicator	7821
- PAV - 5 TB indicator	7822
- PAV - 10 TB indicator	7823
- PAV - 25 TB indicator	7824
- PAV - 50 TB indicator	7825
- PAV - 100 TB indicator	7830
- I/O Priority Manager - inactive	7840
- I/O Priority Manager - 1 TB indicator	7841
- I/O Priority Manager - 5 TB indicator	7842

- I/O Priority Manager - 10 TB indicator 7843
- I/O Priority Manager - 25 TB indicator 7844
- I/O Priority Manager - 50 TB indicator 7845
- I/O Priority Manager - 100 TB indicator 7850

- HyperPAV indicator 7899

- IGF transaction:
- IGF transaction indicator 7999

Description	Machine	Model	Feature
DS8870 Expansion Unit	2424	96E	
Model 9xE merge indicators:			
- 9xE factory merge			0001
- 9xE field merge			0002
DoD indicator			0020
JEMT indicator			0021
Shipping weight reduction			0200
Model 9xE position indicators:			
- 961 - 96E position 1			0361
- 961 - 96E position 2			0362
- 961 - 96E position 3			0363
Initial system capacity:			
- Up to 2.0 TB capacity			0800
- 2.1 to 5.0 TB capacity			0802
- 5.1 to 10.0 TB capacity			0805
- 10.1 to 25.0 TB capacity			0810
- 25.1 to 50.0 TB capacity			0815
- 50.1 to 75.0 TB capacity			0820
- 75.1 to 100.0 TB capacity			0825
- 100.1 to 150.0 TB capacity			0830
- 150.1 to 200.0 TB capacity			0835
- 200.1 to 250.0 TB capacity			0840
- 250.1 to 300.0 TB capacity			0845
- 300.1 to 350.0 TB capacity			0850
- 350.1 to 400.0 TB capacity			0855
- 400.1 to 450.0 TB capacity			0860
- 450.1 to 500.0 TB capacity			0865
- 500.1 to 550.0 TB capacity			0870
- 550.1 to 600.0 TB capacity			0871
- 600.1 to 700.0 TB capacity			0872
- 700.1 to 800.0 TB capacity			0873
- 800.1 to 900.0 TB capacity			0874
- 900.1 to 1000.0 TB capacity			0875
- 1000.1 to 1100.0 TB capacity			0876
- 1100.1 to 1200.0 TB capacity			0877
- 1200.1 to 1300.0 TB capacity			0878
- 1300.1 to 1400.0 TB capacity			0879
- 1400.1 to 1500.0 TB capacity			0880
- 1500.1 to 1600.0 TB capacity			0881
- 1600.1 to 1700.0 TB capacity			0882
- 1700.1 to 1800.0 TB capacity			0883
- 1800.1 to 1900.0 TB capacity			0884
- 1900.1 to 2000.0 TB capacity			0885
- 2000.1 to 2200.0 TB capacity			0886
- 2200.1 to 2400.0 TB capacity			0887
- 2400.1 to 2600.0 TB capacity			0888
- 2600.1 to 2800.0 TB capacity			0889
- 2800.1 to 3000.0 TB capacity			0890
Attachment indicators:			
- IBM/Openwave alliance indicator			0930
- IBM System i indicator			0931
- IBM System p indicator			0932
- IBM System x indicator			0933

- IBM System z indicator	0934
- IBM System z B/C indicator	0935
- Linux indicator	0940
- IBM System Storage ProtecTIER indicator	0960
- IBM Storwize V7000 indicator	0961
- IBM System Storage N series indicator	0962
- IBM System Storage SAN Volume Controller indicator	0963
- IBM/EPIC attachment indicator	0964
- VMware VAAI indicator	0965
Power:	
- Battery assembly	1051
- Extended PLD	1055
Single phase line cords:	
- SPP cord, 200-240V, 60A, 3-pin connector	1061
- SPP cord, 200-240V, 63A, no connector	1068
- Top exit SPP, 200-240V, 60A, 3-pin connector	1072
- Top exit SPP, 200-240V, 63A, no connector	1073
Three phase line cords:	
- Three phase wye, 380-440V, 32A, no connector	1081
- Three phase delta, 200-240V, 60A, 4-pin connector	1082
- Top exit three phase wye, 380-440V, 32A, no connector	1083
- Top exit three phase delta, 200-240V, 60A, 4-pin connector	1084
Disk drive enclosures:	
- HD disk enclosure pair	1241
- HD STD enclosure indicator	1242
- 3.5" disk enclosure indicator	1244
- 400 GB SSD enclosure indicator	1245
Disk drive cables:	
- HD disk drive cable group 2	1247
- HD disk drive cable group 4	1248
- HD disk drive cable group 5	1249
I/O enclosure pair PCIe	1301
I/O cables:	
- PCIe cable group 3	1322
Top exit bracket:	
- Top exit bracket for Fibre cable	1400
Fibre Channel/FICON cables:	
- 50 um Fibre cable (LC)	1410
- 50 um Fibre cable (LC/SC)	1411
- 50 um Fibre cable (Jumper)	1412
- 9 um Fibre cable (LC)	1420
- 9 um Fibre cable (LC/SC)	1421
- 9 um Fibre cable (Jumper)	1422
DS8000 Licensed Machine Code:	
- DS8000 LMC R7.0 indicator	1831
Earthquake kit	1906
Hardware installation MES	1999
Disk enclosure filler sets:	
- 3.5" disk enclosure filler set	2997
- Disk enclosure half filler set	2998
- Disk enclosure filler set	2999
Device adapters:	
- Device adapter pair I	3053
Host adapters:	
- 8 Gb 4 port SW FCP/FICON adapter PCIe	3153
- 8 Gb 8 port SW FCP/FICON adapter PCIe	3157
- 8 Gb 4 port LW FCP/FICON adapter PCIe	3253
- 8 Gb 8 port LW FCP/FICON adapter PCIe	3257

Encryption disk drive sets:		
- 146 GB 15K FDE drive set		5108
- 300 GB 15K FDE drive set		5308
- 600 GB 10k FDE drive Set		5708
- 900 GB 10K FDE drive set		5758
- 3 TB 7.2K FDE half drive set		5858
Encryption Standby CoD disk drive sets:		
- 146 GB 15K FDE CoD drive set		5209
- 300 GB 15K FDE CoD drive set		5309
- 600 GB 10k FDE CoD drive Set		5709
- 900 GB 10K FDE CoD drive set		5759
- 3 TB 7.2K FDE CoD half drive set		5859
Encryption SSD half drive sets:		
- 400 GB SSD FDE half drive set		6156
Encryption SSD drive sets:		
- 400 GB SSD FDE drive set		6158

Feature conversions (Machine type 2424 Model 961)

I/O cables:

Feature From	To	Returned parts*	Description
1320	1321	Yes	I/O cable conversion

Host adapters:

Feature from	To	Returned parts*	Description
3153	3157	Yes	Host adapter conversion
3153	3253	Yes	Host adapter conversion
3153	3257	Yes	Host adapter conversion
3157	3153	Yes	Host adapter conversion
3157	3253	Yes	Host adapter conversion
3157	3257	Yes	Host adapter conversion
3253	3153	Yes	Host adapter conversion
3253	3157	Yes	Host adapter conversion
3253	3257	Yes	Host adapter conversion
3257	3153	Yes	Host adapter conversion
3257	3157	Yes	Host adapter conversion
3257	3253	Yes	Host adapter conversion

Processor memory:

Feature from	To	Returned parts*	Description
4311	4312	No	Processor memory conversion
4311	4313	No	Processor memory conversion
4311	4314	No	Processor memory conversion
4311	4315	No	Processor memory conversion
4311	4316	Yes	Processor memory conversion
4311	4317	Yes	Processor memory conversion
4312	4313	No	Processor memory conversion
4312	4314	No	Processor memory conversion
4312	4315	No	Processor memory conversion
4312	4316	Yes	Processor memory conversion
4312	4317	Yes	Processor memory conversion
4313	4314	No	Processor memory conversion
4313	4315	No	Processor memory conversion
4313	4316	Yes	Processor memory conversion
4313	4317	Yes	Processor memory conversion

4314	4315	No	Processor memory conversion
4314	4316	Yes	Processor memory conversion
4314	4317	Yes	Processor memory conversion
4315	4316	Yes	Processor memory conversion
4315	4317	Yes	Processor memory conversion
4316	4317	Yes	Processor memory conversion

Processor License feature indicators:

Feature from	To	Returned parts*	Description
4401	4402	No	Processor License feature conversion
4401	4403	No	Processor License feature conversion
4401	4404	No	Processor License feature conversion
4402	4403	No	Processor License feature conversion
4402	4404	No	Processor License feature conversion
4403	4404	No	Processor License feature conversion

Encryption disk drive sets:

Feature from	To	Returned parts*	Description
5108	5308	Yes	Encryption disk drive set conversion
5108	5708	Yes	Encryption disk drive set conversion
5108	5758	Yes	Encryption disk drive set conversion
5308	5708	Yes	Encryption disk drive set conversion
5308	5758	Yes	Encryption disk drive set conversion
5708	5758	Yes	Encryption disk drive set conversion

Encryption Standby CoD disk drive sets:

Feature from	To	Returned parts*	Description
5209	5108	No	Encryption CoD disk drive conversion
5309	5308	No	Encryption CoD disk drive conversion
5709	5708	No	Encryption CoD disk drive conversion
5759	5758	No	Encryption CoD disk drive conversion
5859	5858	No	Encryption CoD disk drive conversion

Encryption SSD drive sets:

Feature from	To	Returned parts*	Description
6156	6158	No	Encryption SSD drive conversion

Feature conversions (Machine type 2424 Model 96E)

Host adapters:

Feature from	To	Returned parts*	Description
3153	3157	Yes	Host adapter conversion
3153	3253	Yes	Host adapter conversion
3153	3257	Yes	Host adapter conversion
3157	3153	Yes	Host adapter conversion

3157	3253	Yes	Host adapter conversion
3157	3257	Yes	Host adapter conversion
3253	3153	Yes	Host adapter conversion
3253	3157	Yes	Host adapter conversion
3253	3257	Yes	Host adapter conversion
3257	3153	Yes	Host adapter conversion
3257	3157	Yes	Host adapter conversion
3257	3253	Yes	Host adapter conversion

Encryption disk drive sets:

Feature from	To	Returned parts*	Description
5108	5308	Yes	Encryption disk drive set conversion
5108	5708	Yes	Encryption disk drive set conversion
5108	5758	Yes	Encryption disk drive set conversion
5308	5708	Yes	Encryption disk drive set conversion
5308	5758	Yes	Encryption disk drive set conversion
5708	5758	Yes	Encryption disk drive set conversion

Encryption Standby CoD disk drive sets:

Feature from	To	Returned parts*	Description
5209	5108	No	Encryption CoD disk drive conversion
5309	5308	No	Encryption CoD disk drive conversion
5709	5708	No	Encryption CoD disk drive conversion
5759	5758	No	Encryption CoD disk drive conversion
5859	5858	No	Encryption CoD disk drive conversion

Encryption SSD drive sets:

Feature from	To	Returned parts*	Description
6156	6158	No	Encryption SSD drive conversion

* Parts removed or replaced become the property of IBM and must be returned.

Business Partner information

If you are a Direct Reseller - System Reseller acquiring products from IBM , you may link directly to Business Partner information for this announcement. A PartnerWorld® ID and password are required (use IBM ID).

<https://www.ibm.com/partnerworld/mem/sla.jsp?num=112-172>

Publications

The following publication has been updated to reflect this announcement and will be available by October 19, 2012.

Title	Order number
IBM System Storage DS8870 Introduction and Planning Guide	GC27-4209

The following publications are shipped with the DS8000 series:

Title	Order number
IBM System Storage DS8000 Series Documentation CDROM	98Y3874
IBM System Storage DS8000 Series License Documentation CDROM	98Y3853

The publications CD contains the following documents:

Title	Order number
IBM System Storage DS8870 Introduction and Planning Guide	GC27-4209
IBM System Storage DS8000 Host Systems Attachment Guide	GC27-4210
IBM System Storage DS Command-Line Interface User's Guide	GC53-4212
IBM System Storage DS Open Application Programming Interface Reference	GC35-0516
IBM System Storage Notice Regarding Storage Encryption	45W6389
READ ME FIRST for IBM System Storage Products	GA32-1061
IBM System Storage Multipath Subsystem Device Driver User's Guide	GC52-1309

The following documents are on the publications CD:

- IBM Warranty Information, GC26-7919
- IBM System Storage DS8000 series Non-IBM Licenses and Notices-Rel 5.x-6.0, 6.1, 6.2, 6.3, 7.0
- IBM System Storage DS8000 Licensed Machine Code Agreement, SC28-6872-02 (P/N 88Y7960)

The license CD contains the following documentation:

- IBM System Storage DS Storage Manager Version 7 Release 0 and IBM CIM Agent for DS Open Application Programming Interface 5.7.0, GC27-3907-04
- IBM International License Agreement for Non-Warranted Programs (ILAN), P/N 98Y2827
- Global Mirroring Utilities for ICKDSF Users and Open Systems Environments License Information, GC26-7644-03

DS8000 publications are available at

<http://www.ibm.com/shop/publications/order/>

The DS8000 information center is designed to provide comprehensive, browser-based information. It can help provide easy access to tasks, concepts, reference information, tutorials, code samples, scenarios, and other product information. It contains assistance for the tasks that users must perform and links to additional information. To find information, users can search, browse the contents, use the index, follow links from one topic to related topics, and print the topics they want to read offline.

The information center is available at

<http://www.ibm.com/support/publications/us/library/>

The IBM System Storage DS8000 Information Center allows you to browse and search documentation for the DS8000 series.

The IBM System Storage DS8000 Information Center is at

<http://publib.boulder.ibm.com/infocenter/dsichelp/ds8000ic/index.jsp>

Services

Global Technology Services

IBM services include business consulting, outsourcing, hosting services, applications, and other technology management.

These services help you learn about, plan, install, manage, or optimize your IT infrastructure to be an On Demand Business. They can help you integrate your high-speed networks, storage systems, application servers, wireless protocols, and an array of platforms, middleware, and communications software for IBM and many non-IBM offerings. IBM is your one-stop shop for IT support needs.

For details on available services, contact your IBM representative or visit

<http://www.ibm.com/services/>

For details on available IBM Business Continuity and Recovery Services, contact your IBM representative or visit

<http://www.ibm.com/services/continuity>

For details on education offerings related to specific products, visit

<http://www.ibm.com/services/learning/index.html>

Select your country, and then select the product as the category.

Technical information

Specified operating environment

Physical specifications

- Width: 848 mm (33.4 in)
- Depth: 1,227 mm (48.3 in)
- Height: 1,934 mm (76 in)
- Weight: 1,216 kg (2,675 lb)

Operating environment

- Temperature: 16° to 32.0° C (60° to 90° F)
- Relative humidity: 20% to 80%
- Wet bulb (caloric value):
 - 20,500 BTU for A rack
 - 19,200 BTU for B rack
 - 19,800 BTU for C rack
- Electrical power:
 - 6.0 KW for A rack
 - 5.6 KW for B rack
 - 5.8 KW for C rack

- Capacity of exhaust:
 - 32.5 cubic meter/minute for 961
 - 35.4 cubic meter/minute for 96E
- Noise level: 60 dB
- Leakage and starting current: 60mA/<100 ampere

Model 961 (2-core):

- Maximum physical storage capacity: 216 TB
- Power consumption: 4.1 KW

Model 961 (4, 8, 16-core):

- Maximum physical storage capacity: 360 TB
- Power consumption: 6.0 KW

Model 96E with 336 drives:

- Maximum physical storage capacity: 302 TB
- Power consumption: 5.6 KW

Model 96E with 480 drives:

- Maximum physical storage capacity: 432 TB
- Power consumption: 5.8 KW

Limitations

Conversions between warranty machine types are not supported.

Management limitations

- For the Dynamic Volume Expansion function, volumes that are expanded may not be in Copy Services relationships (Point-in-Time Copy, FlashCopy SE, Metro Mirror, Global Mirror, Metro/Global Mirror, and z/OS Global Mirror) while expansion is taking place.
- The size limit for single volumes in a Copy Services relationship is 2 TB. This limit does not apply to extents (when part of multiple volumes).
- For VMware VAAI support, the following functions will not be available:
 - Write same or bulk zero
 - Thin Provisioning in ESXi 5.x
 - Block Delete in ESXi 5.x

Disruptive activities

- Removal of an expansion unit model from the base unit model. Data will not be preserved during this activity.

The deactivation of an activated licensed function, or a lateral change or reduction in the license scope, is a nondisruptive activity which will occur at the next machine IML.

- A lateral change is defined as changing the license scope from FB to CKD or from CKD to FB.
- A reduction is defined as changing the license scope from ALL to FB or from ALL to CKD.
- The amount of physical capacity within a 2424 system that can be logically configured for use will be enforced by the 2424 Licensed Machine Code to maintain compliance with the extent of IBM authorization established for licensed functions activated on the machine.

SSD limitations

SSD drive sets are not supported in RAID-6 or RAID-10 configurations. Intermixing of drives within the disk enclosure is not supported on the entire system.

Thin provisioning limitations

No thin provisioning support on System z/OS volumes series.

Model conversion/upgrade limitations

- No brand model conversion from 951/95E to 961/96E
- Business class configuration reduces the total number of drives per system to 144. This restriction can be removed by concurrently upgrading to other processor/memory combinations.

Planning information

Customer responsibilities

Physical configuration planning

Physical configuration planning is a customer responsibility. A marketing specialist can help plan and select the DS8000 series physical configuration and features. Introductory information, including required and optional features, can be found in the *IBM System Storage DS8870 Introduction and Planning Guide (GC27-4209)*.

Capacity and performance planning assistance is also available. Through the use of Disk Magic, a disk marketing specialist can help plan and anticipate performance characteristics for specific workloads by modeling proposed configurations.

Installation planning

Installation planning is a customer responsibility. Information about planning the installation of a DS8000 series, including equipment, site, and power requirements, can be found in the *IBM System Storage DS8870 Introduction and Planning Guide (GC27-4209)*.

Logical configuration planning and application

Logical configuration planning is a customer responsibility. Logical configuration refers to the creation of RAID ranks, volumes, and LUNs, and the assignment of the configured capacity to servers.

Application of the initial logical configuration and all subsequent modifications to the logical configuration is a customer responsibility. The logical configuration can be created, applied, and modified using the DS Storage Manager, DS CLI, or DS Open API.

IBM Global Services (IGS) will also apply or modify the logical configuration (fee-based services).

Licensed Machine Code planning and application

IBM may release changes to the DS8000 series Licensed Machine Code. IBM plans to make most DS8000 series Licensed Machine Code changes available for download by the DS8000 series system from the IBM System Storage technical support website. Not all Licensed Machine Code changes may be available via the support website. If the machine does not function as warranted and a problem can be resolved through the application of downloadable Licensed Machine Code, the customer is responsible for downloading and installing these designated Licensed Machine Code changes as IBM specifies. IBM has responsibility for installing changes that IBM does not make available for you to download. The DS8000 series includes many enhancements to make the Licensed Machine Code change process simpler, quicker, and more

automated. A request can be made for IBM to install downloadable Licensed Machine Code changes, however there may be a charge for that service.

Calculating physical and effective capacity

Refer to the *IBM System Storage DS8870 Introduction and Planning Guide* (GC27-4209) for capacity calculation guidelines.

Encryption planning

Encryption planning is a customer responsibility. here are three major planning components to the implementation of an encryption environment. Review all planning requirements and include them in the installation considerations.

- Key server planning
- Tivoli Key Lifecycle Manager (TKLM) planning
- Full Disk Encryption Activation review planning

Key server planning

Key server planning is a customer responsibility. Introductory information, including required and optional features, can be found in the *IBM System Storage DS8870 Introduction and Planning Guide* (GC27-4209).

DS8870 requires at least two key servers and associated software for each site which has one or more encryption-enabled DS8000 systems, according to the encryption best practices. One server must be isolated and the others can be of any supported key server configuration. Any site that operates independently of other sites must have key servers for the encryption enabled DS8000 systems at that site.

- DS8000 Encryption environments are recommended to configure external Laptop HMC for high availability (feature number 1130).
- It is the customer's responsibility to replicate any key labels and their associated key material across all key servers attached to a given encryption-enabled DS8000 before configuring that key label on the DS8000 .

Dual platform key server planning

DS8000 supports the ability to configure two independent key labels for each encryption-enabled DS8000 . This capability allows the use of two independent key server platforms when one or both key server platforms are using secure-key mode key stores, allowing the isolated key server platform to be used in conjunction with a second key server platform that is operating with a secure-key mode key store.

For customers needing dual platform key server support on DS8000 , the installation of TKLM IFIX 2 (TKLM Version 1.0.0.2, or later) is recommended to support displaying both key labels in the GUI. Additionally, for customers who intend to replicate keys between separate z Series Sysplexes using ICSF with the JCECCARACFKS key store in secure key mode and with the secure key configuration flag set in TKLM, TKLM Fix Pack 3 (TKLM Version 1.0.0.3, or later) is required.

Tivoli Key Lifecycle Manager planning

The DS8000 series supports IBM Tivoli Key Lifecycle Manager V1.0. V2.0, and IBM Security Key Lifecycle Manager V1.1.

Program number	VRM	Program name
5724-T60	1.0.0 2.0.0	IBM Tivoli Key Lifecycle Manager
5608-A91	1.0.0	IBM Tivoli Key Lifecycle Manager (distributed for non-Passport Advantage) IBM Tivoli Key Lifecycle Manager for z/OS V1.0

Program number	VRM	Program name
5698-B35	1.0.0	IBM Security Key Lifecycle Manager for z/OS
5698-B42	1.1.0	IBM Security Key Lifecycle Manager for Storage

Isolated key server ordering options:

- **TKLM isolated key server - feature number 1760**

Isolated key servers ordered with feature number 1760 will have a Linux operating system and TKLM software preinstalled.

- **Customer acquired Isolated Key Server**

Refer to the *IBM Tivoli Key Lifecycle Manager Installation and Configuration Guide (SC27-2741)* for hardware and operating system requirements.

Note: Regardless of the ordering method, customers will need to acquire a TKLM license for use of the TKLM software ordered separately from the stand-alone server hardware.

Note: The licensing for TKLM includes both an install license for the TKLM management software as well as licensing for the encrypting drives.

Refer to the following publications:

- *IBM Tivoli Key Lifecycle Manager Quick Start Guide (GI11-8738)*
- *IBM Tivoli Key Lifecycle Manager Installation and Configuration Guide (SC27-2741)*
- *IBM Tivoli Key Lifecycle Manager Program Directory (for z/OS) (GI11-4300)*

Full Disk Encryption Activation review planning

Full Disk Encryption Activation is a customer responsibility. IBM Full Disk Encryption offerings must be activated prior to use. This activation is part of the installation and configuration steps required for use of the technology. This installation and activation review is performed by the IBM Systems and Technology Lab Services group.

Send email to

storsvcs@us.ibm.com

Visit the website below and click on "Contact now" to submit your inquiry or request.

http://www-03.ibm.com/systems/services/labservices/platforms/labservices_storage.html

You are responsible for downloading or obtaining from IBM , and installing designated Machine Code (microcode, basic input/output system code (called BIOS), utility programs, device drivers, and diagnostics delivered with an IBM machine) and other software updates in a timely manner from an IBM Internet website or from other electronic media, and following the instructions that IBM provides. You may request IBM to install Machine Code changes; however, you may be charged for that service.

Cable orders

Cables are required to connect DS8000 series 8 Gb FCP/FICON host adapter ports to server or fabric ports.

Cables can be purchased using DS8000 series feature numbers. Additional cable options, along with product support services such as installation, are offered by IBM Global Services' Networking Services.

Fibre Channel/FICON (shortwave)

Shortwave Fibre Channel and FICON ports on the DS8000 series require a 50 micron (multimode) Fibre optic cable terminated with a LC connector. Fibre Channel cables can be purchased using feature numbers 141x for 50 micron cables.

Fibre Channel/FICON (longwave)

Longwave Fibre Channel and FICON ports on the DS8000 series require either a 9 micron (singlemode) or 50 micron (multimode) Fibre optic cable terminated with either a LC or SC connector. A 50 micron cable is required when the longwave port is operating at a 4 Gb per second transfer rate. Fibre Channel cables can be purchased using feature numbers 141x for 50 micron cables and feature numbers 142x for 9 micron cables.

Security, auditability, and control

This product uses the security and auditability features of the host hardware, host software, and/or application software to which it is attached.

The customer is responsible for evaluation, selection, and implementation of security features, administrative procedures, and appropriate controls in application systems and communications facilities.

IBM Electronic Services

IBM has transformed its delivery of hardware and software support services to help you achieve higher system availability. Electronic Services is a web-enabled solution that offers an exclusive, no-additional-charge enhancement to the service and support available for IBM servers. These services are designed to provide the opportunity for greater system availability with faster problem resolution and preemptive monitoring. Electronic Services comprises two separate, but complementary, elements: Electronic Services news page and Electronic Services Agent.

The Electronic Services news page is a single Internet entry point that replaces the multiple entry points traditionally used to access IBM Internet services and support. The news page enables you to gain easier access to IBM resources for assistance in resolving technical problems.

The Electronic Service Agent™ is no-additional-charge software that resides on your server. It monitors events and transmits system inventory information to IBM on a periodic, client-defined timetable. The Electronic Service Agent automatically reports hardware problems to IBM. Early knowledge about potential problems enables IBM to deliver proactive service that may result in higher system availability and performance. In addition, information collected through the Service Agent is made available to IBM service support representatives when they help answer your questions or diagnose problems. Installation and use of IBM Electronic Service Agent for problem reporting enables IBM to provide better support and service for your IBM server.

To learn how Electronic Services can work for you, visit

<http://www.ibm.com/support/electronic>

Terms and conditions

Volume orders: Contact your IBM representative.

IBM Global Financing

Yes

Warranty period

Four years

An IBM part or feature installed during the initial installation of an IBM machine is subject to a full warranty effective on the date of installation of the machine. An IBM part or feature that replaces a previously installed part or feature assumes the remainder of the warranty period for the replaced part or feature. An IBM part or feature added to a machine without replacing a previously installed part or feature is subject to a full warranty effective on its date of installation. Unless specified otherwise, the warranty period, type of warranty service, and service level of a part or feature are the same as those for the machine in which it is installed.

Warranty service

On-site 24x7 Same Day (SD)

If required, IBM provides repair or exchange service depending on the types of warranty service specified for the machine. IBM will attempt to resolve your problem over the telephone, or electronically via an IBM website. Certain machines contain remote support capabilities for direct problem reporting, remote problem determination, and resolution with IBM. You must follow the problem determination and resolution procedures that IBM specifies. Following problem determination, if IBM determines on-site service is required, scheduling of service will depend upon the time of your call, machine technology and redundancy, and availability of parts.

Service levels are response-time objectives and are not guaranteed. The specified level of warranty service may not be available in all worldwide locations. Additional charges may apply outside IBM's normal service area. Contact your local IBM representative or your reseller for country-specific and location-specific information.

On-site Service

IBM will repair the failing machine at your location and verify its operation. You must provide a suitable working area to allow disassembly and reassembly of the IBM machine. The area must be clean, well lit, and suitable for the purpose.

Service level is:

- 24 hours per day, 7 days a week, 4 hour average, same day response.

Warranty service upgrades

Usage plan machine

No

IBM hourly service rate classification

Three

When a type of service involves the exchange of a machine part, the replacement may not be new, but will be in good working order.

Field-installable features

Yes

Model conversions

No

Machine installation

Installation is performed by IBM . IBM will install the machine in accordance with the IBM installation procedures for the machine. In the United States, contact IBM at 1-800-IBM-SERV (426-7378). In other countries contact the local IBM office.

The following activities are a customer responsibility:

- Installation planning
- Retrieval and installation of feature activation codes
- Logical configuration planning and application

Refer to the [Customer responsibilities](#) section for more information.

Customer requests for installation of items not covered in the installation guide may be performed at IBM's hourly service rate designated for the machine.

Graduated program license charges apply

No

Licensed machine code

IBM Machine Code is licensed for use by a customer on the IBM machine for which it was provided by IBM under the terms and conditions of the IBM License Agreement for Machine Code, to enable the machine to function in accordance with its specifications, and only for the capacity authorized by IBM and acquired by the customer. You can obtain the agreement at

http://www.ibm.com/servers/eserver/support/machine_warranties/machine_code.html

IBM may release changes to the Machine Code. IBM plans to make the Machine Code changes available for download from the IBM System Storage technical support website

http://www-01.ibm.com/support/docview.wss?rs=1114&context=HW2C2&dc=500&q1=ssg1*&uid=ssg1S1002949&loc=en_US&cs=utf-8&lang=en

You may also obtain updated code by contacting your IBM representative.

If the machine does not function as warranted and your problem can be resolved through your application of downloadable Machine Code, you are responsible for downloading and installing these designated Machine Code changes as IBM specifies. If you would prefer, you may request IBM to install downloadable Machine Code changes; however, you may be charged for that service.

Educational allowance

A reduced charge is available to qualified education customers. The educational allowance may not be added to any other discount or allowance.

The educational allowance is 15% for the products in this announcement.

Pricing

Product charges

Description	Machine type	Model	Feature number
System Storage DS8870	2424	961	
Model 9xE merge indicators:			

- 9xE factory merge	0001
DoD indicator	0020
JEMT indicator	0021
Generic cover and packaging - for OEM only	0168
Shipping weight reduction	0200
Model 9xE position indicator:	
- 961 - 96E position 1	0361
- 961 - 96E position 2	0362
- 961 - 96E position 3	0363
Licensed Function indicators:	
- OEL indicator	0700
- FICON attach indicator	0703
- Thin Provisioning indicator	0707
- DB protection indicator	0708
- High Performance FICON indicator	0709
- Easy Tier indicator	0713
- z/OS Distributed Data Backup indicator	0714
- PTC indicator	0720
- SE indicator	0730
- MGM indicator	0742
- MM indicator	0744
- GM indicator	0746
- RMZ indicator	0760
- RMZ resync indicator	0763
- PAV indicator	0780
- HyperPAV indicator	0782
- I/O Priority Manager indicator	0784
Initial system capacity:	
- Up to 2.0 TB capacity	0800
- 2.1 to 5.0 TB capacity	0802
- 5.1 to 10.0 TB capacity	0805
- 10.1 to 25.0 TB capacity	0810
- 25.1 to 50.0 TB capacity	0815
- 50.1 to 75.0 TB capacity	0820
- 75.1 to 100.0 TB capacity	0825
- 100.1 to 150.0 TB capacity	0830
- 150.1 to 200.0 TB capacity	0835
- 200.1 to 250.0 TB capacity	0840
- 250.1 to 300.0 TB capacity	0845
- 300.0 to 350.0 TB capacity	0850
- 350.1 to 400.0 TB capacity	0855
- 400.1 to 450.0 TB capacity	0860
- 450.1 to 500.0 TB capacity	0865
- 500.1 to 550.0 TB capacity	0870
- 550.1 to 600.0 TB capacity	0871
- 600.1 to 700.0 TB capacity	0872
- 700.1 to 800.0 TB capacity	0873
- 800.1 to 900.0 TB capacity	0874
- 900.1 to 1000.0 TB capacity	0875
- 1000.1 to 1100.0 TB capacity	0876
- 1100.1 to 1200.0 TB capacity	0877
- 1200.1 to 1300.0 TB capacity	0878
- 1300.1 to 1400.0 TB capacity	0879
- 1400.1 to 1500.0 TB capacity	0880
- 1500.1 to 1600.0 TB capacity	0881
- 1600.1 to 1700.0 TB capacity	0882
- 1700.1 to 1800.0 TB capacity	0883
- 1800.1 to 1900.0 TB capacity	0884
- 1900.1 to 2000.0 TB capacity	0885
- 2000.1 to 2200.0 TB capacity	0886
- 2200.1 to 2400.0 TB capacity	0887
- 2400.1 to 2600.0 TB capacity	0888
- 2600.1 to 2800.0 TB capacity	0889
- 2800.1 to 3000.0 TB capacity	0890
Standby CoD indicators:	
- Non-Standby CoD	0900

- Standby CoD indicator	0901
- Standby CoD indicator	0902
- Standby CoD indicator	0903
- Standby CoD indicator	0904
Attachment indicators:	
- IBM/Openwave Alliance indicator	0930
- IBM System i indicator	0931
- IBM System p indicator	0932
- IBM System x indicator	0933
- IBM System z indicator	0934
- IBM System z B/C indicator	0935
- Linux indicator	0940
- Global Mirror indicator	0950
- IBM System Storage ProtecTIER indicator	0960
- IBM Storwize V7000 indicator	0961
- IBM System Storage N series indicator	0962
- IBM System Storage SAN Volume Controller indicator	0963
- IBM/EPIC attachment indicator	0964
- VMware VAAI indicator	0965
Power:	
- Remote power control	1000
- Battery assembly	1051
- Extended PLD	1055
Single phase line cords:	
- SPP cord, 200-240V, 60A, 3-pin connector	1061
- SPP cord, 200-240V, 63A, no connector	1068
- Top exit SPP, 200-240V, 60A, 3-pin connector	1072
- Top exit SPP, 200-240V, 63A, no connector	1073
Three phase line cords:	
- Three phase wye, 380-440V, 32A, no connector	1081
- Three phase delta, 200-240V, 60A, 4-pin connector	1082
- Top exit three phase wye, 380-440V, 32A, no connector	1083
- Top exit three phase delta, 200-240V, 60A, 4-pin connector	1084
Special tool:	
- Universal ladder	1101
Management console:	
- Mgmt console - English laptop internal	1120
- Mgmt console - English laptop external	1130
External management console - line cords:	
- MC line cord standard rack	1170
- MC line cord group 1	1171
- MC line cord group 2	1172
Disk drive enclosures:	
- HD disk enclosure pair	1241
- HD STD enclosure indicator	1242
- 3.5" disk enclosure indicator	1244
- 400 GB SSD enclosure indicator	1245
Disk drive cables:	
- HD disk drive cable group 1	1246
I/O enclosure pair PCIe	1301
I/O cables:	
- PCIe cable group 1	1320
- PCIe cable group 2	1321
Top exit bracket:	
- Top exit bracket for Fibre cable	1400
Fibre Channel/FICON cables:	
- 50 um Fibre cable (LC)	1410

- 50 um Fibre cable (LC/SC)	1411
- 50 um Fibre cable (jumper)	1412
- 9 um Fibre cable (LC)	1420
- 9 um Fibre cable (LC/SC)	1421
- 9 um Fibre cable (jumper)	1422
DS8000 Licensed Machine Code:	
- DS8000 LMC R7.0	1731
Encryption support:	
- Encrypted drive set activation indicator	1750
- Encrypted drive deactivation indicator	1754
- TKLM isolated key server	1760
Earthquake kit	1906
Hardware installation MES	1999
Disk enclosure filler sets:	
- 3.5" disk enclosure filler set	2997
- Disk enclosure half filler set	2998
- Disk enclosure filler set	2999
Device adapter:	
- Device adapter pair I	3053
Host adapters:	
- 8 Gb 4 port SW FCP/FICON adapter PCIe	3153
- 8 Gb 8 port SW FCP/FICON adapter PCIe	3157
- 8 Gb 4 port LW FCP/FICON adapter PCIe	3253
- 8 Gb 8 port LW FCP/FICON adapter PCIe	3257
Processor memory:	
- 16 GB Processor memory (2-core BC only)	4311
- 32 GB Processor memory (2-core BC only)	4312
- 64 GB Processor memory (4-core only)	4313
- 128 GB Processor memory (8-core only)	4314
- 256 GB Processor memory (8-core only)	4315
- 512 GB Processor memory (16-core only)	4316
- 1 TB Processor memory (16-core only)	4317
Processor License feature indicators:	
- 2-core Processor indicator	4401
- 4-core Processor indicator	4402
- 8-core Processor indicator	4403
- 16-core Processor indicator	4404
Encryption disk drive sets:	
- 146 GB 15k FDE drive set	5108
- 300 GB 15k FDE drive set	5308
- 600 GB 10k FDE drive set	5708
- 900 GB 10k FDE drive set	5758
- 3 TB 7.2k FDE half drive set	5858
Encryption Standby CoD disk drive sets:	
- 146 GB 15k FDE CoD drive set	5209
- 300 GB 15K FDE CoD drive set	5309
- 600 GB 10k FDE CoD drive set	5709
- 900 GB 10k FDE CoD drive set	5759
- 3 TB 7.2k FDE CoD half drive set	5859
Encryption SSD half drive sets:	
- 400 GB SSD FDE half drive set	6156
Encryption SSD drive sets:	
- 400 GB SSD FDE drive set	6158
Function Authorization indicators:	
- OEL - inactive	7030
- OEL - 1 TB unit	7031
- OEL - 5 TB unit	7032
- OEL - 10 TB unit	7033
- OEL - 25 TB unit	7034
- OEL - 50 TB unit	7035

- OEL - 100 TB unit	7040
- OEL - 200 TB unit	7045
- OEL - Value Unit inactive	7050
- OEL - 1 Value Unit	7051
- OEL - 5 value Unit	7052
- OEL - 10 Value Unit	7053
- OEL - 25 Value Unit	7054
- OEL - 50 Value Unit	7055
- OEL - 100 Value Unit	7060
- OEL - 200 Value Unit	7065
- Thin Provisioning indicator	7071
- DB protection indicator	7080
- Easy Tier indicator	7083
- FICON indicator	7091
- zHPF indicator	7092
- z/OS Distributed Data Backup indicator	7094
- PTC - inactive indicator	7250
- PTC - 1 TB indicator	7251
- PTC - 5 TB indicator	7252
- PTC - 10 TB indicator	7253
- PTC - 25 TB indicator	7254
- PTC - 50 TB indicator	7255
- PTC - 100 TB indicator	7260
- SE - inactive indicator	7350
- SE - 1 TB indicator	7351
- SE - 5 TB indicator	7352
- SE - 10 TB indicator	7353
- SE - 25 TB indicator	7354
- SE - 50 TB indicator	7355
- SE - 100 TB indicator	7360
- MGM - inactive indicator	7480
- MGM - 1 TB indicator	7481
- MGM - 5 TB indicator	7482
- MGM - 10 TB indicator	7483
- MGM - 25 TB indicator	7484
- MGM - 50 TB indicator	7485
- MGM - 100 TB indicator	7490
- MM - inactive indicator	7500
- MM - 1 TB indicator	7501
- MM - 5 TB indicator	7502
- MM - 10 TB indicator	7503
- MM - 25 TB indicator	7504
- MM - 50 TB indicator	7505
- MM - 100 TB indicator	7510
- GM - inactive indicator	7520
- GM - 1 TB indicator	7521
- GM - 5 TB indicator	7522
- GM - 10 TB indicator	7523
- GM - 25 TB indicator	7524
- GM - 50 TB indicator	7525
- GM - 100 TB indicator	7530
- RMZ - inactive indicator	7650
- RMZ - 1 TB indicator	7651
- RMZ - 5 TB indicator	7652
- RMZ - 10 TB indicator	7653
- RMZ - 25 TB indicator	7654
- RMZ - 50 TB indicator	7655
- RMZ - 100 TB indicator	7660
- RMZ resync - inactive indicator	7680
- RMZ resync - 1 TB indicator	7681
- RMZ resync - 5 TB indicator	7682
- RMZ resync - 10 TB indicator	7683
- RMZ resync - 25 TB indicator	7684
- RMZ resync - 50 TB indicator	7685
- RMZ resync - 100 TB indicator	7690

- PAV - inactive indicator 7820
- PAV - 1 TB indicator 7821
- PAV - 5 TB indicator 7822
- PAV - 10 TB indicator 7823
- PAV - 25 TB indicator 7824
- PAV - 50 TB indicator 7825
- PAV - 100 TB indicator 7830

- I/O Priority Manager - inactive 7840
- I/O Priority Manager - 1 TB indicator 7841
- I/O Priority Manager - 5 TB indicator 7842
- I/O Priority Manager - 10 TB indicator 7843
- I/O Priority Manager - 25 TB indicator 7844
- I/O Priority Manager - 50 TB indicator 7845
- I/O Priority Manager - 100 TB indicator 7850

- HyperPAV indicator 7899

IGF transaction:

- IGF transaction indicator 7999

System Storage DS8870 2424 96E
Expansion Unit

Model 9xE merge indicators:

- 9xE factory merge 0001
- 9xE field merge 0002

DoD indicator 0020

JEMT indicator 0021

Shipping weight reduction 0200

Model 9xE position indicators:

- 961 - 96E position 1 0361
- 961 - 96E position 2 0362
- 961 - 96E position 3 0363

Initial system capacity:

- Up to 2.0 TB capacity 0800
- 2.1 to 5.0 TB capacity 0802
- 5.1 to 10.0 TB capacity 0805
- 10.1 to 25.0 TB capacity 0810
- 25.1 to 50.0 TB capacity 0815
- 50.1 to 75.0 TB capacity 0820
- 75.1 to 100.0 TB capacity 0825
- 100.1 to 150.0 TB capacity 0830
- 150.1 to 200.0 TB capacity 0835
- 200.1 to 250.0 TB capacity 0840
- 250.1 to 300.0 TB capacity 0845
- 300.0 to 350.0 TB capacity 0850
- 350.1 to 400.0 TB capacity 0855
- 400.1 to 450.0 TB capacity 0860
- 450.1 to 500.0 TB capacity 0865
- 500.1 to 550.0 TB capacity 0870
- 550.1 to 600.0 TB capacity 0871
- 600.1 to 700.0 TB capacity 0872
- 700.1 to 800.0 TB capacity 0873
- 800.1 to 900.0 TB capacity 0874
- 900.1 to 1000.0 TB capacity 0875
- 1000.1 to 1100.0 TB capacity 0876
- 1100.1 to 1200.0 TB capacity 0877
- 1200.1 to 1300.0 TB capacity 0878
- 1300.1 to 1400.0 TB capacity 0879
- 1400.1 to 1500.0 TB capacity 0880
- 1500.1 to 1600.0 TB capacity 0881
- 1600.1 to 1700.0 TB capacity 0882
- 1700.1 to 1800.0 TB capacity 0883
- 1800.1 to 1900.0 TB capacity 0884
- 1900.1 to 2000.0 TB capacity 0885

- 2000.1 to 2200.0 TB capacity	0886
- 2200.1 to 2400.0 TB capacity	0887
- 2400.1 to 2600.0 TB capacity	0888
- 2600.1 to 2800.0 TB capacity	0889
- 2800.1 to 3000.0 TB capacity	0890
Attachment indicators:	
- IBM/Openwave Alliance indicator	0930
- IBM System i indicator	0931
- IBM System p indicator	0932
- IBM System x indicator	0933
- IBM System z indicator	0934
- IBM System z B/C indicator	0935
- Linux indicator	0940
- IBM System Storage ProtecTIER indicator	0960
- IBM Storwize v7000 indicator	0961
- IBM System Storage N series indicator	0962
- IBM System Storage SAN Volume Controller indicator	0963
- IBM/EPIC attachment indicator	0964
- VMware VAAI indicator	0965
Power:	
- Battery assembly	1051
- Extended PLD	1055
Single phase line cords:	
- SPP cord, 200-240V, 60A, 3-pin connector	1061
- SPP cord, 200-240V, 63A, no connector	1068
- Top exit SPP, 200-240V, 60A, 3-pin connector	1072
- Top exit SPP, 200-240V, 63A, no connector	1073
Three phase line cords:	
- Three phase wye, 380-440V, 32A, no connector	1081
- Three phase delta, 200-240V, 60A, 4-pin connector	1082
- Top exit three phase wye, 380-440V, 32A, no connector	1083
- Top exit three phase delta, 200-240V, 60A, 4-pin connector	1084
Disk drive enclosures:	
- HD disk enclosure pair	1241
- HD STD enclosure indicator	1242
- 3.5" disk enclosure indicator	1244
- 400 GB SSD enclosure indicator	1245
Disk drive cables:	
- HD disk drive cable group 2	1247
- HD disk drive cable group 4	1248
- HD disk drive cable group 5	1249
I/O enclosure pair PCIe	1301
I/O cables:	
- PCIe cable group 3	1322
Top exit bracket:	
- Top exit bracket for Fibre cable	1400
Fibre Channel/FICON cables:	
- 50 um Fibre cable (LC)	1410
- 50 um Fibre cable (LC/SC)	1411
- 50 um Fibre cable (jumper)	1412
- 9 um Fibre cable (LC)	1420
- 9 um Fibre cable (LC/SC)	1421
- 9 um Fibre cable (jumper)	1422
DS8000 Licensed Machine Code:	
- DS8000 LMC R7.0 indicator	1831
Earthquake kit	1906
Hardware installation MES	1999

Disk enclosure filler sets:
 - 3.5" disk enclosure filler set 2997
 - Disk enclosure half filler set 2998
 - Disk enclosure filler set 2999

Device adapters:
 - Device adapter pair I 3053

Host adapters:
 - 8 Gb 4 port SW FCP/FICON adapter PCIe 3153
 - 8 Gb 8 port SW FCP/FICON adapter PCIe 3157
 - 8 Gb 4 port LW FCP/FICON adapter PCIe 3253
 - 8 Gb 8 port LW FCP/FICON adapter PCIe 3257

Encryption disk drive sets:
 - 146 GB 15k FDE drive set 5108
 - 300 GB 15k FDE drive set 5308
 - 600 GB 10k FDE drive set 5708
 - 900 GB 10k FDE drive set 5758
 - 3 TB 7.2k FDE half drive set 5858

Encryption Standby CoD disk drive sets:
 - 146 GB 15k FDE CoD drive set 5209
 - 300 GB 15k FDE CoD drive set 5309
 - 600 GB 10k FDE CoD drive set 5709
 - 900 GB 10k FDE CoD drive set 5759
 - 3 TB 7.2k FDE CoD half drive set 5859

Encryption SSD half drive sets:
 - 400 GB SSD FDE half drive set 6156

Encryption SSD drive sets:
 - 400 GB SSD FDE drive set 6158

ServiceSuite® and ServiceElect (formerly ESA) maintenance

Description	Machine type	Model	Feature number
System Storage DS8870	2424	961	
Power:			
- Battery assembly			1051
Management Console:			
- Mgmt console - English laptop internal			1120
- Mgmt console - English laptop external			1130
I/O enclosure pair PCIe			1301
Encryption support:			
- TKLM isolated key server			1760
Earthquake kit			1906
Host adapters:			
- 8 Gb 4 port SW FCP/FICON adapter PCIe			3153
- 8 Gb 8 port SW FCP/FICON adapter PCIe			3157
- 8 Gb 4 port LW FCP/FICON adapter PCIe			3253
- 8 Gb 8 port LW FCP/FICON adapter PCIe			3257
Processor memory:			
- 16 GB Processor memory (2-core BC only)			4311
- 32 GB Processor memory (2-core BC only)			4312
- 64 GB Processor memory (4-core only)			4313
- 128 GB Processor memory (8-core only)			4314
- 256 GB Processor memory (8-core only)			4315
- 512 GB Processor memory (16-core only)			4316
- 1 TB Processor memory (16-core only)			4317
Processor License feature indicators:			

- 4-core Processor indicator	4402
- 8-core Processor indicator	4403
- 16-core Processor indicator	4404
Encryption disk drive sets:	
- 146 GB 15k FDE drive set	5108
- 300 GB 15k FDE drive set	5308
- 600 GB 10k FDE drive set	5708
- 900 GB 10k FDE drive set	5758
- 3 TB 7.2k FDE half drive set	5858
Encryption Standby CoD disk drive sets:	
- 146 GB 15k FDE CoD drive set	5209
- 300 GB 15k FDE CoD drive set	5309
- 600 GB 10k FDE CoD drive set	5709
- 900 GB 10k FDE CoD drive set	5759
- 3 TB 7.2K FDE CoD half drive set	5859
Encryption SSD half drive sets:	
- 400 GB SSD FDE half drive set	6156
Encryption SSD drive sets:	
- 400 GB SSD FDE drive set	6158
Function Authorization indicators:	
- Thin Provisioning indicator	7071
- DB protection indicator	7080
- FICON indicator	7091
- zHPP indicator	7092
- PTC - 1 TB indicator	7251
- PTC - 5 TB indicator	7252
- PTC - 10 TB indicator	7253
- PTC - 25 TB indicator	7254
- PTC - 50 TB indicator	7255
- PTC - 100 TB indicator	7260
- SE - 1 TB indicator	7351
- SE - 5 TB indicator	7352
- SE - 10 TB indicator	7353
- SE - 25 TB indicator	7354
- SE - 50 TB indicator	7355
- SE - 100 TB indicator	7360
- MGM - 1 TB indicator	7481
- MGM - 5 TB indicator	7482
- MGM - 10 TB indicator	7483
- MGM - 25 TB indicator	7484
- MGM - 50 TB indicator	7485
- MGM - 100 TB indicator	7490
- MM - 1 TB indicator	7501
- MM - 5 TB indicator	7502
- MM - 10 TB indicator	7503
- MM - 25 TB indicator	7504
- MM - 50 TB indicator	7505
- MM - 100 TB indicator	7510
- GM - 1 TB indicator	7521
- GM - 5 TB indicator	7522
- GM - 10 TB indicator	7523
- GM - 25 TB indicator	7524
- GM - 50 TB indicator	7525
- GM - 100 TB indicator	7530
- RMZ - 1 TB indicator	7651
- RMZ - 5 TB indicator	7652
- RMZ - 10 TB indicator	7653
- RMZ - 25 TB indicator	7654
- RMZ - 50 TB indicator	7655
- RMZ - 100 TB indicator	7660
- RMZ resync - 1 TB indicator	7681
- RMZ resync - 5 TB indicator	7682

- RMZ resync - 10 TB indicator	7683
- RMZ resync - 25 TB indicator	7684
- RMZ resync - 50 TB indicator	7685
- RMZ resync - 100 TB indicator	7690
- PAV - 1 TB indicator	7821
- PAV - 5 TB indicator	7822
- PAV - 10 TB indicator	7823
- PAV - 25 TB indicator	7824
- PAV - 50 TB indicator	7825
- PAV - 100 TB indicator	7830
- I/O Priority Manager - 1 TB indicator	7841
- I/O Priority Manager - 5 TB indicator	7842
- I/O Priority Manager - 10 TB indicator	7843
- I/O Priority Manager - 25 TB indicator	7844
- I/O Priority Manager - 50 TB indicator	7845
- I/O Priority Manager - 100 TB indicator	7850
- HyperPAV indicator	7899

System Storage DS8870 2424 96E
Expansion Unit

Power:
- Battery assembly 1051

I/O enclosure pair PCIe 1301

Earthquake kit 1906

Host adapters:
- 8 Gb 4 port SW FCP/FICON adapter PCIe 3153
- 8 Gb 8 port SW FCP/FICON adapter PCIe 3157
- 8 Gb 4 port LW FCP/FICON adapter PCIe 3253
- 8 Gb 8 port LW FCP/FICON adapter PCIe 3257

Encryption disk drive sets:
- 146 GB 15k FDE drive set 5108
- 300 GB 15k FDE drive set 5308
- 600 GB 10k FDE drive set 5708
- 900 GB 10k FDE drive set 5758
- 3 TB 7.2k FDE half drive set 5858

Encryption Standby CoD disk drive sets:
- 146 GB 15k FDE CoD drive set 5209
- 300 GB 15k FDE CoD drive set 5309
- 600 GB 10k FDE CoD drive set 5709
- 900 GB 10k FDE CoD drive set 5759
- 3 TB 7.2k FDE CoD half drive set 5859

Encryption SSD half drive sets:
- 400 GB SSD FDE half drive set 6156

Encryption SSD drive sets:
- 400 GB SSD FDE drive set 6158

Feature change options

Description	Feature number	Install* type	Feature Conversion	Feature Exchange	Feature Remove
Model 9xE merge indicators:					
- 9xE factory merge	0001	Plant only	No	No	No
- 9xE field merge	0002	Plant only	No	No	No
DoD indicator	0020	Plant only	No	No	No
JEMT indicator	0021	Plant only	No	No	No
Generic cover and packaging	0168	Plant only	No	No	No

Shipping weight reduction	0200	Plant only	No	No	No
Model 9xE position indicators:					
- 961 - 96E position 1	0361	Both	No	No	Yes
- 961 - 96E position 2	0362	Both	No	No	Yes
- 961 - 96E position 3	0363	Both	No	No	Yes
Licensed Function indicators:					
- OEL indicator	0700	Both	No	No	Yes
- FICON attach indicator	0703	Both	No	No	Yes
- Thin Provisioning indicator	0707	Both	No	No	Yes
- DB protection indicator	0708	Both	No	No	Yes
- High Performance FICON indicator	0709	Both	No	No	Yes
- Easy Tier indicator	0713	Both	No	No	Yes
- z/OS Distributed Data Backup indicator	0714	Both	No	No	Yes
- PTC indicator	0720	Both	No	No	Yes
- SE indicator	0730	Both	No	No	Yes
- MGM indicator	0742	Both	No	No	Yes
- MM indicator	0744	Both	No	No	Yes
- GM indicator	0746	Both	No	No	Yes
- RMZ indicator	0760	Both	No	No	Yes
- RMZ resync indicator	0763	Both	No	No	Yes
- PAV indicator	0780	Both	No	No	Yes
- HyperPAV indicator	0782	Both	No	No	Yes
- I/O Priority Manager	0784	Both	No	No	Yes
Initial system capacity:					
- Up to 2.0 TB capacity	0800	Plant only	No	No	Yes
- 2.1 to 5.0 TB capacity	0802	Plant only	No	No	Yes
- 5.1 to 10.0 TB capacity	0805	Plant only	No	No	Yes
- 10.1 to 25.0 TB capacity	0810	Plant only	No	No	Yes
- 25.1 to 50.0 TB capacity	0815	Plant only	No	No	Yes
- 50.1 to 75.0 TB capacity	0820	Plant only	No	No	Yes
- 75.1 to 100.0 TB capacity	0825	Plant only	No	No	Yes
- 100.1 to 150.0 TB capacity	0830	Plant only	No	No	Yes
- 150.1 to 200.0 TB capacity	0835	Plant only	No	No	Yes
- 200.1 to 250.0 TB capacity	0840	Plant only	No	No	Yes
- 250.1 to 300.0 TB capacity	0845	Plant only	No	No	Yes
- 300.1 to 350.0 TB capacity	0850	Plant only	No	No	Yes
- 350.1 to 400.0 TB capacity	0855	Plant only	No	No	Yes
- 400.1 to 450.0 TB capacity	0860	Plant only	No	No	Yes
- 450.1 to 500.0 TB capacity	0865	Plant only	No	No	Yes
- 500.1 to 550.0 TB capacity	0870	Plant only	No	No	Yes
- 550.1 to 600.0 TB capacity	0871	Plant only	No	No	Yes
- 600.1 to 700.0 TB capacity	0872	Plant only	No	No	Yes
- 700.1 to 800.0 TB capacity	0873	Plant only	No	No	Yes
- 800.1 to 900.0 TB capacity	0874	Plant only	No	No	Yes
- 900.1 to 1000.0 TB capacity	0875	Plant only	No	No	Yes
- 1000.1 to 1100.0 TB capacity	0876	Plant only	No	No	Yes
- 1100.1 to 1200.0 TB capacity	0877	Plant only	No	No	Yes
- 1200.1 to 1300.0 TB capacity	0878	Plant only	No	No	Yes
- 1300.1 to 1400.0 TB capacity	0879	Plant only	No	No	Yes
- 1400.1 to 1500.0 TB capacity	0880	Plant only	No	No	Yes
- 1500.1 to 1600.0 TB capacity	0881	Plant only	No	No	Yes
- 1600.1 to 1700.0 TB capacity	0882	Plant only	No	No	Yes
- 1700.1 to 1800.0 TB capacity	0883	Plant only	No	No	Yes
- 1800.1 to 1900.0 TB capacity	0884	Plant only	No	No	Yes
- 1900.1 to 2000.0 TB capacity	0885	Plant only	No	No	Yes
- 2000.1 to 2200.0 TB capacity	0886	Plant only	No	No	Yes
- 2200.1 to 2400.0 TB capacity	0887	Plant only	No	No	Yes
- 2400.1 to 2600.0 TB capacity	0888	Plant only	No	No	Yes
- 2600.1 to 2800.0 TB capacity	0889	Plant only	No	No	Yes
- 2800.1 to 3000.0 TB capacity	0890	Plant only	No	No	Yes
Standby CoD indicators:					
- Non-Standby CoD	0900	Both	No	No	Yes
- Standby CoD indicator	0901	Both	No	No	Yes
- Standby CoD indicator	0902	Plant only	No	No	Yes
- Standby CoD indicator	0903	Plant only	No	No	Yes
- Standby CoD indicator	0904	Both	No	No	Yes

Attachment indicators:						
- IBM/Openwave Alliance indicator	0930	Both	No	No	No	No
- IBM System i indicator	0931	Both	No	No	No	No
- IBM System p indicator	0932	Both	No	No	No	No
- IBM System x indicator	0933	Both	No	No	No	No
- IBM System z indicator	0934	Both	No	No	No	No
- IBM System z B/C indicator	0935	Both	No	No	No	No
- Linux indicator	0940	Both	No	No	No	No
- Global Mirror indicator	0950	Both	No	No	No	No
- IBM System Storage ProtecTIER indicator	0960	Both	No	No	No	No
- IBM Storwize V7000 indicator	0961	Both	No	No	No	No
- IBM System Storage N series indicator	0962	Both	No	No	No	No
- IBM System Storage SAN Volume Controller indicator	0963	Both	No	No	No	No
- IBM/EPIC attachment indicator	0964	Both	No	No	No	No
- VMware VAAI indicator	0965	Both	No	No	No	No
Power:						
- Remote power control	1000	Both	No	No	No	No
- Battery assembly	1051	Both	No	No	No	No
- Extended PLD	1055	Both	No	No	No	No
Single phase line cords:						
- SPP cord, 200-240V, 60A, 3-pin connector	1061	Both	No	No	No	No
- SPP cord, 200-240V, 63A, no connector	1068	Both	No	No	No	No
- Top exit SPP, 200-240V, 60A, 3-pin connector	1072	Both	No	No	No	No
- Top exit SPP, 200-240V, 63A, no connector	1073	Both	No	No	No	No
Three phase line cords:						
- Three phase wye, 380-440V, 32A, no connector	1081	Both	No	No	No	No
- Three phase delta, 200-240V, 60A, 4-pin connector	1082	Both	No	No	No	No
- Top exit three phase wye, 380-440V, 32A, no connector	1083	Both	No	No	No	No
- Top exit three phase delta, 200-240V, 60A, 4-pin connector	1084	Both	No	No	No	No
Special tool:						
- Universal ladder	1101	Both	No	No	No	No
Management console:						
- Mgmt console - English laptop internal	1120	Plant only	No	No	No	No
- Mgmt console - English laptop external	1130	Both	No	No	No	No
External management console - line cords:						
- MC line cord standard rack	1170	Both	No	No	No	No
- MC line cord group 1	1171	Both	No	No	No	No
- MC line cord group 2	1172	Both	No	No	No	No
Disk drive enclosures:						
- HD disk enclosure pair	1241	Both	No	No	No	No
- HD STD enclosure indicator	1242	Both	No	No	No	No
- 3.5" disk enclosure indicator	1244	Both	No	No	No	No
- 400 GB SSD enclosure indicator	1245	Both	No	No	No	No
Disk drive cables:						
- HD disk drive cable group 1	1246	Plant only	No	No	No	No
- HD disk drive cable group 2	1247	Both	No	No	No	Yes

- HD disk drive cable group 4	1248	Both	No	No	Yes
- HD disk drive cable group 5	1249	Both	No	No	Yes
I/O enclosure pair PCIe	1301	Both	No	No	No
I/O cables:					
- PCIe cable group 1	1320	Both	Yes	No	No
- PCIe cable group 2	1321	Both	No	No	No
- PCIe cable group 3	1322	Both	No	No	No
Top exit bracket:					
- Top exit bracket for Fibre cable	1400	Both	No	No	No
Fibre Channel/FICON cables:					
- 50 um Fibre cable (LC)	1410	Both	No	No	No
- 50 um Fibre cable (LC/SC)	1411	Both	No	No	No
- 50 um Fibre cable (jumper)	1412	Both	No	No	No
- 9 um Fibre cable (LC)	1420	Both	No	No	No
- 9 um Fibre cable (LC/SC)	1421	Both	No	No	No
- 9 um Fibre cable (jumper)	1422	Both	No	No	No
DS8000 Licensed Machine Code:					
- DS8000 LMC R7.0	1731	Both	No	No	Yes
Encryption support:					
- Encrypted drive set activation indicator	1750	Both	No	No	Yes
- Encrypted drive deactivation indicator	1754	Both	No	No	Yes
- TKLM isolated key server	1760	Both	No	No	Yes
DS8000 Licensed Machine Code:					
- DS8000 LMC R7.0 indicator	1831	Both	No	No	Yes
Earthquake kit	1906	Both	No	No	Yes
Hardware installation MES	1999	Field only	No	No	No
Disk enclosure filler sets:					
- 3.5" disk enclosure filler set	2997	Both	No	No	Yes
- Disk enclosure half filler set	2998	Both	No	No	Yes
- Disk enclosure filler set	2999	Both	No	No	Yes
Device adapters:					
- Device adapter pair I	3053	Both	No	No	No
Host adapters:					
- 8 Gb 4 port SW FCP/FICON adapter PCIe	3153	Both	Yes	No	No
- 8 Gb 8 port SW FCP/FICON adapter PCIe	3157	Both	Yes	No	No
- 8 Gb 4 port LW FCP/FICON adapter PCIe	3253	Both	Yes	No	No
- 8 Gb 4 port LW FCP/FICON adapter PCIe	3257	Both	Yes	No	No
Processor memory:					
- 16 GB Processor memory (2-core BC only)	4311	Both	Yes	No	No
- 32 GB Processor memory (2-core BC only)	4312	Both	Yes	No	No
- 64 GB Processor memory (4-core only)	4313	Both	Yes	No	No
- 128 GB Processor memory (8-core only)	4314	Both	Yes	No	No
- 256 GB Processor memory (8-core only)	4315	Both	Yes	No	No
- 512 GB Processor memory (16-core only)	4316	Both	Yes	No	No
- 1 TB Processor memory (16-core only)	4317	Both	Yes	No	No

Processor License feature indicators:

- 2-core Processor indicator	4401	Both	No	No	Yes
- 4-core Processor indicator	4402	Both	No	No	Yes
- 8-core Processor indicator	4403	Both	No	No	Yes
- 16-core Processor indicator	4404	Both	No	No	Yes

Encryption disk drive sets:

- 146 GB 15k FDE drive set	5108	Both	Yes	Yes	No
- 300 GB 15k FDE drive set	5308	Both	Yes	Yes	No
- 600 GB 10k FDE drive set	5708	Both	Yes	Yes	No
- 900 GB 10k FDE drive set	5758	Both	Yes	Yes	No
- 3 TB 7.2k FDE half drive set	5858	Both	Yes	Yes	No

Encryption Standby CoD disk drive sets:

- 146 GB 15k FDE CoD drive set	5209	Both	Yes	Yes	No
- 300 GB 15k FDE CoD drive set	5309	Both	Yes	Yes	No
- 600 GB 10k FDE CoD drive set	5709	Both	Yes	Yes	No
- 900 GB 10k FDE CoD drive set	5759	Both	Yes	Yes	No
- 3 TB 7.2k FDE CoD half drive set	5859	Both	Yes	Yes	No

Encryption SSD half drive sets:

- 400 GB SSD FDE half drive set	6156	Both	Yes	Yes	No
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Encryption SSD drive sets:

- 400 GB SSD FDE drive set	6158	Both	Yes	Yes	No
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Function Authorization indicators:

- OEL - inactive	7030	Both	No	No	Yes
- OEL - 1 TB unit	7031	Both	No	No	Yes
- OEL - 5 TB unit	7032	Both	No	No	Yes
- OEL - 10 TB unit	7033	Both	No	No	Yes
- OEL - 25 TB unit	7034	Both	No	No	Yes
- OEL - 50 TB unit	7035	Both	No	No	Yes
- OEL - 100 TB unit	7040	Both	No	No	Yes
- OEL - 200 TB unit	7045	Both	No	No	Yes
- OEL - Value Unit inactive	7050	Both	No	No	Yes
- OEL - 1 value Unit	7051	Both	No	No	Yes
- OEL - 5 Value Unit	7052	Both	No	No	Yes
- OEL - 10 Value Unit	7053	Both	No	No	Yes
- OEL - 25 Value Unit	7054	Both	No	No	Yes
- OEL - 50 Value Unit	7055	Both	No	No	Yes
- OEL - 100 Value Unit	7060	Both	No	No	Yes
- OEL - 200 Value Unit	7065	Both	No	No	Yes
- Thin Provisioning indicator	7071	Both	No	No	Yes
- DB protection indicator	7080	Both	No	No	Yes
- Easy Tier indicator	7083	Both	No	No	Yes
- FICON indicator	7091	Both	No	No	Yes
- zHPF indicator	7092	Both	No	No	Yes
- z/OS Distributed Data Backup indicator	7094	Both	No	No	Yes
- PTC - inactive indicator	7250	Both	No	No	Yes
- PTC - 1 TB indicator	7251	Both	No	No	Yes
- PTC - 5 TB indicator	7252	Both	No	No	Yes
- PTC - 10 TB indicator	7253	Both	No	No	Yes
- PTC - 25 TB indicator	7254	Both	No	No	Yes
- PTC - 50 TB indicator	7255	Both	No	No	Yes
- PTC - 100 TB indicator	7260	Both	No	No	Yes
- SE - inactive indicator	7350	Both	No	No	Yes
- SE - 1 TB indicator	7351	Both	No	No	Yes
- SE - 5 TB indicator	7352	Both	No	No	Yes
- SE - 10 TB indicator	7353	Both	No	No	Yes
- SE - 25 TB indicator	7354	Both	No	No	Yes
- SE - 50 TB indicator	7355	Both	No	No	Yes
- SE - 100 TB indicator	7360	Both	No	No	Yes
- MGM - inactive indicator	7480	Both	No	No	Yes

- MGM - 1 TB indicator	7481	Both	No	No	Yes
- MGM - 5 TB indicator	7482	Both	No	No	Yes
- MGM - 10 TB indicator	7483	Both	No	No	Yes
- MGM - 25 TB indicator	7484	Both	No	No	Yes
- MGM - 50 TB indicator	7485	Both	No	No	Yes
- MGM - 100 TB indicator	7490	Both	No	No	Yes
- MM - inactive indicator	7500	Both	No	No	Yes
- MM - 1 TB indicator	7501	Both	No	No	Yes
- MM - 5 TB indicator	7502	Both	No	No	Yes
- MM - 10 TB indicator	7503	Both	No	No	Yes
- MM - 25 TB indicator	7504	Both	No	No	Yes
- MM - 50 TB indicator	7505	Both	No	No	Yes
- MM - 100 TB indicator	7510	Both	No	No	Yes
- GM - inactive indicator	7520	Both	No	No	Yes
- GM - 1 TB indicator	7521	Both	No	No	Yes
- GM - 5 TB indicator	7522	Both	No	No	Yes
- GM - 10 TB indicator	7523	Both	No	No	Yes
- GM - 25 TB indicator	7524	Both	No	No	Yes
- GM - 50 TB indicator	7525	Both	No	No	Yes
- GM - 100 TB indicator	7530	Both	No	No	Yes
- RMZ - inactive indicator	7650	Both	No	No	Yes
- RMZ - 1 TB indicator	7651	Both	No	No	Yes
- RMZ - 5 TB indicator	7652	Both	No	No	Yes
- RMZ - 10 TB indicator	7653	Both	No	No	Yes
- RMZ - 25 TB indicator	7654	Both	No	No	Yes
- RMZ - 50 TB indicator	7655	Both	No	No	Yes
- RMZ - 100 TB indicator	7660	Both	No	No	Yes
- RMZ resync - inactive indicator	7680	Both	No	No	Yes
- RMZ resync - 1 TB indicator	7681	Both	No	No	Yes
- RMZ resync - 5 TB indicator	7682	Both	No	No	Yes
- RMZ resync - 10 TB indicator	7683	Both	No	No	Yes
- RMZ resync - 25 TB indicator	7684	Both	No	No	Yes
- RMZ resync - 50 TB indicator	7685	Both	No	No	Yes
- RMZ resync - 100 TB indicator	7690	Both	No	No	Yes
- PAV - inactive indicator	7820	Both	No	No	Yes
- PAV - 1 TB indicator	7821	Both	No	No	Yes
- PAV - 5 TB indicator	7822	Both	No	No	Yes
- PAV - 10 TB indicator	7823	Both	No	No	Yes
- PAV - 25 TB indicator	7824	Both	No	No	Yes
- PAV - 50 TB indicator	7825	Both	No	No	Yes
- PAV - 100 TB indicator	7830	Both	No	No	Yes
- I/O Priority Manager - inactive	7840	Both	No	No	Yes
- I/O Priority Manager - 1 TB indicator	7841	Both	No	No	Yes
- I/O Priority Manager - 5 TB indicator	7842	Both	No	No	Yes
- I/O Priority Manager - 10 TB indicator	7843	Both	No	No	Yes
- I/O Priority Manager - 25 TB indicator	7844	Both	No	No	Yes
- I/O Priority Manager - 50 TB indicator	7845	Both	No	No	Yes
- I/O Priority Manager - 100 TB indicator	7850	Both	No	No	Yes
- HyperPAV indicator	7899	Both	No	No	Yes
IGF transaction:					
- IGF transaction indicator	7999	Field only	No	No	Yes

* Install type of Both designates plant and field install.
The feature change options define the approach by which the feature number is removed from the machine and/or IBM machine-level inventory records.

- Feature Conversion: As necessary, IBM service personnel will remove components from the machine and/or install additional components required to complete the conversion.
- Feature Exchange: As necessary, IBM service personnel will remove components from the machine and/or install additional components required to complete the conversion.
- Feature Remove: This is an administrative transaction and only updates IBM machine and inventory records, except under the following condition:
 - IBM will remove components from the machine if the Feature Remove is ordered in conjunction with a Feature Add transaction.

ServicePac prices

For ServiceElect (ESA) maintenance service charges, contact IBM Global Services at 888-IBM-4343 (426-4343).

Feature conversion purchase price

Machine Type 2424 Model 961

Feature from	To	Returned parts*	Description	Continuous maintenance
1320	1321	Yes	I/O cable conversion	Yes

Feature from	To	Returned parts*	Description	Continuous maintenance
3153	3157	Yes	Host adapter conversion	Yes
3153	3253	Yes	Host adapter conversion	Yes
3153	3257	Yes	Host adapter conversion	Yes
3157	3153	Yes	Host adapter conversion	Yes
3157	3253	Yes	Host adapter conversion	Yes
3157	3257	Yes	Host adapter conversion	Yes
3253	3153	Yes	Host adapter conversion	Yes
3253	3157	Yes	Host adapter conversion	Yes
3253	3257	Yes	Host adapter conversion	Yes
3257	3153	Yes	Host adapter conversion	Yes
3257	3157	Yes	Host adapter conversion	Yes
3257	3253	Yes	Host adapter conversion	Yes

Feature from	To	Returned parts*	Description	Continuous maintenance
4311	4312	No	Processor memory conversion	Yes
4311	4313	No	Processor memory conversion	Yes
4311	4314	No	Processor memory conversion	Yes

4311	4315	No	Processor memory conversion	Yes
4311	4316	Yes	Processor memory conversion	Yes
4311	4317	Yes	Processor memory conversion	Yes
4312	4313	No	Processor memory conversion	Yes
4312	4314	No	Processor memory conversion	Yes
4312	4315	No	Processor memory conversion	Yes
4312	4316	Yes	Processor memory conversion	Yes
4312	4317	Yes	Processor memory conversion	Yes
4313	4314	No	Processor memory conversion	Yes
4313	4315	No	Processor memory conversion	Yes
4313	4316	Yes	Processor memory conversion	Yes
4313	4317	Yes	Processor memory conversion	Yes
4314	4315	No	Processor memory conversion	Yes
4314	4316	Yes	Processor memory conversion	Yes
4314	4317	Yes	Processor memory conversion	Yes
4315	4316	Yes	Processor memory conversion	Yes
4315	4317	Yes	Processor memory conversion	Yes
4316	4317	Yes	Processor memory conversion	Yes

Feature from	To	Returned parts*	Description	Continuous maintenance
4401	4402	No	Processor License feature conversion	Yes
4401	4403	No	Processor License feature conversion	Yes
4401	4404	No	Processor License feature conversion	Yes
4402	4403	No	Processor License feature conversion	Yes
4402	4404	No	Processor License feature conversion	Yes
4403	4404	No	Processor License feature conversion	Yes
Feature from	To	Returned parts*	Description	Continuous maintenance
5108	5308	Yes	Encryption disk drive set conversion	Yes
5108	5708	Yes	Encryption disk drive set conversion	Yes
5108	5758	Yes	Encryption disk drive set conversion	Yes
5308	5708	Yes	Encryption disk drive set conversion	Yes
5308	5758	Yes	Encryption disk drive set conversion	Yes

5708	5758	Yes	Encryption disk drive set conversion	Yes
5209	5108	No	Encryption CoD disk drive conversion	Yes
5309	5308	No	Encryption CoD disk drive conversion	Yes
5709	5708	No	Encryption CoD disk drive conversion	Yes
5759	5758	No	Encryption CoD disk drive conversion	Yes
5859	5858	No	Encryption CoD disk drive conversion	Yes

Machine Type 2424 Model 96E

Feature from	To	Returned parts*	Description	Continuous maintenance
3153	3157	Yes	Host adapter conversion	Yes
3153	3253	Yes	Host adapter conversion	Yes
3153	3257	Yes	Host adapter conversion	Yes
3157	3153	Yes	Host adapter conversion	Yes
3157	3253	Yes	Host adapter conversion	Yes
3157	3257	Yes	Host adapter conversion	Yes
3253	3153	Yes	Host adapter conversion	Yes
3253	3157	Yes	Host adapter conversion	Yes
3253	3257	Yes	Host adapter conversion	Yes
3257	3153	Yes	Host adapter conversion	Yes
3257	3157	Yes	Host adapter conversion	Yes
3257	3253	Yes	Host adapter conversion	Yes

Feature from	To	Returned parts*	Description	Continuous maintenance
5108	5308	Yes	Encryption disk drive set conversion	Yes
5108	5708	Yes	Encryption disk drive set conversion	Yes
5108	5758	Yes	Encryption disk drive set conversion	Yes
5308	5708	Yes	Encryption disk drive set conversion	Yes
5308	5758	Yes	Encryption disk drive set conversion	Yes
5708	5758	Yes	Encryption disk drive set conversion	Yes
5209	5108	No	Encryption CoD disk drive conversion	Yes
5309	5308	No	Encryption CoD disk drive conversion	Yes

Feature from	To	Returned parts*	Description	Continuous maintenance
			drive conversion	
5709	5708	No	Encryption CoD disk drive conversion	Yes
5759	5758	No	Encryption CoD disk drive conversion	Yes
5859	5858	No	Encryption CoD disk drive conversion	Yes
6156	6158	No	Encryption SSD drive conversion	Yes

* Parts removed or replaced become the property of IBM and must be returned.

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