

IBM TotalStorage DS6000



Introduction and Planning Guide

IBM TotalStorage DS6000



Introduction and Planning Guide

Note:

Before using this information and the product it supports, read the information in the **Safety and environmental notices** and **Notices** sections.

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About this guide

This publication introduces the IBM® TotalStorage® DS6000 and discusses what you need to consider when planning for the DS6000 series. Topics covered include licensed functions, physical configuration, site requirements, and ordering features.

Who should use this guide

This publication is for anyone who is planning to install and configure an IBM TotalStorage DS6000 series.

Summary of Changes for GC26-7679-04 IBM TotalStorage DS6000 Introduction and Planning Guide

This document contains terminology, maintenance, and editorial changes. Technical changes or additions to the text and illustrations are indicated by a vertical line to the left of the change. This summary of changes describes new functions that have been added to this release.

New Information

Feature codes added for remote access using a dial-up connection in “Feature codes for a modem” on page 40

Changed Information

Added power cord feature code for Taiwan to “Power line cords” on page 38

Corrected service clearance minimum requirements in “Preparing the physical environment for your DS6000 series” on page 43

Chapter 1. Introduction

The IBM® TotalStorage® DS6000 series is a member of the family of DS products and is built upon 2 Gbps fibre channel technology that provides RAID-protected storage with advanced functionality, scalability, and increased addressing capabilities.

The DS6000 series offers a high reliability and performance midrange storage solution through the use of hot-swappable redundant RAID controllers in a space efficient modular design. The DS6000 series provides storage sharing and consolidation for a wide variety of operating systems and mixed server environments.

The DS6000 series offers high scalability while maintaining excellent performance. With the DS6800 (Model 1750-511), you can install up to 16 disk drive modules (DDMs). The minimum storage capability with 8 DDMs is 584 GB. The maximum storage capability with 16 DDMs for the DS6800 model is 4.8 TB.

If you want to connect more than 16 disks, you use the optional DS6000 expansion enclosures (Model 1750-EX1) that allow a maximum of 224 DDMs per storage system and provide a maximum storage capability of 67 TB.

The DS6800 measures 5.25-in. high and is available in a 19-in. rack mountable package with an optional modular expansion enclosure of the same size to add capacity to help meet your growing business needs.

The DS6000 series addresses business efficiency needs through its heterogeneous connectivity, high performance and manageability functions, thereby helping to reduce total cost of ownership.

The DS6000 series offers the following major features:

- PowerPC 750GX processors
- Dual active controllers provide continuous operations through the use of two processors that form a pair to back up the other
- A selection of 2 GB fibre channel (FC) disk drives, including 73 GB, 146 GB, and 300 GB sizes with speeds of 10 000 or 15 000 revolutions per minute (RPM)
- 2 GB fibre channel and FICON host attachments of up to 8 ports, which can be configured with an intermix of Fibre Channel Protocol (FCP) and FICON
- Fibre channel arbitrated loop (FC AL) switched device attachment of up to 2 dual loops
- Storage virtualization
- Battery backed mirrored cache
- Fully redundant power and cooling system
- Disaster Recovery and Copy Service solutions

Overview of the DS6000 series models

The DS6000 series offers a base enclosure model with storage and optional expansion enclosures.

DS6800 (Model 1750-511)

The DS6800 offers the following features:

- Two FC controller cards
- PowerPC 750GX 1 GHz processor
- 4 GB of cache
- Two battery backup units (one per each controller card)
- Two ac/dc power supplies with imbedded enclosure cooling units
- Eight 2 Gb/sec. device ports
- Connectivity with the availability of two to eight fibre channel/FICON host ports. The host ports auto-negotiate to either 2 Gbps or 1 Gbps link speeds.
- Attachment to 13 DS6000 expansion enclosures.



The DS6800 is a self-contained 3U enclosure that can be mounted in a standard 19-inch rack. The DS6800 comes with authorization for up to 16 internal FC DDMs, offering up to 4.8 TB of storage capability. The DS6800 allows up to 13 DS6000 expansion enclosures to be attached. A storage system supports up to 224 disk drives for a total of up to 67.2 TB of storage.

The DS6800 system offers connectivity with the availability of two to eight Fibre Channel/FICON host ports. The 2 GB fibre channel/FICON host ports, which are offered in long-wave and shortwave, auto-negotiate to either 2 Gbps or 1 Gbps link speeds. This flexibility supports the ability to exploit the potential benefits offered by higher performance, 2 Gbps SAN-based solutions, while also maintaining compatibility with existing 1 Gbps infrastructures. In addition, with the maximum of eight host ports enabled, the DS6800 system can be configured with an intermix of

Fibre Channel Protocol (FCP) and FICON. This can help protect your investment in fibre channel adapters, and increase your ability to migrate to new servers.

The DS6800 system offers connectivity support across a broad range of server environments, including IBM eServer™, zSeries®, iSeries™, and pSeries® servers as well as servers from Sun Microsystems, Hewlett-Packard, and other Intel-based providers. This rich support of heterogeneous environments and attachments, along with the flexibility to easily partition the DS6800 system storage capacity among the attached environments, helps support storage consolidation requirements and dynamic, changing environments.

DS6000 expansion enclosure (Model 1750-EX1)

The DS6000 series expansion enclosure contains the following features:

- Two expansion controller cards. Each controller card provides the following:
 - 2 inbound ports (2 Gb/sec.)
 - 2 outbound ports (2 Gb/sec.)
 - 1 FC switch per controller card
- Controller disk enclosure that holds up to 16 FC DDMs
- Two ac/dc power supplies with imbedded enclosure cooling units
- Supports attachment to DS6800



The 3U DS6000 expansion enclosure can be mounted in a standard 19-inch rack. The front of the enclosure contains the docking sites where you can install up to 16 DDMs.

The DDMs are installed in a horizontal position with a locking handle. The rear of the enclosure provides the docking sites for the power supplies and the controller cards.

You can attach the DS6800 and expansion enclosure by using the controller card interfaces at the rear of the enclosure. A system display panel is also located at the rear of the enclosure.

Performance features

The DS6000 series is built upon 2 Gbps fibre channel technology that can help bring high availability RAID-protected storage with scalable capacity, increased addressing capabilities, and connectivity to a wide range of storage area network (SAN) applications.

The DS6000 series provides the following technology and hardware to meet today's on demand business environments:

Integrated RAID controller technology

The DS6000 series features IBM's 32-bit PowerPC microprocessor, a fourth generation processing technology.

High availability

The DS6000 series is designed with component redundancy to eliminate single points of hardware failure, and no single point of repair other than the enclosure.

Industry standard fibre channel disk drives

The DS6000 series offers a selection of 2 Gb fibre channel disk drives, including 300 GB drives, allowing the DS6000 series to scale up to 67 TB of capacity.

LUN and volume management

LUN and volume creation and deletion is nondisruptive. When you delete a LUN or volume, the capacity can immediately be reused. You can configure LUN and volumes to span arrays, which allows larger LUNs and volumes.

Addressing capabilities

The DS6000 series allows:

- Up to 32 logical subsystems
- Up to 8192 logical volumes
- Up to 1040 volume groups

Simplified storage management for zSeries with z/OS

The DS6000 series supports a new 65 520 cylinder 3390 volume. This volume option has a capacity of approximately 55.7 GB. It helps 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.

System management

The DS6000 series provides online and offline configuration capability features and a graphical user interface (GUI) designed to offer increased ease of use.

A single command line interface (CLI) supports both logical configuration and copy services.

Online Information Center

The online Information Center is an information database that provides you

the opportunity to quickly familiarize yourself with the major aspects of the DS6000 series and to easily recognize the topics for which you might require more information. It provides information regarding user assistance for tasks, concepts, reference, user scenarios, tutorials, and other types of user information. Using the wonderful search tool and because the information is all in one place rather than across multiple publications, you can access the information that you need more efficiently and effectively.

Data availability features

This section provides information about data availability features that are supported by DS6000 series.

The DS6000 series provides the following features:

- RAID implementation
- Copy services
- Availability support for open systems, iSeries, zSeries, and pSeries hosts
- Component redundancy to eliminate single points of hardware failure, and no single point of repair other than the enclosure.

RAID implementation

RAID implementation improves data storage reliability and performance.

With RAID implementation, the DS6000 series offers fault-tolerant data storage by storing the same data in different places on multiple disk drive modules (DDMs). By placing data on multiple disks, input/output operations can overlap in a balanced way to improve the basic reliability and performance of the attached storage devices.

Physical capacity for the DS6000 series can be configured as RAID 5, RAID 10, or a combination of both. RAID 5 can offer excellent performance for most applications, while RAID 10 can offer better performance for selected applications, in particular, high random write content applications in the open systems environment. Each array in the DS6000 series is composed of four drives.

RAID 5 overview

RAID 5 is a method of spreading volume data across multiple disk drives. The DS6000 series supports RAID 5 arrays.

RAID 5 provides faster performance by striping data across a defined set of DDMs. Data protection is provided by parity, which redundantly saves the data to the same DDMs.

RAID 10 overview

RAID 10 provides high availability by combining features of RAID 0 and RAID 1. The DS6000 series supports RAID 10 arrays.

RAID 0 optimizes performance by striping volume data across multiple disk drives at a time. RAID 1 provides disk mirroring which duplicates data between two disk drives. By combining the features of RAID 0 and RAID 1, RAID 10 provides a second optimization for fault tolerance. Data is striped across half of the disk drives in the RAID 1 array, and the other half of the array mirrors the first set of disk drives. Access to data is preserved if one disk in each mirrored pair remains available.

RAID-10 offers faster data reads and writes than RAID 5 because it does not need to manage parity. However, with half of the DDMs in the group used for data and the other half to mirror that data, RAID 10 disk groups have less capacity than RAID 5 disk groups.

Copy Services

This topic provides overviews of the different functions of Copy Services, including the benefits of using Copy Services for disaster recovery.

Overview of Copy Services

Copy Services is a collection of functions that provide disaster recovery, data migration, and data duplication functions. Copy Services runs on the DS6000 series and supports open systems and zSeries® environments.

Many design characteristics of the DS6000 series and data copying and mirroring capabilities of Copy Services features contribute to the protection of your data, 24 hours a day and seven days a week. A brief description of each of these licensed features is provided below.

You can manage Copy Services functions through a command-line interface called IBM TotalStorage DS CLI and a Web-based interface called IBM TotalStorage DS Storage Manager. The DS Storage Manager allows you to set up and manage the following types of data-copy features from any point from which network access is available:

Point-in-time copy

The point-in-time copy feature, which includes FlashCopy®, enables you to create full volume copies of data using source and target volumes that span logical subsystems within a single storage unit. After the FlashCopy function completes, you can immediately access both the source and target copies.

Remote Mirror and Copy

The remote mirror and copy feature copies data between volumes on two or more storage units. When your host system performs I/O operations, the source volume is copied or mirrored to the target volume automatically. After you create a remote mirror and copy relationship between a source volume and a target volume, the target volume continues to be updated with changes from the source volume until you remove the relationship between the volumes.

The following functions of remote mirror and copy are available:

- Metro Mirror
- Global Copy
- Global Mirror

Consider the following Copy Services information:

- The feature activation codes for Copy Services features (remote mirror and copy and point-in-time copy) must be obtained and enabled on the DS Storage Manager before you can begin using the features.

IBM TotalStorage Resiliency Family

IBM TotalStorage Resiliency Family is a set of products and features that are designed to help you implement storage solutions that keep your business running 24 hours a day, 7 days a week.

The IBM TotalStorage Resiliency Family is a set of hardware and software features, products, and services that are available on the IBM TotalStorage DS6000 and DS8000 series and IBM TotalStorage Enterprise Storage Server® (ESS) Models 750 and 800. The DS6000 series has a number of advanced Copy Services functions that are part of the IBM TotalStorage Resiliency family. Copy Services is a collection of functions that provides disaster recovery, data migration, and data duplication functions. Copy Services runs on the DS6000 series and supports open systems and zSeries environments.

The following are key features of the IBM TotalStorage Resiliency family:

- Point-in-time copy, which includes FlashCopy
- Remote mirror and copy, which includes the following functions:
 - IBM TotalStorage Metro Mirror
 - IBM TotalStorage Global Copy
 - IBM TotalStorage Global Mirror
- Concurrent copy, which is available only for zSeries

Disaster recovery using Copy Services

The prime purpose for backing up, copying, and mirroring data is in preparation for a possible disaster.

Having a disaster recovery plan can ensure that critical data is recoverable at the time of a disaster. Because most disasters are unplanned, your disaster recovery plan must provide a way that allows you to recover your applications quickly, and more importantly, to access your data. This means that you must be able to restart your critical applications at a backup site.

Disasters often occur over a period of time. This type of unplanned disaster, called a rolling disaster, is the most common. Other unplanned outages include fatal hardware failures or data center damage that is caused by natural occurrences, such as earthquakes or hurricanes. Planned outages include system maintenance operations, and although they are intended, planned outages can be just as effective as unplanned outages at removing service from users.

Most users decide to use a combination of remote mirror and copy and point-in-time copy features to form a comprehensive enterprise solution for disaster recovery.

Disaster recovery solutions include, but are not limited to the following functions:

Global Mirror

Global Mirror provides recoverable copies of your production data at a long distance remote site by continually forming consistent sets of data with no significant performance impact. This allows a quick restart at your remote site in case of a disaster at your production site.

Failover and failback operations

A failover operation is the process of switching production to a remote site. A failback operation is the process of returning production to its original location after a disaster. These operations help reduce the time that is required to synchronize remote mirror and copy volumes after switching between sites during planned and unplanned outages.

FlashCopy

The FlashCopy function enables you to make point-in-time, full volume copies of data, with the copies immediately available for read or write access. You can use the copy with standard backup tools that are available in your environment to create backup copies on tape.

FlashCopy creates a copy of a source volume on the target volume. This copy is called a point-in-time copy. When you initiate a FlashCopy operation, a FlashCopy relationship is created between a source volume and target volume. A FlashCopy relationship is a "mapping" of the FlashCopy source volume and a FlashCopy target volume. This mapping allows a point-in-time copy of that source volume to be copied to the associated target volume. The FlashCopy relationship exists between this volume pair from the time that you initiate a FlashCopy operation until the storage unit copies all data from the source volume to the target volume or you delete the FlashCopy relationship, if it is a persistent FlashCopy.

The benefits of FlashCopy are that the point-in-time copy is immediately available for use for backups and that the source volume is immediately released so that applications can be restarted, with minimal application downtime. The target volume is available for read and write processing so it can be used for testing or backup purposes.

When the data is physically copied, a background process copies tracks from the source volume to the target volume. The amount of time that it takes to complete the background copy depends on the following criteria:

- The amount of data being copied
- The number of background copy processes that are occurring
- The other activities that are occurring on the DS6000 series

FlashCopy supports the following copy options:

Consistency groups

Creates a consistent point-in-time copy of multiple volumes, with negligible host impact. You can enable FlashCopy consistency groups from the command-line interface (DS CLI).

Change recording

Activates the change recording function on the volume pair that is participating in a FlashCopy relationship. This enables a subsequent refresh to the target volume.

Establish FlashCopy on existing Metro Mirror source

Allows you to establish a FlashCopy relationship where the target volume is also the source of an existing remote mirror and copy source volume. This enables you to create full or incremental point-in-time copies at a local site and then use remote mirroring commands to copy the data to the remote site.

Fast reverse

Reverses the FlashCopy relationship without waiting for the finish of the background copy of the previous FlashCopy. This option applies to the Global Mirror mode.

Inhibit writes to target

Ensures that write operations are inhibited on the target volume until a refresh FlashCopy operation is complete.

Multiple Relationship FlashCopy

Allows a source volume to have multiple target volumes at the same time.

Persistent FlashCopy

Allows the FlashCopy relationship to remain even after the FlashCopy operation completes. You must explicitly delete the relationship.

Refresh target volume

Provides the ability to “refresh” a FlashCopy relationship, without recopying all tracks from the source volume to the target volume.

Reverse restore

Reverses the FlashCopy relationship and copies data from the target volume to the source volume.

Multiple relationship FlashCopy

Multiple relationship FlashCopy allows a source volume to have multiple targets simultaneously.

When a FlashCopy operation copies data from a source volume to a target volume, that source volume can be involved in more than one FlashCopy relationship at the same time (known as a multiple relationship FlashCopy). If a track on a volume is not a target track of an existing FlashCopy relationship, it can become the target in a new FlashCopy relationship. Up to twelve different target FlashCopy relationships can exist for a single source volume.

If you require multiple copies of the same data, this function allows you to copy a single source volume multiple (up to twelve) times to different target volumes as soon as a FlashCopy volume is established. For example, suppose you use FlashCopy to copy volume A to volume B. As soon as that FlashCopy relationship is established, you can copy volume A to volume C. Once that relationship is established, you can copy volume A to volume D, and so on. Multiple sessions within a single volume are also possible.

Re-synchronizing FlashCopy volume pairs

Re-synchronizing FlashCopy volumes provides the ability to update an initial point-in-time copy of a source volume.

You can resync your FlashCopy volumes without having to recopy your entire volume. This process is only possible with a persistent relationship, whereby the storage unit continually tracks updates to the source and target volumes. With persistent relationships, the relationship between the source and target volumes is maintained after the background copy has completed.

This function reduces the background copy completion time because only a subset of data is copied when either the source or target volume has changed. The target volume becomes current with the newly established point-in-time source copy.

To enable this function of FlashCopy, the storage unit uses a feature called change recording to monitor write operations and record changes that were made to volumes participating in FlashCopy relationships since the initial (or last) incremental FlashCopy was performed. After the initial copy of the source volume to the target volume, the FlashCopy relationship between the volumes is not automatically deleted. Rather, it remains to allow the volumes to be re-synchronized. The next time that you want to update the information on your target volume, you can resync your target volume again.

Note: If you perform a resync operation, it is sent to any source and volume pair. All source and target volume pairs will be re-synchronized, not just the one pair that you selected.

Remote Mirror and Copy

Remote mirror and copy is a storage server feature that constantly updates a target copy of a volume so that it matches changes that were made to its associated source volume.

The remote mirror and copy feature is a hardware solution that enables the mirroring of data from one site (the local site) and its associated volumes (source volumes) to a second storage unit at another site (the recovery or remote site) and its volumes (target volumes).

Note: Remote mirror and copy was referred to as Peer-to-Peer Remote Copy (PPRC) in earlier documentation for the IBM TotalStorage Enterprise Storage Server. Currently, the remote mirror and copy feature name is used generically for all methods of synchronous and asynchronous methods. In addition, in a remote mirror and copy environment, a site where production applications run might be referred to as the production site, local site, or Site A. A site that has mirrored data of your local site might be referred to as a recovery site, backup site, remote site, or Site B.

Remote mirror and copy differs from FlashCopy in two essential ways. First, the source and target volumes can be on the same storage server or on separate storage servers that are located at some distance from each other. Second, and more significantly, remote mirror and copy does not capture the state of the source volume at some point in time, but rather reflects all changes that were made on the source volume to the target volume.

The following modes of operation are available:

IBM TotalStorage Global Copy

Global Copy copies data nonsynchronously and over longer distance than is possible with Metro Mirror. In Global Copy mode, the source volume sends a periodic, incremental copy of updated tracks to the target volume instead of a constant stream of updates. Because the original order of updates is not strictly maintained, this is considered a "fuzzy" copy. All updates that an attached host performs on the source volume are also performed on the target volume, but at a later time.

IBM TotalStorage Global Mirror

Global Mirror copying provides a two-site extended distance remote copy option for disaster recovery. This solution is based on existing Global Copy and FlashCopy. With Global Mirror, the data that the host writes to the storage unit at the local site is asynchronously shadowed to the storage unit at the remote site. A consistent copy of the data is then automatically maintained on the storage unit at the remote site.

IBM TotalStorage Metro Mirror

Metro Mirror synchronously mirrors updates that are done to source volumes. All updates that any attached host performs on the source volume are also performed on the target volume before operation completion is indicated. Metro Mirror copying supports a maximum distance of 300 km (186 mi).

Global Copy

Global Copy functions offer a nonsynchronous long-distance copy option whereby write operations to a storage unit at your production site are considered complete before they are transmitted to a storage unit at your recovery site.

Global Copy is a nonsynchronous mirroring function and is an alternative mirroring approach to Metro Mirror operations. Host updates to the source volume are not delayed by waiting for the update to be confirmed by a storage unit at your recovery site. The source volume sends a periodic, incremental copy of updated tracks to the target volume instead of a constant stream of updates. There is no guarantee that dependent write operations are transferred in the same sequence that they have been applied to the source volume. This nonsynchronous operation results in a “fuzzy copy” at the recovery site; however, through operational procedures, you can create a point-in-time consistent copy at your recovery site that is suitable for data migration, backup, and disaster recovery purposes.

To ensure that a consistent copy of the data is created, you can periodically switch from Global Copy to Metro Mirror mode. Then, either stop application I/O or freeze write applications to source volumes and wait for all pending updates to be copied to the recovery site. At this point, you can create a FlashCopy operation at your recovery site to obtain a consistent data.

The Global Copy function can operate at very long distances—well beyond the 300 km distance that is supported for Metro Mirror—and with minimal impact to applications, with the distance that is limited only by the network and the channel extended technology.

During a disaster, data can be restored only to the last known consistent increment that was created. This means that data that is written to the production site but is waiting to be transferred to the recovery site is lost whenever the two storage units can no longer communicate. Be aware that the use of Global Copy functions do not guarantee against data loss. Global Mirror functions, on the other hand, provide recoverable copies of production data at a long distance recovery site by continually forming consistent sets of data with no significant performance impact. This allows a quick restart at your recovery site in case of a disaster at the production site.

The following describes the Global Copy write sequence:

1. During a Global Copy operation, the storage unit at your production site captures information about updates to the source and periodically sends those updates to the target volume at the recovery site.
2. After the initial copy of tracks, the storage unit series periodically starts a synchronization cycle where all updated tracks, in ascending order from the lowest numbered track, is copied from the source volume to the target volume. The storage unit updates the target tracks with the current information for that track, regardless of the number of updates between the time that it was last copied, the current time, and the order in which the updates occurred.
3. When this process completes, the cycle is repeated. There is little response time degradation on application write operations in extended distance mode.
4. Write updates to the source volume receive an immediate completion because the synchronization cycle is independent of the updates to the source volume.

Global Mirror

Global Mirror provides a long-distance remote copy solution across two sites for open systems or z/OS (or both) data using asynchronous technology.

Global Mirror provides a two-site extended distance remote copy option for disaster recovery. With Global Mirror, the data that the host writes to the storage unit at the production (local) site is asynchronously shadowed to the storage unit at the recovery site. The recovery site can be located well beyond the 300 km limit that is associated with Metro Mirror with minimal delays in response times. Separating volumes by larger distances provides greater protection against regional disasters. Only the capabilities of the network and channel extension technologies limit distance.

Global Mirror is based on existing Copy Services functions: Global Copy and FlashCopy. With Global Mirror, a consistent copy of the data is automatically maintained on the storage unit at the recovery site. This consistency is ensured if the order of dependent write operations to disks or disk groups is maintained. With Global Copy operations, data consistency is guaranteed at the recovery site by creating "freeze and run" tasks and then using FlashCopy to create point-in-time copies at the recovery site.

Global Mirror operations periodically invoke a point-in-time FlashCopy at the recovery site, at regular intervals, without disrupting the I/O to the source volume, thus giving a continuously updating, nearly up-to-date data backup. Then, by grouping many volumes into a session, which is managed by the master storage unit, you can copy multiple volumes to the recovery site simultaneously while maintaining point-in-time consistency across those volumes.

To better understand how Global Mirror works, you must be familiar with the following terms:

Master

The master storage unit controls the creation of consistency groups in the Global Mirror session. The master storage unit sends commands to subordinate storage units. A storage unit is allowed to be a master for only one Global Mirror session.

Subordinate

The subordinate storage unit receives commands from a master storage unit. The subordinate storage unit is identified when a Global Mirror session is started. The subordinate storage unit forms consistency groups and performs other Global Mirror processing. A subordinate storage unit can only be controlled by one storage unit master.

Session

A session is a collection of volumes across multiple storage units that are managed together to create consistent copies of data. The session is identified with an ID that is unique across the enterprise. The ID identifies volumes that will participate in the Global Mirror consistency group. A session is opened on each LSS in the enterprise that has or might have volumes that will participate in the Global Mirror consistency group that is associated with the specific session ID.

Control path

The control path is established from the master storage unit to the subordinate storage unit when more than one storage unit participates in the Global Mirror session. If there is only one storage unit that is involved, you do not have to create a control path. The master storage unit communicates directly with its subordinate storage unit.

Fast restore operations:

The fast reverse option allows you to reverse a FlashCopy relationship without waiting for the background copy of a previous FlashCopy to finish.

In disaster recovery situations, when you use Global Mirror, you must use volumes with consistent data at the target site. Part of the setup requires that you enable the fast restore option, a copy option that is available for FlashCopy operations. (This option applies to a Global Mirror operation, which is based on existing Global Copy and FlashCopy operations at the target site.)

Use fast restore option to reverse a FlashCopy target volume and allow consistent data to be copied back to its associated source volume, without having to wait for the background copy from the original source to the original target to complete. You can then vary the volumes online and start your applications.

You can enable the fast reverse option by accessing Copy Services functions from the Web interface called the IBM TotalStorage DS Storage Manager and navigating to the FlashCopy page and then to the Select copy options page.

Global Mirror consistency groups:

Global Mirror can control the formation of consistency groups for data consistency.

Global Mirror is based on a combination of Global Copy and FlashCopy functions. To support consistent data across storage units, Global Mirror uses a function called *sessions* for forming consistent copies. A consistency group is a collection of volumes across multiple storage units that are managed together when creating consistent copies of data. The formation of these consistency groups is coordinated by the master storage unit, which sends commands over remote mirror and copy links to its subordinate storage units.

With Global Mirror functions, consistency groups can be formed many times per hour, as opposed to once or twice per day. By combining many volumes into a session, which is managed by the Global Mirror master storage unit, multiple volumes can be copied to the recovery site simultaneously while maintaining point-in-time consistency across those volumes.

The following properties control how often consistency groups are formed. You can modify these values using the Web-based interface called the IBM TotalStorage DS Storage Manager. Access the Global Mirror page, and then Define Properties from the summary of actions menu.

Consistency group interval time

Indicates how long (in seconds) that the storage unit waits between the formation of consistency groups. If you set this value to zero (requires sufficient bandwidth), the consistency group forms continuously, which means that a consistency group starts forming as soon as the previous consistency group has been formed.

Maximum coordination interval

Indicates the maximum time (in milliseconds) that the master storage unit communicates with its subordinate storage units to form a consistent data point. The default is 50 milliseconds.

Because host write I/O is delayed while the consistent point is being set, performance might be affected by allowing too much time for this interval. If the time set for the maximum coordination interval expires before formation of the consistent data point is complete, the consistency group fails.

Maximum time writes are inhibited to the remote site

Indicates the maximum time (in seconds) that write operations are not allowed at the recovery site before the storage unit stops forming a current consistency group. If the drain time is maintained for an extended period of time, the number of write operations that are required to transfer the data to the recovery site can become large enough to increase the time to form a consistency group.

Note: As distance increases, there is an increasing lag in the time it takes for the data to be written to the recovery site. This lag is referred to as a *drain* time.

Loss of data can also be increased in the event of a disaster. If it is set to zero, it defaults to either four minutes or twice the consistency group interval value, depending on which value is larger. The first consistency group is formed regardless of the consistency group drain time. For the remainder of the consistency groups, if the specified time expires before the data is drained to the recovery site, consistency group formation stops. After the consistency group formation has stopped five consecutive times, the timer is disabled and the next consistency group is formed regardless of the required time.

Session management:

A Copy Services session is a collection of volumes across multiple storage units that are managed together to create consistent copies of data. Sessions are managed for Global Mirror relationships.

The Global Mirror mode supports data consistency across multiple volumes, logical subsystems (LSSs), and storage units by using a concept called *sessions*. For disaster recovery, it is required that the volumes in a session that are necessary for recovery be consistent up to the time of failure. If data on these volumes is copied out of sequence, then the recovery procedures that use these volumes become useless. Global Mirror uses special algorithms to provide data consistency.

Sessions are associated Global Mirror relationships and are defined with an identifier (session ID) that is unique across the enterprise. The ID identifies volumes that are related and that can participate in the Global Mirror consistency group.

You can select a set of volumes across LSSs on multiple storage units to participate in consistency groups. Logical volumes within a given LSS can be part of different sessions and different consistency groups. After you create a session, you can add logical volumes to or remove logical volumes from, a particular session. After a set of logical volumes become part of the session, a single session-based "command" can operate on all of the logical volumes in the session.

Consistency groups

Consistency groups are used for controlling error situations and for maintaining data consistency at a recovery site.

You can create paths from a source LSS to a target LSS have the consistency group option enabled. All volume pairs in remote mirror and copy relationships from this source to target LSS (sharing the same paths) belong to the consistency group. Other volumes pairs are not affected.

With the consistency group option enabled, when an error occurs on any volume pairs or on the links that are associated with these LSS pairs, an alert is issued and

I/O to all duplex remote mirror and copy volumes on LSS pairs will be queued either until a consistency group created operation is run or the consistency group timeout time expires, allowing external automation to use the consistency group created operation to create a dependent write consistent set of target volumes over any number of LSS and disk storage units.

External automation or command-line interface commands can issue a "freeze" to all LSS pairs that relate to the application, affecting the set of source volumes in the consistency group. The freeze operation causes the source volumes to suspend and their associated paths to end. Therefore, all associated updates at the recovery site are halted, resulting in a consistent data checkpoint. The automation program is not a part of the software provided with the storage unit; it must be supplied by the user. However, IBM has offerings to assist with this automation. For more information, contact your IBM storage representative.

A consistency grouping timeout function gives automation software the time to issue the automated requests to ensure consistency. The consistency grouping timeout is a value that specifies the length of time that the volume remains in long-busy (unavailable) following an error. You can change this value by accessing Copy Services functions from the Web interface (DS Storage Manager) and navigating to the Paths page and then to the LSS options page. The default value for this parameter is set to two minutes.

Note: The consistency group option is not required for Global Mirror or for Global Copy. Global Copy always keeps an inconsistent copy of the volumes at the recovery site. The volume pairs become consistent only when all updates are transmitted and copied to the recovery site while the application write operations are quiesced. Global Mirror uses a function called a session to control the formation of consistency groups. (A session is a collection of volumes across multiple storage units that are managed together to create consistent copies of data.) The formation of these consistency groups is coordinated by the "master" storage unit, which sends commands over remote mirror and copy links to its "subordinate" storage units.

The following describes the behavior of these volume pairs when an error occurs that affects a volume in a consistency group:

- Without the consistency group option enabled, the storage unit causes the volume where the error is detected to enter a suspended state, but updates to that volume are still allowed.
- With the consistency group option enabled, the volume becomes suspended and additionally enters a long-busy state. Updates are not possible to volumes from the source LSS to target LSS that are sharing the same path.

A critical mode determines the behavior of the remote mirror and copy pairs or consistency groups after a failure in communication between the source and target storage units when all the paths between a pair are lost. You can enable this mode also by accessing Copy Services functions from the DS Storage Manager and by navigating to the Paths page and then to the LSS options page.

Failover and failback operations

The failover operation is the process of switching production to a backup facility (normally your recovery site). A failback operation is the process of returning production to its original location after a disaster or a scheduled maintenance period.

There are times, both planned and unplanned, when it is necessary to suspend disk mirroring and to make use of the secondary storage unit in your configuration. As a manual process, this can be complex. However, failover and failback recovery operations are available to simplify this process and reduce the risk of error and the time it takes to switch sites and restart I/O operations.

Failover is the process of temporarily switching production to a backup facility (normally your recovery site) following a scheduled maintenance period or a disaster at your production (or local) site. A failover operation is always followed by a failback operation, which is the process of returning production to its original location. These operations use remote mirror and copy functions to reduce the time that is required to synchronize volumes after switching sites during planned or unplanned outages.

The failover and failback operations allow change recording to be enabled on the target volumes without having to communicate between the target and source storage units. This method eliminates the need to perform a full volume copy from your recovery site to the production site, which can reduce the time that is required to resume operations at your production site.

In a typical remote mirror and copy environment, processing will temporarily failover to the storage unit at your recovery site if an outage occurs at the production site. Through use of failover operations, the state of a storage unit in your target configuration changes. As a result, the storage unit is recognized as the source storage unit in the pair. Because the failover process puts the volumes into a suspended state, changes are tracked within a bitmap. Assuming that change recording is enabled, only change data is sent to the production site to synchronize the volumes, thereby reducing the time that is required to complete the failback operation.

When it is safe to return to your production site, assuming that no physical damage has occurred to the storage unit in the location, you can delete paths and create new ones from your production site to your recovery site. Then, you can create a failback recovery request to restore the storage unit as the production storage unit in the relationship.

The following considerations are for failover and failback operations:

- The failover operation does not reverse the direction of a remote mirror and copy pair. It changes a target device into a suspended source device, while leaving the source device in its current state.
- The failback recovery operation can be issued against any remote mirror and copy volume that is in a primary suspended state. The operation copies required data from the source volume to the target volume in order to resume mirroring. Failback operations are commonly used after a failover operation has been issued to restart mirroring either in the reverse direction (remote site to local site) or in the original direction (local site to remote site).

z/OS Copy Services

Copy Services functions are also supported in a z/OS® environment. These functions allow you to create a point-in-time copy or to mirror data at your remote or recovery site as applications make changes to the source volumes at your production site.

Concurrent Copy

Concurrent Copy is an optional function that is available with the z/OS remote mirror and copy feature and is supported on the DS6000 series.

DS6000 storage complexes support the Concurrent Copy feature on zSeries hosts. Concurrent Copy, like FlashCopy, creates point-in-time copies of volumes. However, Concurrent Copy can also copy data sets from a source volume. It can copy the data to tape, to an optical library, or to another storage device. Data systems like the IBM DB2® product can also initiate Concurrent Copy.

Subsystem Device Driver for open-systems

The IBM TotalStorage Multi-path Subsystem Device Driver (SDD) supports open-systems hosts.

The Subsystem Device Driver (SDD) resides in the host server with the native disk device driver for the storage unit. It uses redundant connections between the host server and disk storage in the DS6000 series to provide enhanced performance and data availability.

Balancing the I/O load

You can generally maximize the performance of an application by spreading the I/O load across clusters, arrays, and device adapters in the storage unit.

During an attempt to balance the load within the storage unit, placement of application data is the determining factor. The following resources are the most important to balance, roughly in order of importance:

- Activity to the RAID disk groups. Use as many RAID disk groups as possible for the critical applications. Most performance bottlenecks occur because a few disks are overloaded. Spreading an application across multiple RAID disk groups ensures that as many disk drives as possible are available. This is extremely important for open-system environments where cache-hit ratios are usually low.
- Activity to the clusters. When selecting RAID disk groups for a critical application, spread them across separate clusters. Because each cluster has separate memory buses and cache memory, this maximizes the use of those resources.
- Activity to the device adapters. When selecting RAID disk groups within a cluster for a critical application, spread them across separate device adapters.
- Activity to fibre-channel or FICON ports. Use the IBM TotalStorage Multipath Subsystem Device Driver (SDD) or similar software for other platforms to balance I/O activity across fibre-channel ports.

Note: For information about SDD, see *IBM TotalStorage Multipath Subsystem Device Driver User's Guide*. This document also describes the product engineering tool, the ESSUTIL tool, which is supported in the pcmpath commands and the datapath commands.

Storage consolidation

When you use a storage unit, you can consolidate data and workloads from different kinds of independent servers into a single shared resource.

You might mix production and test servers in an open systems environment or mix S/390 or zSeries and open systems hosts. In this kind of independent server environment, servers rarely, if ever, contend for the same resource.

Although sharing resources in the storage unit has advantages for storage administration and resource sharing, there are additional implications for workload planning. The benefit of sharing is that a larger resource pool (for example, disk drives or cache) is available for critical applications. However, you must ensure that uncontrolled or unpredictable applications do not interfere with critical work. This requires the same kind of workload planning that you use when you mix various types of work on a server.

If your workload is critical, consider isolating it from other workloads. To isolate the workloads, place the data as follows:

- On separate RAID disk groups. S/390 or zSeries and open-systems data are automatically placed on separate arrays, which reduces the contention for disk use.
- On separate device adapters.
- In separate storage unit clusters, which isolates use of memory buses, microprocessors, and cache resources. Before you make this decision, verify that the isolation of your data to a single cluster provides adequate data access performance for your application.

Count key data

In count-key-data (CKD) disk data architecture, the data field stores the user data.

Because data records can be variable in length, in CKD they all have an associated count field that indicates the user data record size. The key field enables a hardware search on a key. The commands used in the CKD architecture for managing the data and the storage devices are called channel command words (CCWs).

Fixed block (FB)

In fixed block (FB) architecture, the data (the logical volumes) are mapped over fixed-size blocks or sectors.

With an FB architecture, the location of any block can be calculated to retrieve that block. This architecture uses tracks and cylinders. On a physical disk there are multiple blocks per track, and a cylinder is the group of tracks that exists under the disk heads at one point in time without performing a seek operation.

Logical volumes

A logical volume is the storage medium that is associated with a logical disk. It typically resides on one or more hard disk drives.

For the storage unit, the logical volumes are defined at logical configuration time. For count-key-data (CKD) servers, the logical volume size is defined by the device emulation mode and model. For fixed block (FB) hosts, the size is 100 MB to the maximum capacity of a rank.

A logical device that has a non-removable media has one and only one associated logical volume. A logical volume is composed of one or more extents. Each extent is associated with a contiguous range of addressable data units on the logical volume.

Parallel access volumes

Parallel access volumes (PAVs) allow your system to access volumes in parallel.

A PAV capability represents a significant performance improvement by the storage unit over traditional I/O processing. With PAVs, your system can access a single volume from a single host with multiple concurrent requests.

You must configure both your storage unit and operating system to use PAVs. You can use the logical configuration definition to define PAV-bases, PAV-aliases, and their relationship in the storage unit hardware. This unit address relationship creates a single logical volume, allowing concurrent I/O operations.

Static PAVs are PAVs in which the association between a PAV-base address and its PAV-aliases is pre-defined and fixed. That is, the PAV-aliases of a PAV-base address remain unchanged. Dynamic PAVs, on the other hand, are PAVs in which the association between a PAV-base address and its PAV-aliases is dynamic. The device number types (PAV-alias or PAV-base) must match the unit address types as defined in the storage unit hardware.

The DS6000 series supports concurrent or parallel data transfer operations to or from the same volume from the same system or system image for zSeries hosts.

Base and alias exposures

An exposure is a device extension that enables an MVS system to perform multiple concurrent I/O operations to the device.

The storage unit uses two types of exposures:

- Base exposure: A device number associated with a parallel access volume (PAV). It is used for query, data control, and data access operations.
- Alias exposure: A device number that is associated with a base exposure and that represents the same logical volume as the base device number. It is used for data access I/O operations, query, and control operations.

Multiple allegiance for FICON hosts

The DS6000 series provides multiple allegiance facility support for FICON hosts.

The multiple allegiance facility enables the storage unit to accept concurrent I/O requests for a volume from multiple channel paths. This enables the storage unit to process requests from separate FICON hosts in parallel. Parallel processing of requests improves throughput and performance. The multiple allegiance facility does not require any user action.

Host systems that DS6000 series supports

The DS6000 series provides a variety of host attachments so that you can consolidate storage capacity and workloads for open-systems hosts and zSeries hosts. The storage unit can be configured for fibre-channel adapters, for support of fibre-channel protocol (FCP) and fibre connection (FICON) protocol.

For fibre channel attachments, you can establish zones. The zones must contain a single port that is attached to a system adapter with the desired number of ports that are attached to the storage unit. By establishing zones, you reduce the

possibility of interactions between system adapters in switched configurations. You can establish the zones by using either of two zoning methods:

- Port number
- Worldwide port name (WWPN)

You can configure switch ports and hub ports that are attached to the storage unit in more than one zone. This enables multiple system adapters to share access to the storage unit fibre channel ports. Shared access to an storage unit fibre channel port might come from host platforms that support a combination of bus adapter types and the operating systems. For information about host systems, operating system levels, host bus adapters, cables, and fabric support that IBM supports, see the DS6000 series **Interoperability Matrix** at:

<http://www.ibm.com/servers/storage/disk/ds6000/interop.html>.

Fibre channel host attachments

Fibre channel technology supports increased performance, scalability, availability, and distance for attaching storage subsystems to network servers. Fibre channel technology supports applications that require large amounts of disk storage that is shared by two or more servers. You can use fibre channel to connect large amounts of disk storage to a server or cluster of servers.

The DS6000 series provides a fibre channel connection when you install a fibre-channel SFP (shortwave or longwave) in the DS6800 model.

Fibre channel architecture provides a variety of communication protocols on the storage server. The servers that are interconnected are referred to as *nodes*. Each node has one or more ports.

A storage unit is a node in a fibre channel network. Each port on a DS6800 fibre channel SFP is a fibre channel port. A host is also a node in a fibre channel network. Each port attaches to a serial-transmission medium that provides duplex communication with the node at the other end of the medium.

There are three basic topologies supported by fibre channel interconnection architecture:

Point-to-point

You can use the point-to-point topology to interconnect ports directly.

Switched fabric

The switched-fabric topology provides the necessary switching functions to support communication between multiple nodes. You can use a fabric to support communication between multiple nodes.

Arbitrated loop

A fibre channel arbitrated loop (FC-AL) is a ring topology where two or more ports can be interconnected. You can use the FC-AL to interconnect up to 127 hosts on a loop. An arbitrated loop may be connected to a fabric, known as a public loop. When the loop is not connected to a fabric, it is referred to as a private loop.

Attaching a DS6000 series to an open-systems host with fibre channel adapters

You can attach a DS6000 series to an open-systems host with fibre-channel adapters.

Fibre channel is a 1 Gbps or 2 Gbps, full-duplex, serial communications technology to interconnect I/O devices and host systems that are separated by tens of kilometers.

The IBM TotalStorage DS6000 series supports SAN connections at 1 Gbps to 4 Gbps with 2 Gbps host bus adapters. The DS6000 series negotiates automatically and determines whether it is best to run at 1 Gbps link or 2 Gbps link. The IBM TotalStorage DS6000 series detects and operates at the higher link speed.

Fibre channel transfers information between the sources and the users of the information. This information can include commands, controls, files, graphics, video, and sound. Fibre-channel connections are established between fibre-channel ports that reside in I/O devices, host systems, and the network that interconnects them. The network consists of elements like switches, bridges, and repeaters that are used to interconnect the fibre-channel ports.

FICON-attached zSeries hosts

The DS6000 series supports FICON-attached and zSeries hosts.

The storage unit attaches to S/390® and zSeries host systems with FICON™ channels. Each storage unit fibre channel adapter has one port. You can configure the port to operate with the FICON upper-layer protocol. When configured for FICON, the fibre channel port supports connections to a maximum of 128 FICON hosts. On FICON, the fibre channel adapter can operate with fabric or point-to-point topologies. With fibre channel adapters that are configured for FICON, the DS6800 series supports the following:

- Either fabric or point-to-point topologies
- A maximum of 128 channel connections per fibre-channel port
- A maximum of 32 logical subsystems
- A maximum of 8192 logical volumes
- A maximum of 1040 volume groups

The DS6800 supports the following operating systems for zSeries hosts:

- Transaction Processing Facility (TPF)
- Virtual Storage Extended/Enterprise Storage Architecture (VSE/ESA™)
- z/OS
- z/VM®

FICON is an optional feature on the DS6800 system, and is available with the FICON Attachment feature number 5915.

For details about models, versions of operating systems, and releases that the DS6800 supports for these host systems, see the DS6000 series **Interoperability Matrix** at:

<http://www.ibm.com/servers/storage/disk/ds6000/interop.html>

DS6000 Interfaces

This section describes the following interfaces:

- IBM TotalStorage DS Storage Manager
- DS Open application programming interface
- DS Command-Line Interface (CLI)

IBM TotalStorage DS Storage Manager

The IBM TotalStorage DS Storage Manager is an interface that is used to perform logical configurations, service, copy services management, and for firmware upgrades.

The DS Storage Manager software must be installed on a computer (management console) that you provide.

You can install the DS Storage Manager as either a GUI or in unattended (silent mode) for the Windows operating systems. The unattended (silent) installation option allows you to run the installation program unattended. Use this method of installation to customize a response file and issue a command from a command prompt window. The response file is a template on the IBM TotalStorage Storage Manager CD.

The DS Storage Manager can be accessed from any location that has network access using a Web browser. It offers you the following choices that are available with the applicable license management code:

Offline configuration

This feature allows you to create and save logical configurations and apply them to an online DS6000 series. This offline configuration tool is installed on your server and can be used for the configuration of a DS6000 series at initial installation or for reconfiguration activities.

Online configuration

This feature provides you with real-time configuration support.

Express configuration

This feature provides the simplest and fastest configuration method.

Copy services

This feature allows you to process copy services functions.

DS Open application programming interface

The DS Open application programming interface (API) is a nonproprietary storage management client application that supports routine LUN management activities, such as LUN creation, mapping and masking, and the creation or deletion of RAID5 and RAID10 volume spaces. The DS Open API also enables Copy Services functions such as FlashCopy and Remote Mirror and Copy (formally known as peer-to-peer remote copy).

The IBM TotalStorage DS Open API helps integrate DS configuration management support into storage resource management (SRM) applications, which allow customers to benefit from existing SRM applications and infrastructures. The DS Open API also enables the automation of configuration management through customer-written applications. Either way, the DS Open API presents another option for managing storage units by complementing the use of the IBM TotalStorage DS Storage Manager web-based interface and the DS command-line interface.

You must implement the DS Open API through the IBM TotalStorage Common Information Model (CIM) agent, a middleware application that provides a CIM-compliant interface. The DS Open API uses the CIM technology to manage proprietary devices as open system devices through storage management applications. The DS Open API allows these storage management applications to communicate with a storage unit.

DS command-line interface

The IBM TotalStorage DS Command-Line Interface (CLI) enables open systems hosts to invoke and manage FlashCopy and Metro and Global Mirror functions through batch processes and scripts.

The command-line interface provides a full-function command set that allows you to check your storage unit configuration and perform specific application functions when necessary.

Note: Before you can use the DS CLI commands, you must ensure the following:

- Your Storage Management Console must be equipped with the DS Storage Manager graphical user interface (GUI).
- The GUI must have been installed as a Full Management Console installation management type.
- Your storage unit must be configured (part of DS Storage Manager postinstallation instructions).
- You must activate your license activation codes (part of DS Storage Manager postinstallation instructions) before you can use the CLI commands associated with Copy Services functions.
- You cannot install the DS CLI on a Windows 64-bit operating system.

The following list highlights a few of the specific types of functions that you can perform with the DS command-line interface:

- Check and verify your storage unit configuration
- Check the current Copy Services configuration that is used by the storage unit
- Create new logical storage and Copy Services configuration settings
- Modify or delete logical storage and Copy Services configuration settings

Software Requirements

To see current information on servers, operating systems, I/O adapters, and connectivity products supported by the DS6000 series, click **Interoperability Matrix** at the following DS6000 series Web site:

<http://www.ibm.com/servers/storage/disk/ds6000/interop.html>

Notification methods

Call home support and SNMP messages provide notifications to you and IBM if an event occurs on your storage unit.

Call home

The call home feature allows the transmission of operational and error-related data to IBM. It is the ability for the storage unit to alert IBM support to machine conditions. The DS Storage Manager sends data to IBM for error analysis and resolution.

Call home is enabled by default. You can disable the call home feature through the DS Storage Manager.

The following list contains the reasons or types of data for which call home support would be initiated:

- Problem notification: Data is sent when there is a problem that might require the attention of IBM support personnel.
- Heartbeat information: monitors the availability of the call home functions.
- Communication tests: to test for the successful installation and communication infrastructure.
- Informational data such as current code levels.

SNMP

Simple network management protocol (SNMP) is the standard protocol for managing networks and exchanging messages. It enables the storage unit to send external messages to notify personnel about an event.

The SNMP messages are sent from the storage unit over the local area network. You can configure the SNMP messages through the DS Storage Manager.

Remote support

The remote support function allows IBM Support to connect to your storage unit to assist you with problem determination, perform repairs, and correct error events.

Remote support provides a means for skilled IBM personnel that are located at a remote site to perform service on the storage unit, provided appropriate access has been enabled. It provides a communication method that enables faster problem determination and resolution.

You can enable remote support access through the DS6000 Storage Manager. Remote support uses secure shell (SSH) or the DS6000 Storage Manager to enable skilled remotely located IBM personnel to interact with your storage unit. Optionally, remote support can be done with virtual node configuration (VNC) if you download the VNC server. There are two ways to establish physical remote support to access the storage unit. The preferred way is through a connection to the local area network that is connected to the DS6000 processor card. However, IBM customer engineers can also access the storage unit through the serial port located on the rear operator panel.

Remote support is connected through a virtual private network (VPN) that you must initiate and maintain. You must initiate a VPN connection to IBM before IBM support personnel can use the remote support function. You can initiate a VPN connection through the DS6000 Storage Manager. The VPN manages any required data encryption for the data being transferred through the VPN connection.

You must grant permission for the support personnel to access your storage unit using SSH. You can use the DS6000 Storage Manager or command-line interface to enable or disable remote support over SSH. Also, you can enable or disable

remote support using the secure shell or serial port. Use the guest user ID to enable or disable remote support using the secure shell or serial port.

Licensed function

Activate licensed features before you configure your DS6000 series.

Before you can configure your DS6000 series, you must activate your licensed features to enable the functions purchased on your machine. The DS6000 series is licensed at the following levels:

- **Machine licensing** uses licensed machine code (LMC) to activate base functions on your machine. When you receive a DS6800 and/or DS6000 expansion enclosure, you receive an LMC agreement. The use of the machine constitutes acceptance of the license terms outlined in the LMC agreement. The DS6800 system requires LMC level 5.0.0, or later.

Some DS6000 series features and functions may not be available or supported in all environments. Current information on supported environments, prerequisites, and minimum operating systems levels is available at:<http://www.ibm.com/servers/storage/disk/ds6000/interop.html>

- **Operating environment licensing (OEL)** manages the machine operating environment and is required on every DS6800 system. The extent of IBM authorization acquired through the DS6800 feature numbers (5xxx) must cover the physical capacity of the DS6800 system, where system is defined as the base enclosure and all attached expansion enclosures.

If the operating environment license has not been acquired and activated on the machine, disk drives installed within the DS6800 system cannot be logically configured for use. Upon activation, disk drives can be logically configured up to the extent of authorization.

As additional disk drives are installed, the extent of IBM authorization must be increased by acquiring additional DS6800 feature numbers (5xxx). Otherwise, the additional disk drives cannot be logically configured for use.

- **Feature licensing** controls the licenses of features of each DS6800. Each DS6800 licensed function feature number enables the use of, and establishes the extent of, IBM authorization for licensed function(s) acquired for a DS6800 system.

Each licensed function feature number is applicable only for the specific DS6800 (by serial number) for which it was acquired and is not transferable to another serial numbered DS6800.

To activate the feature licenses for your DS6000 series, you must access the Disk Storage Feature Activation (DSFA) application from the IBM Web site.

Chapter 2. Planning use of licensed functions

Licensed functions are storage unit system operating system and software functions. These include both required features and optional features.

The following categories represent the types of DS6000 series licensed functions that are available.

- **Operating environment licensing**

You must order an operating environment license (OEL) for every DS6800 system. The extent of IBM authorization acquired through the DS6800 feature numbers (50xx) must cover the physical capacity of the DS6800 system, where system is defined as the base enclosure and all attached expansion enclosures.

- **DS6000 series Copy Services**

The DS6000 series offers licensing options, which are available for the DS6800 FlashCopy (Point-in-Time Copy) feature numbers 52xx and Remote Mirror and Copy feature numbers 53xx, 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 zSeries 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 zSeries data, a license is required for the total physical capacity of the DS6800 system including the DS6000 Expansion Enclosures.

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

- **Parallel access volumes**

The parallel access volume (PAV) function is an optional feature (number 51xx) that enables zSeries hosts to conduct multiple concurrent I/O operations. PAV requires the purchase of the FICON attachment feature number 5915.

A PAV license authorizes the use of PAV at the specified capacity. The authorization level provided by each feature number is stated within the feature number description. The unit represents physical capacity, where a TB (terabyte) equals one trillion bytes. The total authorization level for this licensed function is the sum of the units (terabytes) associated with all the purchased feature numbers.

These features can be purchased in any sequence or combination. The extent of IBM authorization is increased by purchasing additional feature numbers.

This licensed function is authorized on the basis of physical capacity and has a license scope of CKD. The total authorization level must be equal to or greater than the total amount of physical capacity within the DS6800 system that will be logically configured as CKD.

Feature codes for operating environment licensing

You must order an operating environment licensing (OEL) feature for every DS6000 series.

Table 1 on page 28 lists the operating environment licensing feature codes for the DS6000 series.

Table 1. Operating environment licensing feature codes for DS6800

Feature code	Description
5000	OEL - 1 TB unit
5001	OEL - 5 TB unit
5002	OEL - 10 TB unit
5003	OEL - 25 TB unit
5004	OEL - 50 TB unit

Copy Services functions

Review the types of DS6000 series Copy Services and identify those functions that you will use.

There are several types of Copy Services functions. Most users decide to use a combination of two or more types to form a comprehensive enterprise solution for disaster recovery, data duplication, and data migration.

Copy Services include the following types of functions:

- Point-in-time copy functions, which includes FlashCopy
- Remote mirror and copy functions, which includes Metro Mirror, Global Mirror, and Global Copy

Feature codes for point-in-time copy

When you order point-in-time copy functions, you specify the feature code that represents the physical capacity you want to authorize for the function.

You can combine feature codes to order the exact capacity that you need. For example, if you determine that you need 23 TB of point-in-time capacity, you can order two 7203 features and three 7200 features.

Note: If you have a 9A2 storage unit, you can later activate and manage the function authorization on a per-image basis. For example, if you ordered 23 TB, you could activate 10 TB on one image and 13 TB on the other image. You will activate your licenses on the IBM Disk Storage Feature Activation (DSFA) Web site after you receive the serial number for your ordered function authorization.

Table 2 provides the feature codes for the point-in-time copy function.

Table 2. Point-in-time copy (PTC) feature codes for DS6800

Feature code	Description
5200	PTC - 1 TB unit
5201	PTC - 5 TB unit
5202	PTC - 10 TB unit
5203	PTC - 25 TB unit
5204	PTC - 50 TB unit

Feature codes for remote mirror and copy

When you order remote mirror and copy functions, you specify the feature code that represents the physical capacity to authorize for the function.

Remote mirror and copy features must be purchased for both the primary and secondary DS6000 systems.

Remote mirroring solutions require the installation of at least one fibre channel or FICON host port on each DS6000 system in the remote mirroring configuration to serve as the communications link between the primary and secondary machines. For higher availability, use more than one host port per DS6800 be used for the remote mirroring connectivity.

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.

Remote mirror and copy solutions are supported with the use of SAN fabric products. To see a current list of supported environments, configurations, networks, and products, see the DS6000 series **Interoperability Matrix** at:

<http://www.ibm.com/servers/storage/disk/ds6000/interop.html>

Table 3 provides the feature codes for the remote mirror and copy functions.

Table 3. Remote mirror and copy (RMC) feature codes for DS6800

Feature code	Description
5300	RMC - 1 TB unit
5301	RMC - 5 TB unit
5302	RMC - 10 TB unit
5303	RMC - 25 TB unit
5304	RMC - 50 TB unit

Feature codes for parallel access volume

When you order the parallel access volume (PAV) function, you specify the feature code that represents the physical capacity allowed for the function.

PAV requires the purchase of the FICON attachment feature number 5915.

A license is required for the total physical capacity in the storage unit that is configured as count key data.

The following table provides the feature codes for the parallel access volume function.

Table 4. Parallel access volume (PAV) feature codes for DS6800

Feature code	Description
5100	PAV - 1 TB unit
5101	PAV - 5 TB unit
5102	PAV - 10 TB unit

Table 4. Parallel access volume (PAV) feature codes for DS6800 (continued)

Feature code	Description
5103	PAV - 25 TB unit
5104	PAV - 50 TB unit

FICON Attachment license

If you order the PAV function, you must also order a FICON attachment feature.

Table 5 provides the feature code for a FICON server attachment license.

Table 5. Server attachment license (FICON) for DS6800

Feature code	Server attachment license
5915	FICON attachment

Chapter 3. Planning the physical configuration

This section provides planning information to help you set up your DS6000 series environment. It also lists the feature codes that you will need to order the various features of your storage complex.

Storage Management Console

A Storage Management Console is the configuration, service, and management portal for the DS6800.

A Storage Management Console is required for your DS6800. You must provide either a computer to use as your Storage Management Console or you can optionally order a computer from IBM. This computer must meet a minimum set of hardware and operating system compatibility requirements. If a Storage Management Console is ordered, it is placed as a separate order from the DS6800.

The Storage Management Console requires the DS Storage Manager software that is provided with your DS6800.

You use the management system to perform the following tasks:

- Logically configure your DS6000 series
- Manage the following functions:
 - Local maintenance
 - Copy services
 - Remote service support and call home
 - Event notification messaging

Storage Management Console requirements

Use a computer that meets hardware and operating system compatibility requirements to install DS Storage Manager software.

Before you can install the DS Storage Manager software on a computer that you will use to manage your storage system, you must ensure that your computer meets a minimum set of hardware and operating system compatibility requirements:

- IBM PC compatible with the following components:
 - 1.4 GHz Pentium® 4 processor
 - 256 KB cache
 - 512 MB memory
 - 1 GB disk space for the DS Storage Manager software
 - 1 GB work space per managed Integrated RAID Controller (IRC)
 - Ethernet IP connectivity to each RAID controller card
 - Ethernet IP connectivity to external network (for call home and remote support)
 - CD connectivity

Supported operating systems:

Operating System	Full management console install	Offline management console install
Windows® Server 2003 Enterprise Edition	X	X
Windows Server 2003 Standard Edition	X	X
Windows 2000 Advanced Server SP4	X (English only)	X
Windows 2000 Server SP4	X (English only)	X
Windows 2000 Professional SP4	X (English only)	X
Windows XP Professional SP1		X
Windows XP Professional SP1a		X
Windows XP Professional SP2	X	X

Note: The DS6000 Storage Manager is not supported on any Windows 64-bit operating system.

Note: Animations must be turned on in your browser if you want to observe the installation progress bars that are associated with the DS Storage Manager installation. Use the following instructions for your specific browser:

- Internet Explorer
 1. From the **Tools** menu select **Internet Options**.
 2. Select the **Advanced** tab and scroll down to the **Multimedia** section.
 3. Check **Play animation in web pages**.
- Netscape
 1. From the **Edit** menu select **Preferences**.
 2. Double-click on **Privacy and Security**.
 3. Select **Images** and select **as many times as the image specifies** in the **Animated image should loop** section.

Ensure that you complete and have available these planning work sheets. They can be found in the DS6000 Introduction and Planning Guide, Chapters 5 and 6:

- Configuration work sheet
- Network settings work sheet
- Host attachment work sheet
- Activation codes work sheet

If you want to order a management console, consider the IBM 8141 ThinkCentre™ M51 Model 23U (8141-23U) Desktop system with a 3.0 GHz/800 MHz Intel® Pentium 4 Processor. If a monitor also is required, IBM suggests the IBM 6737 ThinkVison C170 (6737-66x or 6737-K6x) 17-inch full flat shadow mask CRT color monitor with a flat screen (16-inch viewable-image).

Storage Management Console configuration

You can use the direct management method for your DS6000 series storage configuration.

This method uses Ethernet connections from a management console to each controller. The management station can be the host or a workstation on the Ethernet network.

Each RAID controller must have connectivity to each other and to your Storage Management Console. Use the Ethernet interface ports on each RAID controller at the rear of the storage enclosure to connect a pair of Ethernet cables from the Storage Management Console to the controllers for direct management.

Disk drive module (DDM) storage features

Use the disk drive feature codes to order the disk drive sets for your base enclosure or an expansion enclosure.

Disk drive sets contains 4 identical disk drives with the same capacity and rpm. Disk drives are available in 73 GB (15,000 rpm), 146 GB (10,000 rpm), or 300 GB (10,000 rpm) disk drives. A minimum of two disk drive feature codes (8 drives) are required (see Table 6) for your DS6000 series configuration.

You also can order additional storage capacity to your base enclosure or to an expansion enclosure. They also must be a minimum of two feature codes (8 drives).

Table 6. Fibre-channel disk drive sets for DS6000 series

Feature code	Description	Quantity
2002	146 GB (10K rpm) drive set	4 per feature
2004	300 GB (10K rpm) drive set	4 per feature
2052	73 GB (15K rpm) drive set	4 per feature
2990	HDD Dummy Carriers	4 per feature

Capacity calculation guidelines

To help you determine the type and number of disk drives to add to your storage unit, calculate the physical and effective capacity of the disk drives.

Calculating physical and effective capacity

To calculate the total physical capacity of a DS6000 series, multiply each disk drive set feature by its total physical capacity and sum the values.

The logical configuration of your DS6000 series storage affects the effective capacity of the disk drive set.

Specifically, effective capacities depend on the following:

- Whether the physical capacity is logically configured as fixed block (FB) or count key data (CKD)
Data for open systems must be logically configured as FB. Open systems hosts. Data for zSeries must be configured as count key data (CKD).
- How the arrays on the system are combined into ranks
One or more arrays are combined to create a contiguous storage space called a rank. Each rank is divided into DS6000 extents. The effective capacity for FB extents will be different than the capacity for CKD extents.

Table 7 and Table 8 lists the effective capacity of a DS6800 disk drive sets.

Table 7. Disk drive set capacity (RAID 10 arrays)

Disk size (GB) (See Note 2)	Total physical capacity per (GB) disk drive set (See Note 3)	Fixed block (FB) or count key data (CKD)	Effective capacity in GB (Number of Extents)			
			Ranks of RAID 10 arrays			
			1 × 2 (See Note 4)	2 × 2 (See Note 5)	3 × 3 (See Note 6)	4 × 4 (See Note 7)
73	292	FB	67.57 (62)	136.06 (127)	204.01 (190)	272.73 (254)
		CKD	64.33 (68)	135.28 (143)	201.50 (213)	268.67 (284)
146	584	FB	136.37 (127)	275.32 (256)	414.46 (386)	552.98 (515)
		CKD	134.33 (142)	271.50 (287)	408.67 (432)	545.85 (577)
300	1200	FB	281.32 (262)	561.27 (523)	845.03 (787)	1125.28 (1050)
		CKD	275.293 (291)	555.31 (587)	832.48 (880)	1110.61 (1174)
Note:						
1. All values for capacity and extent numbers are based on preliminary data.						
2. Physical capacities are in decimal gigabytes (GB). One GB is one billion bytes.						
3. Although disk drive sets contain 4 drives, arrays use either 4 or 8 drives.						
4. The array consists of 1 data drive that is mirrored to 1 copy drive. Two other drives in the disk drive set are used as spares.						
5. The array consists of 2 data drives that are mirrored to 2 copy drives.						
6. The array consists of 3 data drives that are mirrored to 3 copy drives. Two other drives in the disk drive set are used as spares.						
7. The array consists of 4 data drives that are mirrored to 4 copy drives.						

Table 8. Disk drive set capacity (RAID 5 arrays)

Disk size (GB) (See Note 2)	Total physical capacity (GB) per disk drive set (See Note 3)	Fixed block (FB) or count key data (CKD)	Effective capacity in G (Number of Extents)			
			Ranks of RAID 5 arrays (See Note 4)			
			2 + P (See Note 5)	3 + P (See Note 6)	6 + P (See Note 7)	7 + P (See Note 8)
73	292	FB	136.06 (127)	204.01 (190)	410.17 (382)	477.82 (445)
		CKD	135.28 (143)	201.50 (213)	404.89 (428)	473.00 (500)
146	584	FB	275.32 (256)	410.46 (386)	830.00 (773)	968.52 (902)
		CKD	271.50 (287)	408.67 (432)	820.19 (867)	956.41 (1011)

Table 8. Disk drive set capacity (RAID 5 arrays) (continued)

Disk size (GB) (See Note 2)	Total physical capacity (GB) per disk drive set (See Note 3)	Fixed block (FB) or count key data (CKD)	Effective capacity in G (Number of Extents)			
			Ranks of RAID 5 arrays (See Note 4)			
			2 + P (See Note 5)	3 + P (See Note 6)	6 + P (See Note 7)	7 + P (See Note 8)
300	1200	FB	561.27 (523)	845.03 (787)	1692.22 (1576)	1972.46 (1837)
		CKD	555.31 (587)	832.48 (880)	1669.70 (1765)	1947.83 (2059)

Note:

1. All values for capacity and extent numbers are based on preliminary data.
2. Physical capacities are in decimal gigabytes (GB). One GB is one billion bytes.
3. Although disk drive sets contain 4 drives, arrays use either 4 or 8 drives.
4. In RAID 5 configurations, the parity information uses the capacity of one disk but is actually distributed across all of the disks within the array.
5. The array consists of 2 data drives and 1 parity drive. One other drive is used as a spare.
6. The array consists of 3 data drives and 1 parity drive.
7. The array consists of 6 data drives and 1 parity drive. One other drive is used as a spare.
8. The array consists of 7 data drives and 1 parity drive.

Fiber optic host cables

Each host port requires one LC-LC type fiber optic cable to attach to host systems or switches. Cables are available with two duplex LC-type connectors (LC-LC type) of various lengths.

The fiber optic host cables can be multimode 50 micrometers or 9.0 micrometers for distances up to 300 meters at 2 Gbps performance for the host port.

Table 9 lists the feature codes used to order 50 micron (multimode) host cables for use with the fibre channel/FICON host shortwave Small Form-factor Pluggable (SFP) feature (#1310). The cables include a LC connector for attachment to the DS6800 with SFPs. The cables range from 2 meters to 31 meters in length.

Table 9. Shortwave fiber optic host cables feature codes for DS6800

Feature Code	Cable Type (LC-LC)	Quantity
1350	2M (50 micron) LC-LC cable	1 per feature
1351	7M (50 micron) LC-LC cable	1 per feature
1352	31M (50 micron) LC-LC cable	1 per feature

Table 10 on page 36 lists the feature codes used to order a 9 micron (singlemode) host cable for use with the Fibre Channel/FICON host longwave SFP feature (#1315). The cables include an LC connector for attachment to the DS6800 SFPs and are available with an LC connector for attachment to servers and fabric components. The cables range from 2 meters to 31 meters in length.

Table 10. Longwave fiber optic host cables feature codes for DS6800

Feature Code	Cable Type (LC-LC)	Quantity
1360	2M (9 micron) LC-LC cable	1 per feature
1361	7M (9 micron) LC-LC cable	1 per feature
1362	31M (9 micron) LC-LC cable	1 per feature

Fibre channel host interposers

If you are attaching a host port to systems or switches using the larger SC-type connector, an LC-SC fibre channel host interposer is required.

Table 11 lists the fibre channel host interposers that you can order for your DS6000 series.

Table 11. Fibre channel host interposers feature codes for DS6800

Feature Code	Cable Type (LC-SC)	Description
1370	50 micron LC-SC interposers	Attaches to a shortwave fibre optical cable
1371	9 micron LC-SC interposers	Attaches to a longwave fibre optical cable.

Expansion enclosure cables

The DS6000 series provides device ports for attaching the expansion enclosure (1750-EX1) to the DS6800 series.

Each connection from the DS6800 to the DS6000 expansion enclosure requires an LC-LC type connector on the fiber optic cable.

Four fiber optical expansion cables, offered in multiple lengths, are required to attach the DS6800 and the expansion enclosure. Each feature code contains four cables.

Table 12 lists the expansion cables that you can order.

Table 12. DS6000 expansion enclosure cable feature codes

Feature Code	Cable Type (LC-LC)	Quantity
1380	2M (50 micron) fiber optic expansion cable	4 per feature
1381	7M (50 micron) fiber optic expansion cable	4 per feature
1382	31M (50 micron) fiber optic expansion cable	4 per feature

Fibre channel host attachment ports

Use these feature codes when you order fibre channel host ports for your DS6800.

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The DS6800 host interface requires a minimum of two host attachment ports to be enabled, one per each RAID controller card. For the DS6800, a minimum of two SFP connectivity ports (one per controller) and a maximum of eight SFPs are available for direct connection to host servers or switched SAN fabrics.

The SFPs are available for host connections in shortwave SFP Pairs (feature number 1310) and longwave SFP Pairs (feature 4 number 1315). Shortwave SFPs are for use with fiber cable lengths of 300 meters or less. Longwave SFPs are used for cable distances up to 10 km (6.2 miles). If the DS6800 (1750-511) is to be attached to the DS6000 expansion enclosure (1750-EX1), eight shortwave SFPs will be included in the order of the DS6000 expansion enclosure.

Table 13. Host connectivity ports - shortwave for DS6800

Feature Code	Connectivity port	Quantity
1310	Shortwave SFP pair	2 per feature code

Table 14. Host connectivity ports - longwave for DS6800

Feature Code	Connectivity port	Quantity
1315	Longwave SFP pair	2 per feature code

System rack feature codes

You can install the DS6000 series in a 2101-200 system rack or in a supported rack enclosure.

The feature code 0800, listed in Table 15, is used to indicate that the DS6000 series ordered will be assembled into an IBM TotalStorage 2101-200 System Rack by IBM manufacturing. When selecting this feature the DS6000 series, Machine Type 1750 must be included on the same system order as the 2101-200 Rack. This feature will be automatically added to DS6000 series orders using the ECFGSSG configurator.

The feature code 0801 is used to indicate that the DS6000 series ordered will be shipped as an assembled enclosure for field integration into a supported rack enclosure. Supported rack enclosures include the IBM 7014 RS/6000 Rack, and the IBM 9308 Netfinity Enterprise Rack. Field integration of the DS6000 series is customer setup, unless the DS6000 Installation Services are utilized. This feature will be automatically added to DS6000 series orders using the ECFGSSG configurator.

Use these feature codes when you order a system rack for your DS6000 series.

Table 15. System rack feature codes for DS6000 series

Feature Code	System rack
0800	Plant integrate into 2101-200 system rack
0801	Field integrate in supported rack enclosure

Power line cords

Each DS6000 series (Model 1750-511 or 1750-EX1) uses two standard power cords. You can connect the power cords to a primary power unit inside the rack, such as a properly grounded ac distribution unit, or to an external source, such as a properly grounded electrical outlet.

Power cords to connect the DS6000 series to a rack Power Distribution Unit (PDU) that has IEC 320, sheet C13, type power outlets, is shipped with the each DS6000 series. If the DS6000 series will be installed in a rack with a PDU that has wall type power outlets, power cords must be ordered with the DS6000 series models to connect to this type of PDU (PDU with wall type power outlets).

IBM power cords used in the United States and Canada are listed by Underwriter's Laboratories (UL) and certified by the Canadian Standards Association (CSA).

For units intended to be operated at 115 volts: Use a UL-listed and CSA-certified cord set consisting of a minimum 18 AWG, Type SVT or SJT, three-conductor cord, a maximum of 15 feet in length and a parallel blade, grounding-type attachment plug rated 15 amperes, 125 volts.

For units intended to be operated at 230 volts (U.S. use): Use a UL-listed and CSA-certified cord set consisting of a minimum 18 AWG, Type SVT or SJT, three-conductor cord, a maximum of 15 feet in length and a tandem blade, grounding-type attachment plug rated 15 amperes, 250 volts.

For units intended to be operated at 230 volts (outside the U.S.): Use a cord set with a grounding-type attachment plug. The cord set should have the appropriate safety approvals for the country in which the equipment will be installed.

The feature codes listed in Table 16 provide two power cords for the DS6000 series. You must specify the power cord appropriate for your country or region from the feature codes listed in this section. IBM power cords for a specific country or region are usually available only in that country or region. Only one of these feature codes can be selected.

Table 16. Power cord feature codes

Feature Code	Cord specifics	Used in these countries or regions
9800	125V/10A, 2.8M	Albania, Antigua, Aruba, Bahamas, Barbados, Belize, Bermuda, Bolivia, Brazil, Canada, Cayman Islands, Columbia, Costa Rica, Dominica, Dominican Republic, Ecuador, El Salvador, Eritrea, Grenadines, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Japan, Korea, Nicaragua, Mexico, Panama, Peru, Philippines, Saudi Arabia, St. Lucia, St. Vincent, Suriname, Taiwan, Trinidad, United States (U.S.), Venezuela, Vietnam

Table 16. Power cord feature codes (continued)

Feature Code	Cord specifics	Used in these countries or regions
9820	250V/10A, 2.8M	Afghanistan, Angola, Antilles, Arab Republic, Armenia, Austria, Belgium, Belarus, Bosnia, Botswana, Bulgaria, Burundi, Cameroon, Cape Verde Islands, Central Africa Republic, Congo, Czech Republic, Egypt, Estonia, Finland, France, French Polynesia, Germany, Greece, Guinea, Hungary, Iceland, Indonesia, Kazakhstan, Kirghizstan, Latvia, Lebanon, Lesotho, Liberia, Liechtenstein, Luxembourg, Macedonia, Mali, Mauritania, Moldavia, Morocco, Mozambique, Netherlands, Norway, Poland, Portugal, Republic of Djibouti, Romania, Russia, Rwanda, Sao Tome and Principe, Senegal, Serbia, Slovakia, Slovenia, Spain, Sudan, Swaziland, Sweden, Syria, Tunisia, Turkey, Ukraine, Uzbekistan, Zaire, Zimbabwe
9821	250V/10A, 2.8M	Denmark
9825	250V/10A, 2.8M	Abu Dhabi, Bahrain, Brunei, Cyprus, Fiji, Gambia, Ghana, Hong Kong S.A.R. of China, Iraq, Ireland, Jordan, Kenya, Kuwait, Macao S.A.R of China, Malawi, Malaysia, Nepal, Nigeria, North Yemen, Oman, Qatar, Sierra Leone, Singapore, Tanzania, Uganda, United Arab Emirates, United Kingdom (UK), Zambia
9827	250V/10A, 2.8M	Israel
9828	250V/10A, 2.8M	Switzerland
9829	250V/10A, 2.8M	Bangladesh, India, Myanmar, Pakistan, South Africa, Sri Lanka
9830	250V/10A, 2.8M	Chile, Ethiopia, Italy, Libya, Malta, Somalia
9831	250V/10A, 2.8M	Australia, New Zealand
9833	250V/10A, 2.8M	Thailand
9834	250V/10A, 2.8M	Argentina, Paraguay, Uruguay
9840	250V/10A, 2.8M	People's Republic of China
9841	125V/10A, 2.8M	Taiwan
9986	250V/10A, 2.8M	U.S. Chicago

Power connector requirements

Ensure that the site where you plan to install the DS6000 series meets the power connector requirements.

Table 17 on page 40 provide the power line cords and the inline connectors and receptacles types that they support. Find the power line cord row that is appropriate for your site and ensure that the site where you plan to install the DS6000 series meets the power connector requirements that are shown in that row.

Phase rotation on three-phase power-cable connectors is counterclockwise as you look at the power line cord plug. Phase rotation is clockwise as you look at the face of the power receptacle at your installation site.

Table 17. DS6000 series power connectors

Power Line Cord Feature Code	Power Line Cord Description	Inline Connector	Receptacle
9820	Line cord for Afghanistan, Angola, Antilles, Arab Republic, Armenia, Austria, Belgium, Belarus, Bosnia, Botswana, Bulgaria, Burundi, Cameroon, Cape Verde Islands, Central Africa Republic, Congo, Czech Republic, Egypt, Estonia, Finland, France, French Polynesia, Germany, Greece, Guinea, Hungary, Iceland, Indonesia, Kazakhstan, Kirghizstan, Latvia, Lebanon, Lesotho, Liberia, Liechtenstein, Luxembourg, Macedonia, Mali, Mauritania, Moldavia, Morocco, Mozambique, Netherlands, Norway, Poland, Portugal, Republic of Djibouti, Romania, Russia, Rwanda, Sao Tome and Principe, Senegal, Serbia, Slovakia, Slovenia, Spain, Sudan, Swaziland, Sweden, Syria, Tunisia, Turkey, Ukraine, Uzbekistan, Zaire, Zimbabwe	IEC 320 C13	plug type 18 (CEE7 VII)
9821	Line cord for Denmark	IEC 320 C13	plug type 19 (CEE)
9825	Line cord for Abu Dhabi, Bahrain, Brunei, Cyprus, Fiji, Gambia, Ghana, Hong Kong S.A.R. of China, Iraq, Ireland, Jordan, Kenya, Kuwait, Macao S.A.R of China, Malawi, Malaysia, Nepal, Nigeria, North Yemen, Oman, Qatar, Sierra Leone, Singapore, Tanzania, Uganda, United Arab Emirates, United Kingdom (UK), Zambia	IEC 320 C13	plug type 23 (BS1364A)
9827	Line cord for Israel	IEC 320 C13	plug type 32 (SII 32)
9829	Line cord for Bangladesh, India, Myanmar, Pakistan, South Africa, Sri Lanka	IEC 320 C13	plug type 22 (SABS 164)
9830	Line cord for Chile, Ethiopia, Italy, Libya, Malta, Somalia	IEC 320 C13	plug type 25 (CEI)
9834	Line cord for Argentina, Paraguay, Uruguay	IEC 320 C13	plug type 2 (IRAM) plug type 62
9840	Line cord for People's Republic of China	IEC 320 C13	plug type 62 (GB1053)

Feature codes for a modem

You can use a modem to create a dial-up Virtual Private Network connection for remote support instead of using an Internet connection .

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The following table provides the feature codes that you can use to order a modem.

Feature code	Country Group
1201	Argentina, Belize, Bolivia, Brazil, Canada, Chile, Columbia, Costa Rica, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Japan, Mexico, Nicaragua, Panama, Peru, Puerto Rico, Taiwan, Uruguay, U.S.A., Venezuela
1202	Australia, New Zealand
1203	Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, India, Indonesia, Italy, Kazakhstan, Korea, Latvia, Lebanon, Liechtenstein, Lithuania, Luxemburg, Morocco, Netherlands, Norway, Philippines, Poland, Portugal, Romania, Russia, Slovakia, Slovenia, Spain, Sri Lanka, Suriname, Sweden, Switzerland, Thailand, Turkey, Vietnam
1204	Cyprus, Egypt, Ireland, Kuwait, Malta, Oman, Saudi Arabia, South Africa, United Kingdom
1205	China, Hong Kong S.A.R. of China, Macau, Singapore

Chapter 4. Planning for installation

Before you can start to set up your DS6000 series, you will want to verify that the prerequisite conditions for the DS6000 series are met.

The following planning guidelines will help you identify and gather the information required during the installation process.

1. Prepare your physical site to meet all area, environment, and power requirements.
2. Move the DS6000 series to your site. Ensure that you use safe practices when lifting.
3. Ensure that the floor area provides enough stability to support the weight of the fully configured DS6000 series and associated components.
4. Ensure that you have adequate rack space for your hardware.
5. Assemble the tools and equipment that you will need for installation. This includes the following items:
 - a. Power cords
 - b. Host fibre channel and Ethernet interface cables
 - c. Host SFPs
 - d. Fibre channel disk drives
 - e. Antistatic protection
 - f. The rack-mounting hardware that ships with the DS6000 series
 - g. The IBM TotalStorage DS Storage Manager CD, which includes the DS Storage Manager software and firmware
 - h. Flathead screwdriver
6. Identify a management client server and ensure that it meets the hardware and operating system compatibility requirements.
7. Gather the World Wide Port Names (WWPNs) of your open systems hosts that you want to attach to the DS6000 series.
8. Determine your storage configuration information, such as:
 - a. RAID levels
 - b. Arrays
 - c. LUN sizes

Preparing the physical environment for your DS6000 series

This section provides information you need to ensure that your physical site meets the installation requirements for the DS6000 series.

Table 18 provides the dimensions and weight of either a fully configured Model 1750-511 or the Model 1750-EX1 expansion enclosure.

Table 18. Dimensions and weight for Model 1750-511 or Model 1750-EX1 expansion enclosure

Height	Width	Depth	Maximum Weight (fully configured)
5.25 inches (0.134 meters)	18.80 inches (0.478 meters)	24.00 inches (0.610 meters)	109 lbs. (49.5 kg)

Service-clearance and floor-load requirements

This topic provides floor-loading strength and service clearances for the DS6000 series.

Clearances for the DS6000 models or expansion enclosure

For each DS6000 series model or expansion unit, service personnel must be able to open the front and rear covers to perform service.

Service clearance refers to the empty space in front of, next to, or behind a storage unit that a service person needs in order to access the unit. The service clearance of adjacent units may overlap. Weight distribution areas that are required to handle floor loading do not overlap.

Use the following minimum service clearances when planning the placement of your system.

- At the front of the unit, allow a minimum of 121.9 cm (48-in.)
- At the rear of the unit, allow a minimum of 76.2 cm (30-in.)
- At each side of the unit, allow a minimum of 5.1 cm (2-in.)

Planning for environment requirements

Plan to locate your DS6000 series in a site that has the same environment for the base unit and any expansion units.

Operating environment

Table 19 describes the environment operating requirements for the DS6800 (Model 1750-511). The 1750-EX1 expansion unit has the same environmental requirements.

Table 19. Operating environment

Powered on temperature limit	10 - 40°C (50 - 104°F)
Powered off temperature limit	10 - 52°C (50 - 126°F)
Recommended operating point	22°C (72°F)
Recommended operating range	20 - 25°C (68 - 77°F)
Maximum wet bulb temperature	27°C (80° F) Note: <ol style="list-style-type: none">1. The upper limit of dry bulb temperature must be de-rated (lowered) 1.0°C for every 137 meters of elevation above 915 meters.2. The upper limit of wet bulb temperature must be derated (lowered) 1.0°C for every 274 meters of elevation above 305 meters.
Relative humidity	8 - 80 percent
Typical heat load	550 watts or 1880 Btu/hr
Electrical power	0.8 kVA
Capacity of exhaust	1.8 cubic meters (64 cfm)
Leakage current	1.5 mA (100-127 V ac), 3 mA (200-240 V ac)

Table 19. Operating environment (continued)

Maximum physical storage capacity	67.2 GB
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Table 20 describes the acoustic declaration information for the DS6000 series.

Table 20. Acoustic declaration for the DS6000 series

Product Description	Declared A-Weighted Sound Power Level, LWAd (B)		Declared A-Weighted Sound Pressure Level, LpAm (dB)	
	Operating	Idling	Operating	Idling
DS6000 series when mounted in a 7014 rack with 16 DDMs	6.2	6.1	44	43
Note: <ol style="list-style-type: none"> 1. LWAd is the statistical upper-limit A-weighted sound power level (rounded to the nearest 0.1 B). 2. LpAm is the mean A-weighted emission sound pressure level measured at the 1-meter bystand (rounded to the nearest dB). 3. 10 dB (decibel) = 1 B (bel). 4. All measurements made in conformance with ISO 7779 and declared in conformance with ISO 9296. 				

Power supply

The DS6000 series has built-in redundant, auto-sensing, auto-ranging power supplies. The power supplies are designed for operation on a voltage range of 90-257 V ac, 50-60 Hz.

Input voltage requirements

This topic gives the input voltage requirements for the DS6000 series.

Table 21 lists the input voltages and frequencies that the DS6000 series power line cords support. The values apply to both the primary line cords to any storage or expansion enclosure in a DS6000 series. DS6000 series power inputs are single phase.

Table 21. DS6000 series input voltage requirements

Characteristic	Value
Nominal input voltages	100-127 RMS V ac 200-240 RMS V ac
Minimum input voltage	90 RMS V ac
Maximum input voltage	264 RMS V ac
Input frequencies	50 ± 3.0 Hz 60 ± 3.0 Hz

Preparing the rack

Before you install the DS6000 series in a rack, you must prepare the rack.

The DS6000 series requires an Electronic Industries Association (EIA) 310-D Section 1 19-inch rack cabinet. The distance between EIA rails, from the front to the rear of the rack, is 69.5 centimeters (27.36 inches) minimum to 76.5 centimeters (30.12 inches) maximum. This rack conforms to the EIA standard. Where you place the support rails in the rack depends on where you intend to position the server or storage enclosure.

- Review the documentation that comes with your rack enclosure for safety and cabling considerations.
- To ensure rack stability, load the rack starting at the bottom.
- If you install multiple components in the rack, do not overload the power outlets.
- Always connect the storage server to a properly grounded outlet.
- Always connect the rack power to at least two different power circuits or sources. This reduces the chance of a simultaneous loss of both ac power sources.

Rack mounting template

The rack mounting template identifies the proper locations for mounting the support rails.

Use the following template to identify the proper locations for inserting M5 screws when mounting the support rails and the DS6000 series into a rack. The locations for the top rail pin and the bottom rail pin are highlighted in the template.



Considering safety issues

You must consider various safety issues when you plan your DS6000 series location.

The following list identifies some of the safety issues you must consider:

- Fire suppression
- Earthquake safety

Providing a fire-suppression system

You are responsible for providing a fire suppression system for your DS6000 series.

IBM designs and manufactures equipment to internal and external standards that require certain environments for reliable operation. Because IBM does not test any equipment for compatibility with fire-suppression systems, IBM does not make compatibility claims of any kind. IBM does not provide recommendations on fire-suppression systems.

1. Consult your insurance underwriter, local fire marshal, or local building inspector about selecting a fire-suppression system that provides the proper level of coverage and protection.

2. See “Planning for environment requirements” on page 44 for the temperature and cooling requirements for your DS6000 series.

Considering earthquake preparedness alternatives

If you are installing your DS6000 series in an area that is prone to earthquakes, plan for special installation methods to minimize earthquake damage to your system.

An unsecured storage unit or expansion unit can topple or be thrown around during an earthquake. This places both the unit and your personnel in danger. To help prevent damage, restrain your storage unit using one of the following two methods:

Restraint method

Allows some system movement and provides for both personnel safety and protection of your storage unit.

Hard mounting

Physically attaches your system to the floor. This method increases the safety of personnel during an earthquake. However, it also causes the most damage to the storage unit because the unit absorbs most of the shock. IBM does not support hard mounting.

Delivery requirements

Before you receive your DS6000 series shipment, ensure that you meet all delivery requirements.

The topics in this section will help you ensure that you select a site that meets all requirements.

Receiving the DS6000 series shipment

The shipping carrier is responsible for delivering and unloading the DS6000 series as close to its final destination as possible. You must ensure that your loading ramp and your receiving area can accommodate your DS6000 series shipment.

Use the following steps to ensure that your receiving area and loading ramp can safely accommodate the delivery of your DS6000 series:

1. Find out the packaged weight and dimensions of the storage unit container and other containers that you will receive.
2. Ensure that your loading dock, receiving area, and elevators can safely support the packaged weight and dimensions of the shipping containers.

Shipment weights and dimensions

To help you plan for the delivery of your DS6000 series, you must ensure that your loading dock and receiving area can support the weight and dimensions of the packaged DS6000 shipments.

You receive one or more shipping containers for each DS6000 series that you order depending on whether or not you also ordered a 2101-200 rack. Depending on your order, you will receive the following:

- When you order the DS6000 series without a rack, the shipping container also will include ship group items such as power cords, CDs, and other ordered features or peripherals within the same container.

- When you order the DS6000 series with a 2101-200 rack, the ship group items such as power cords, CDs, and other ordered features or peripherals will be packaged and shipped in a separate container.

Table 22 lists the final packaged dimensions and maximum packaged weight of a DS6000 series shipment without a 2101-200 rack. Table 23 lists the final packaged dimensions and maximum packaged weight of a DS6000 installed in a fully loaded 2102-200 rack and includes the ship group items.

Table 22. Packaged dimensions and weight for DS6000 series without a rack (all countries)

Shipping container	Packaged Dimensions (in millimeters and inches)	Maximum Packaged Weight (in kilograms and pounds)
Model 1750-511 in a Nefab crate with EPE cushioning banded to pallet	Length 1000 mm (39.37 in.) Width 600 mm (23.62 in.) Depth 425 mm (16.73 in.)	70 kg (154.02 lb)
Model 1750-511 in a corrugated HSC carton with EPE cushioning banded to pallet	Length 1000 mm (39.37 in.) Width 600 mm (23.62 in.) Depth 425 mm (16.73 in.)	65 kg (144.01 lb)

Table 23. Packaged dimensions and weight for the DS6000 series including the 2101-200 rack (all countries)

Shipping container	Packaged Dimensions (in millimeters and inches)	Maximum Packaged Weight for a Fully Loaded Rack (in kilograms and pounds)
Model 1750-511 installed in a 2101-200 rack in a Nefab crate	Length 1295 mm (50.98 in.) Width 830 mm (32.68 in.) Depth 2005 mm (78.94 in.)	1000 kg (2204.59 lb)
Model 1750-511 in a 2101-200 rack with fiberboard hood	Length 1295 mm (50.98 in.) Width 830 mm (32.68 in.) Depth 1975 mm (77.76 in.)	1000 kg (2204.59 lb)

Planning for network and communications requirements

You must locate your DS6000 series in a location that meets the network and communications requirements.

Keep in mind the following network and communications issues when you plan the location and interoperability of your storage complex:

- Host attachment requirements
- Remote support connection requirements
- SAN considerations

Host attachment communication requirements

This list describes requirements and other considerations for connecting host attachments in your network.

- You must use worldwide port names to uniquely identify fibre-channel adapter cards that are installed in your host system.
- For open-system hosts with fibre-channel adapters, keep in mind that fibre-channel architecture provides a variety of communication protocols. Each interconnected storage unit within the architecture is referred to as a node, and each host is also a node. Each node corresponds to one or more ports. (In the case of fibre-channel I/O adapters, these ports are fibre-channel ports.) Each port attaches to a serial-transmission medium that provides duplex communication with the node at the other end of the medium. You can configure your network structure based on one of three basic interconnection topologies (network structures):
 - Point-to-point
 - Switched fabric
 - Arbitrated loop

See the *IBM TotalStorage DS6000 Host Systems Attachment Guide*, for more information about these supported topologies.

- The maximum distance between a host fibre-channel port and the following network components is 11 km (6 mi):
 - Fabric switches
 - Fabric hubs
 - Link extenders
 - Storage unit fibre-channel port

The maximum distance might be greater than 11 km (6 mi) when a link extender provides target initiator functions or controller emulation functions.

Note: Do not use link extenders with emulation functions on links over which remote mirror and copy operations are performed. This is because of the additional path delay that is introduced by these units.

- Because the fibre-channel architecture allows any fibre-channel initiator to access any fibre-channel device, without access restrictions, this can represent a security exposure. You must set the fibre-channel access modes to the proper setting. See the *IBM TotalStorage DS6000 Host Systems Attachment Guide*, for more information about fibre-channel access modes.

Remote support connection requirements

You must meet the requirements if you will use remote support.

You must allow an outside connection, such as one of the following:

- A VPN connection
- An internet connection through your firewall that allows IBM to connect to your storage management system.

SAN requirements and considerations

These requirements and considerations can help you plan for a DS6000 series that attaches to a SAN.

A fibre-channel storage area network (SAN) is a specialized, high-speed network that attaches servers and storage devices. With a SAN, you can perform an any-to-any connection across the network using interconnect elements such as routers, gateways, hubs, and switches.

When you connect your DS6000 storage units to a SAN, you must meet the following requirements:

- Fibre-channel I/O adapters must be configured to operate in a point-to-point mode fabric topology. See the *IBM TotalStorage DS6000 Host Systems Attachment Guide*, for more information.

You can also keep the following considerations in mind:

- Fibre-channel SANs can provide the capability to interconnect open systems and storage in the same network as S/390 and zSeries host systems and storage.
- A single fibre-channel I/O adapter can have physical access to multiple fibre-channel ports on the storage unit.

Chapter 5. Planning your DS6000 series

This section provides the following planning information for your DS6000 series setup.

- Configuration work sheet
- Completing the network settings work sheet
- Configuration methods for your storage complex

Configuration work sheet

Complete the configuration work sheet by entering the information that you will need before installing the DS6000 series.

Item or Setting	Instructions	Your information
Nickname	Create a storage unit nickname. The name is limited to 16 characters.	
Storage unit description	You can optionally provide a storage unit description. The description field is limited to 256 characters.	
Processor controller card 1 IP Address	Record the dotted decimal IP address that you are assigning for Processor controller card 0 in the DS6800. The current IP address should be the default address.	
Processor controller card 2 IP Address	Provide the dotted decimal address that you are assigning to Processor card 1 in the DS6800. The current IP address should be the default address.	
Storage unit model, machine type, serial number (MTMS)	Record the storage unit model, machine type, and serial number	

Completing the network settings work sheet

Complete the network settings work sheet to define your network settings that you will need if the DS6000 series is connected to a network.

Item or Setting	Instructions	Your information
Processor controller card 1 IP Address	Provide the dotted decimal IP address that you are assigning for Processor controller card 0 in the DS6800. The current IP address should either be the default address (if a new address has not been specified) or a user-defined address (if the default address had been changed).	
Processor controller card 2 IP Address	Provide the dotted decimal address that you are assigning to Processor card 1 in the DS6800. The current IP address should either be the default address (if a new address has not been specified) or a user-defined address (if the default address had been changed).	
Gateway 1	Provide the dotted decimal or symbolic name address of the gateway (for example, 9.113.155.254 or sanjosegate).	
Subnet mask	Provide the dotted decimal address of Subnet (network) mask.	
Primary domain name server (DNS)	Provide the domain server name and IP address. You must fill-in either the Host name or IP address, or both.	
Alternate domain name server (DNS)	You can optionally provide an alternate DNS. You must fill-in either the server name or IP address, or both.	
Maximum transmission unit (bytes)	You can optionally provide the maximum rate for transmission. The valid range is 1 to 9000 bytes.	
Simple Network Management Protocol (SNMP) destination	Provide the host names or the dotted decimal addresses of the destinations that are to receive SNMP (for example, destination.com or 9.113.152.254).	
Simple Mail Transfer Protocol (SMTP)	Provide either the SMTP server name or the SMTP IP address.	

Host attachment work sheet

Use the host attachment work sheet to record and organize the information that you need as you map host servers to the DS6000 series drives.

Table 24. Host attachment work sheet

Host Name	Number of Ports	Worldwide Port Name

Configuring your DS6000 series

This section provides an overview of the methods you can use to configure a DS6000 series.

You can use one of the following three methods to configure your storage complex:

- Offline Configuration
- Online Configuration
- Express Configuration

Offline configuration overview

You can use the offline configuration method to create or import a new simulated instance of your DS6000 series.

Use the offline configuration method to perform the following tasks:

- Import a physical and/or a logical configuration from an existing storage server.
- Apply logical configurations to either one of the following options:
 - A new or fully de-configured storage server
 - An existing storage server
- Collect communication settings for the storage complex and the management system.
- Apply communication settings as part of the logical configuration process.
- From a single interface, work with new and view an existing storage complex and storage units.
- Create, save, and open configuration documents for later reference and retention purposes.
- Print configuration reports.
- Export configuration data in a spreadsheet ready format.

Online configuration overview

You can use the online configuration method to manage physical and logical configurations from existing storage complexes, storage servers, and storage units over your network.

Use the online configuration method to perform the following tasks:

- Construct and apply valid logical configuration actions on new or fully de-configured storage servers at the time each action is initiated.
- Complete and apply valid logical configuration actions on existing storage complexes, storage servers, and storage units at the time each action is initiated.
- Collect communication settings for the storage complex and the storage manager.
- Apply communication settings as part of the logical configuration process.

Express configuration overview

Express Configuration provides the simplest and fastest method to configure a storage complex.

Some configuration methods require extensive time. Because there are many complex functions available to you, you are required to make several decisions during the configuration process. However, with Express Configuration, the storage server makes several of those decisions for you, decreasing the number of steps required to configure volumes and hosts. This eliminates the extensive configuration process time and simplifies the task for you.

Express Configuration is ideal for the following users:

- Novice users with little knowledge of storage concepts who wants to quickly and easily set up and begin using storage
- Expert users who want to quickly configure a storage complex by allowing the storage server to make decisions for the best storage appropriation

Using Express Configuration, you can perform the following tasks:

- Configure open systems, iSeries, and zSeries volumes
- Create a volume group
- Create a host
- Map a volume group to a host attachment

Chapter 6. Activating licenses

Activate your licenses after installation is complete.

After you have completed your DS6000 series installation, your first step is to activate your licenses by performing the following actions:

- Obtain your feature activation codes.
- Apply the activation codes to your storage unit. You can apply the activation codes by importing a file that you download from the IBM Disk Storage Feature Activation (DSFA) Web site.

The initial enablement of any optional DS6000 licensed function is a concurrent activity (assuming the appropriate level of microcode is installed on the machine for the given function).

Note: The following activating activities are disruptive and require a machine IML.

- Removal of a DS6000 licensed function to deactivate the function.
- A lateral change or reduction in the license scope. A lateral change is defined as changing the license scope from fixed-block (FB) to count key data (CKD) or from CKD to FB. A reduction is defined as changing the license scope from all physical capacity (ALL) to only FB or only CKD capacity.

Obtaining activation codes

To obtain your feature activation codes for the licensed features for each storage unit, you must connect to the IBM Disk Storage Feature Activation (DSFA) Web site.

Before connecting to the site, ensure that you have the following items:

- The IBM License Function Authorization documents. If you are activating codes for a new storage unit, these documents are included in the shipment of the storage unit. If you are activating codes for an existing storage unit, IBM sends these documents to you in an envelope.
 - A diskette for downloading your activation codes into a file if you cannot access the IBM TotalStorage DS Storage Manager from the system that you are using to access the DSFA Web site. Instead of using a diskette, you can also write down the activation codes and then go over to the system that runs the DS Storage Manager and manually enter them.
1. Start the DS Storage Manager application.
 2. In the navigation panel select **Real-time Manager** → **Manage Hardware**, then select **Storage Units**.
 3. In the storage unit main page select the storage unit, click **Properties** in the **Select Action** drop-down list, and then click **Go**. The properties page displays for the storage unit.
 4. Click the **General** tab, and the general properties display in the panel. Gather the following information about your storage unit. You must enter this information at the IBM Web site in the next step of this task. You can use the following table to document this information.
 - From the **MTMS** field, note the machine's serial number, and the model number. The Machine Type - Model Number - Serial Number (MTMS) is a

string that contains the machine type, model number, and serial number. Only the last seven characters of the string are the machine's serial number.

- From the **Machine signature** field, note the machine signature.

Property	Your Storage Unit's Information
Machine's serial number	
Model number	
Machine signature	

5. At a computer with an Internet connection and a browser, connect to the IBM Disk Storage Feature Activation (DSFA) Web site at <http://www.ibm.com/storage/dsfa>.
6. The DSFA application displays in the browser. Use the application to obtain the activation codes and follow the instructions on the screen.

Note: In most situations, the DSFA application can locate your order confirmation code (OCC) when you enter the DS6000 (1750) serial number and signature. However, if the OCC is not attached to the 1750 record, you must assign it to the 1750 record in the DSFA application. In this situation, you will need the OCC (which you can find on the License Function Authorization document).

Activation codes work sheet

Use the activation codes work sheet to record the activation codes for the license features for each DS6000 series. To obtain the activation codes, you must connect to the IBM Disk Storage Feature Activation (DSFA) Web site: www.ibm.com/storage/dsfa.

Table 25. Activation codes work sheet

Item	Instructions	Your information
Operating environment license key	Provide the operating environment license key for your DS6000 series.	
FlashCopy key	Provide the FlashCopy license key for your DS6000 series.	
Remote Mirror and Copy key	Provide the Remote Mirror and Copy license key for your DS6000 series.	
Parallel Access Volumes key	Provide the Parallel Access Volumes license key for your DS6000 series.	
Remote Mirror for z/OS key	Provide the Remote Mirror for z/OS key for your DS6000 series.	

Applying activation codes

Use this process to apply the activation codes that enable you to begin configuring storage on a storage unit.

You cannot have both the Apply activation codes page and the Import activation codes page open at the same time. You must close one in order to access the other.

Note: Before you begin this task, you must resolve any current DS6000 problems. Refer to the *IBM TotalStorage DS6000 Installation, Troubleshooting, and Recovery Guide*. If you need additional assistance to resolve these problems, contact IBM Support.

The easiest way to apply the feature activation codes is to download the activation codes from the IBM Disk Storage Feature Activation (DSFA) Web site to your local computer and then to import the file into the DS Storage Manager. If you cannot access the DS Storage Manager from the same computer that you used to access the DSFA Web site, you can download the file to a diskette or write down the information. If you are using either of these latter methods, ensure that you have your diskette containing the downloaded activation codes file or your paper that contains the written activation codes before you begin the following steps.

1. In the navigation panel, select, in order, Real-time Manager, Manage Hardware, and storage units. In Storage units — Main Page, select a storage unit. Then select **Configure** in the **Select Action** drop-down list, and then click **Go**. Select the **Activation codes** tab. The Activation codes page is displayed.
 - a. If you already imported your activation codes from a file or retrieved existing codes from the storage unit, the values are displayed in the fields and you can modify or overwrite them, as appropriate.
 - b. If you are importing your activation codes from a file that you downloaded from the DSFA Web site, click **Import key file**. Once you complete the import process, the data from the file is displayed.
 - c. If you did not download your activation codes into a file, enter the codes into the appropriate fields.

Note: The **Capacity** and **Storage type** fields are populated based on the information contained within the activation codes.

2. Click **Apply**, then **OK** to complete the process.

Importing activation codes

Use this process to import the activation codes that must be applied before you can begin configuring storage on a storage unit.

Note: Before you begin this task, you must resolve any current DS6000 problems. Refer to the IBM TotalStorage DS6000 Troubleshooting information. If you need additional assistance to resolve these problems, contact IBM Support.

1. In the navigation panel, under Manage Hardware, select Storage units. In Storage units — Main Page, select a Storage unit. Then select the **Activation codes** tab. The Activation codes page is displayed.
2. Click **Import key file**. The Import page is displayed.
3. In the **Select file to import** field, specify the target file. Use the **Browse** button to navigate to the appropriate directory.
4. After you have specified the code file, click **OK** to complete the process.

Order Confirmation Code

IBM provides an order confirmation code for the licensed feature codes that you order.

To activate the function on your DS6800, you must assign the order confirmation code to your DS6000 system using the DS6800 machine serial number. This activity is performed by using the Disk Storage Feature Activation (DSFA) application.

You will not be able to retrieve a feature activation code for a licensed function until you have assigned the order confirmation code to serial number of the DS6800 for which it was acquired.

Applying feature activation keys to a new storage unit

After you obtain the feature activation keys, you must apply them to your storage unit. You can apply the activation keys to a new storage unit by using the **Apply Configuration** wizard in the IBM TotalStorage DS Storage Manager application.

The easiest way to apply the feature activation keys is to download the activation keys from the IBM Disk Storage Feature Activation (DSFA) Web site to your local computer and then access the DS Storage Manager application from that same computer and upload the file. If you cannot access the DS Storage Manager from the same computer that you used to access the DSFA Web site or if you wrote down the information instead of downloading the information into a file, you must ensure that you either have a diskette containing the downloaded activation keys file or have the paper that contains the written activation keys.

1. Start the DS Storage Manager application.
2. In the navigation, click **Simulated Manager > Manage hardware > Storage Images**.
3. Select the storage image.
4. From the **Select Action** drop-down list, click **Apply Configuration**. The **Apply Configuration** wizard appears in the panel.
5. Follow the instructions in the wizard to create a storage image for the storage unit. You will enter the activation keys as one step in the wizard.

Accessibility

Accessibility features provide users who have disabilities with the ability to successfully access information and use technology.

Accessibility features help a user who has a physical disability, such as restricted mobility or limited vision, to use software products successfully.

Features

These are the major accessibility features in the IBM TotalStorage DS6000 information:

- You can use screen-reader software and a digital speech synthesizer to hear what is displayed on the screen. IBM Home Page Reader version 3.0 has been tested.
- You can operate features using the keyboard instead of the mouse.

Navigating by keyboard

You can use keys or key combinations to perform operations and initiate menu actions that can also be done through mouse actions. You can navigate the IBM TotalStorage DS6000 information from the keyboard by using the shortcut keys for your browser or Home Page Reader. See your browser Help for a list of shortcut keys that it supports. See the following Web site for a list of shortcut keys supported by Home Page Reader: http://www-306.ibm.com/able/solution_offerings/keyshort.html

Accessing the publications

You can find HTML versions of the IBM TotalStorage DS6000 information at the following Web site:
<http://www.ehone.ibm.com/public/applications/publications/cgibin/pbi.cgi>

You can access the information using IBM Home Page Reader 3.0.

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Cet appareil numérique de la classe A est conform à la norme NMB-003 du Canada.

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Zulassungsbescheinigung laut Gesetz ueber die elektromagnetische Verträglichkeit von Geraeten (EMVG) vom 30. August 1995.

Dieses Geraet ist berechtigt, in Uebereinstimmung mit dem deutschen EMVG das EG-Konformitaetszeichen - CE - zu fuehren.

Der Aussteller der Konformitaetserklaeung ist die IBM Deutschland.

Informationen in Hinsicht EMVG Paragraph 3 Abs. (2) 2:

Das Geraet erfuehlt die Schutzanforderungen nach EN 50082-1 und EN 55022 Klasse A.

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Nach dem EMVG:

"Geraete duerfen an Orten, fuer die sie nicht ausreichend entstoert sind, nur mit besonderer Genehmigung des Bundesministeriums fuer Post und Telekommunikation oder des Bundesamtes fuer Post und Telekommunikation betrieben werden. Die Genehmigung wird erteilt, wenn keine elektromagnetischen Stoerungen zu erwarten sind." (Auszug aus dem EMVG, Paragraph 3, Abs.4)

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"Dies ist eine Einrichtung der Klasse A. Diese Einrichtung kann im Wohnbereich Funkstoerungen verursachen; in diesem Fall kann vom Betreiber verlangt werden, angemessene Massnahmen durchzufuehren und dafuer aufzukommen."

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Um die Einhaltung des EMVG sicherzustellen, sind die Geraete wie in den Handbuechern angegeben zu installieren und zu betreiben.

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VS07171L

Glossary

This glossary includes terms for the IBM TotalStorage and other Resiliency Family products.

This glossary includes selected terms and definitions from:

- The *American National Standard Dictionary for Information Systems*, ANSI X3.172–1990, copyright 1990 by the American National Standards Institute (ANSI), 11 West 42nd Street, New York, New York 10036. Definitions derived from this book have the symbol (A) after the definition.
- *IBM Terminology*, which is available online at the following Web site: <http://www-306.ibm.com/ibm/terminology/index.html>. Definitions derived from this source have the symbol (GC) after the definition.
- The *Information Technology Vocabulary* developed by Subcommittee 1, Joint Technical Committee 1, of the International Organization for Standardization and the International Electrotechnical Commission (ISO/IEC JTC1/SC1). Definitions derived from this book have the symbol (I) after the definition. Definitions taken from draft international standards, committee drafts, and working papers that the ISO/IEC JTC1/SC1 is developing have the symbol (T) after the definition, indicating that final agreement has not been reached among the participating National Bodies of SC1.

This glossary uses the following cross-reference forms:

- See** Refers the reader to one of two kinds of related information:
- A term that is the expanded form of an abbreviation or acronym. This expanded form of the term contains the full definition.
 - A synonym or more preferred term

See also Refers the reader to one or more related terms.

Contrast with

Refers the reader to a term that has an opposite or substantively different meaning.

Numerics

- 750** A model of the Enterprise Storage Server featuring a 2-way processor with limited physical storage capacity. This model can be updated to the model 800.
- 800** A model of the Enterprise Storage Server featuring a standard processor or an optional Turbo processor. The Model 800 supports RAID 5, RAID 10, and 15000 rpm drives. Model 800 supersedes Model F20.
- 1750** The machine type for the IBM TotalStorage DS6000 series. Models for the DS6000 include the 511 and EX1.
- 2105** The machine number for the IBM TotalStorage Enterprise Storage Server. Models of the Enterprise Storage Server are expressed as the number 2105 followed by "Model <xxx>", such as 2105 Model 800. The 2105 Model 100 is an Enterprise Storage Server expansion enclosure that is typically referred to simply as the Model 100.
- 2107** The machine type for the IBM TotalStorage DS8000 series. Models for the DS8000 series include the base units 921, 922 and 9A2 and expansion units 92E and 9AE.
- 3390** The machine number of an IBM disk storage system. The Enterprise Storage Server, when interfaced to IBM zSeries hosts, is set up to appear as one or more 3390 devices, with a choice of 3390-2, 3390-3, or 3390-9 track formats.
- 3990** The machine number of an IBM control unit.
- 7133** The machine number of an IBM disk storage system. The Model D40 and 020 drawers of the 7133 can be installed in the 2105-100 expansion enclosure of the ESS.

A

access

- 1) To obtain the use of a computer resource.
- 2) In computer security, a specific type of interaction between a subject and an object that results in flow of information from one to the other.

access-any mode

One of the two access modes that can be set for the storage unit during initial configuration. It enables all fibre-channel-attached host systems with no defined access profile to access all logical volumes on the storage unit. With a profile defined in DS Storage Manager for a particular host, that host has access only to volumes that are assigned to the WWPN for that host. See also *pseudo host* and *worldwide port name*.

ACK See *request for acknowledgment and acknowledgment*.

agent A program that automatically performs some service without user intervention or on a regular schedule. See also *subagent*.

alert A message or log that a storage unit generates as the result of error event collection and analysis. An alert indicates that a service action is required.

allegiance

For zSeries, a relationship that is created between a device and one or more channel paths during the processing of certain conditions. See also *implicit allegiance*, *contingent allegiance*, and *reserved allegiance*.

allocated storage

The space that is allocated to volumes but not yet assigned. Contrast with *assigned storage*.

American National Standards Institute (ANSI)

An organization of producers, consumers, and general interest groups that establishes the procedures by which accredited organizations create and maintain voluntary industry standards in the United States. (A)

Anonymous

In the DS Storage Manager, the label on an icon that represents all connections that are using fibre-channel adapters

between the storage unit and hosts but are not completely defined to the storage unit. See also *anonymous host*, *pseudo host*, and *access-any mode*.

anonymous host

Synonym for *pseudo host*. Contrast with *Anonymous* and *pseudo host*.

ANSI See *American National Standards Institute*.

APAR See *authorized program analysis report*. (GC)

API See *application programming interface*.

application programming interface

An interface that allows an application program that is written in a high-level language to use specific data or functions of the operating system or another program.

arbitrated loop

A fibre-channel topology that enables the interconnection of a set of nodes. See also *point-to-point connection* and *switched fabric*.

array An ordered collection, or group, of physical devices (disk drive modules) that is used to define logical volumes or devices. In the storage unit, an array is a group of disks that the user designates to be managed by the RAID technique. See also *redundant array of independent disks*.

ASCII (American National Standard Code for Information Interchange) The standard code, using a coded character set consisting of 7-bit coded characters (8 bits including parity check), that is used for information interchange among data processing systems, data communication systems, and associated equipment. The ASCII set consists of control characters and graphic characters. (A) Some organizations, including IBM, have used the parity bit to expand the basic code set.

assigned storage

The space that is allocated to a volume and that is assigned to a port.

authorized program analysis report (APAR)

A request for correction of a defect in a current release of an IBM-supplied program. (GC)

availability

The degree to which a system or resource is capable of performing its normal function. See *data availability*.

B

bay The physical space that is used for installing SCSI, ESCON, and fibre-channel host adapter cards. The DS6000 has four bays, two in each cluster. See also *service boundary*.

bit 1) Either of the digits 0 or 1 when used in the binary numeration system. (T)
2) The storage medium required to store a single binary digit. See also *byte*.

block A string of data elements recorded or transmitted as a unit. The elements may be characters, words, or physical records. (T)

A group of consecutive bytes used as the basic storage unit in fixed-block architecture (FBA). All blocks on the storage device are the same size (fixed size). See also *fixed-block architecture* and *data record*.

byte 1) A group of eight adjacent binary digits that represent one EBCDIC character.
2) The storage medium required to store eight bits. See also *bit*.

C

cache A special-purpose buffer storage, smaller and faster than main storage, used to hold a copy of instructions and data obtained from main storage and likely to be needed next by the processor. (T)

cache fast write

A form of the fast-write operation in which the storage server writes the data directly to cache, where it is available for later destaging.

cache hit

An event that occurs when a read operation is sent to the cluster, and the requested data is found in cache. Contrast with *cache miss*.

cache memory

Memory, typically volatile memory, that a storage server uses to improve access times to instructions or data. The cache

memory is typically smaller and faster than the primary memory or storage medium. In addition to residing in cache memory, the same data also resides on the storage devices in the storage unit.

cache miss

An event that occurs when a read operation is sent to the cluster, but the data is not found in cache. Contrast with *cache hit*.

call home

A communication link established between the DS6000 and a service provider. The DS6000 can use this link to place a call to IBM or to another service provider when it requires service. With access to the machine, service personnel can perform service tasks, such as viewing error logs and problem logs or initiating trace and dump retrievals. See also *heartbeat* and *remote technical assistance information network*.

cascading

1) Connecting network controllers to each other in a succession of levels to concentrate many more lines than a single level permits.

2) In high-availability cluster multiprocessing (HACMP), cascading pertains to a cluster configuration in which the cluster node with the highest priority for a particular resource acquires the resource if the primary node fails. The cluster node relinquishes the resource to the primary node upon reintegration of the primary node into the cluster.

catcher

A server that service personnel use to collect and retain status data that an DS6000 sends to it.

CCR See *channel command retry*.

CCW See *channel command word*.

CD See *compact disc*.

CEC See *computer-electronic complex*.

channel

For zSeries, the part of a channel subsystem that manages a single I/O interface between a channel subsystem and a set of control units.

channel command retry (CCR)

For zSeries, the protocol used between a channel and a control unit that enables the control unit to request that the channel reissue the current command.

channel command word (CCW)

For zSeries, a data structure that specifies an I/O operation to the channel subsystem.

channel path

For zSeries, the interconnection between a channel and its associated control units.

channel subsystem

For zSeries, the part of a host computer that manages I/O communication between the program and any attached control units.

channel-subsystem image

For zSeries, the logical functions that a system requires to perform the function of a channel subsystem. With ESCON multiple image facility (EMIF), one channel subsystem image exists in the channel subsystem for each logical partition (LPAR). Each image appears to be an independent channel subsystem program, but all images share a common set of hardware facilities.

CKD See *count key data*.

CLI See *command-line interface*. See also *Copy Services command-line interface*.

cluster

1) A partition capable of performing all DS6000 functions. With two clusters in the DS6000, any operational cluster can take over the processing of a failing cluster.

2) In the AIX operating system, a group of nodes within a complex.

cluster processor complex (CPC)

The unit within a cluster that provides the management function for the DS6000. It consists of cluster processors, cluster memory, and related logic.

command-line interface (CLI)

An interface provided by an operating system that defines a set of commands and enables a user (or a script-like language) to issue these commands by typing text in response to the command prompt (for example, DOS commands or

UNIX shell commands). See also *Copy Services command-line interface*.

compact disc

An optically read disc, typically storing approximately 660 MB. CD-ROM (compact disc read-only memory) refers to the read-only format used to distribute DS6000 code and documentation.

compression

1) The process of eliminating gaps, empty fields, redundancies, and unnecessary data to shorten the length of records or blocks.

2) Any encoding that reduces the number of bits used to represent a given message or record. (GC)

computer-electronic complex (CEC)

The set of hardware facilities associated with a host computer.

concurrent copy

A facility on a storage server that enables a program to make a backup of a data set while the logical volume remains available for subsequent processing. The data in the backup copy is frozen at the point in time that the server responds to the request.

concurrent installation of licensed internal code

Process of installing licensed internal code on a DS6000 while applications continue to run.

concurrent maintenance

Service that is performed on a unit while it is operational.

concurrent media maintenance

Service performed on a disk drive module (DDM) without losing access to the data.

configure

In storage, to define the logical and physical configuration of the input/output (I/O) subsystem through the user interface that the storage unit provides for this function.

consistency group

A group of volumes participating in FlashCopy relationships in a logical subsystem, across logical subsystems, or across multiple storage units that must be kept in a consistent state to ensure data integrity.

consistency group interval time

The value in seconds that indicates the length of time between the formation of consistency groups.

consistent copy

A copy of a data entity (a logical volume, for example) that contains the contents of the entire data entity at a single instant in time.

console

A user interface to a server, for example, the interface provided on a personal computer. See also *IBM TotalStorage Management Console*.

contingent allegiance

For zSeries, a relationship that is created in a control unit between a device and a channel when the channel accepts unit-check status. The allegiance causes the control unit to guarantee access; the control unit does not present the busy status to the device. The allegiance enables the channel to retrieve sense data that is associated with the unit-check status on the channel path associated with the allegiance.

control path

The route that is established from the master storage unit to the subordinate storage unit when more than one storage unit participates in a Global Mirror session. If there is only one storage unit (the master) in the Global Mirror session, no control path is required.

control unit (CU)

- 1) A device that coordinates and controls the operation of one or more input/output devices, and synchronizes the operation of such devices with the operation of the system as a whole.
- 2) For zSeries, a storage server with ESCON or OEMI interfaces. The control unit adapts a native device interface to an I/O interface that a zSeries host system supports.
- 3) The portion of the storage unit that supports the attachment of emulated count key data devices over ESCON, FICON, or OEMI interfaces. See also *cluster*.

control-unit image

For zSeries, a logical subsystem that is

accessed through an ESCON I/O interface. One or more control-unit images exist in each control unit. Each image appears as an independent control unit, but all control-unit images share a common set of hardware facilities. The DS6000 can emulate 3990-3, TPF, 3990-6, or 2105 control units.

control-unit-initiated reconfiguration (CUIR)

A software mechanism that the DS6000 uses to request that an operating system of a zSeries host verify that one or more subsystem resources can be taken offline for service. The DS6000 can use this process to automatically vary channel paths offline and online to facilitate bay service or concurrent code installation. Depending on the operating system, support for this process might be model dependent, might depend on the IBM TotalStorage Enterprise Storage Server Subsystem Device Driver, or might not exist.

Coordinated Universal Time (UTC)

The international standard of time that is kept by atomic clocks around the world.

Copy Services

A collection of optional software features, with a Web-browser interface, used for configuring, managing, and monitoring data-copy functions.

Copy Services CLI

See *Copy Services command-line interface*.

Copy Services client

Software that runs on each DS6000 cluster in the Copy Services server group and that performs the following functions:

- Communicates configuration, status and connectivity information to the Copy Services server
- Performs data-copy functions on behalf of the Copy Services server

Copy Services command-line interface (Copy Services CLI)

The command-line interface software that is provided with DS6000 Copy Services and used for invoking Copy Services functions from host systems attached to the DS6000. See also *command-line interface*.

Copy Services server

A cluster that the Copy Services administrator designates to perform the DS6000 Copy Services functions.

Copy Services server group

A collection of user-designated DS6000 clusters participating in Copy Services functions that a designated, active, Copy Services server manages. A Copy Services server group is also called a Copy Services domain.

count field

The first field of a count key data (CKD) record. This eight-byte field contains a four-byte track address (CCHH). It defines the cylinder and head that are associated with the track, and a one-byte record number (R) that identifies the record on the track. It defines a one-byte key length that specifies the length of the record's key field (0 means no key field). It defines a two-byte data length that specifies the length of the record's data field (0 means no data field). Only the end-of-file record has a data length of zero.

count key data (CKD)

For zSeries, a data-record format employing self-defining record formats in which each record is represented by up to three fields: a *count* field that identifies the record and specifies its format, an optional *key* field that identifies the data area contents, and an optional *data* field that typically contains the user data. For CKD records on the storage unit, the logical volume size is defined in terms of the device emulation mode (3390 or 3380 track format). The count field is always 8 bytes long and contains the lengths of the key and data fields, the key field has a length of 0 to 255 bytes, and the data field has a length of 0 to 65 535 or the maximum that will fit on the track. See also *data record*.

CPC See *cluster processor complex*.

CRC See *cyclic redundancy check*.

CU See *control unit*.

CUIR See *control-unit initiated reconfiguration*.

custom volume

A volume in count-key-data (CKD) format that is not a standard volume, which means that it does not necessarily present

the same number of cylinders and capacity to its assigned logical control unit as provided by one of the following standard zSeries volume types: 3390-2, 3390-3, 3390-9, 3390-2 (3380-track mode), or 3390-3 (3380-track mode). See also *count-key-data*, *interleave*, *standard volume*, and *volume*.

CUT See *Coordinated Universal Time*.

cyclic redundancy check (CRC)

A redundancy check in which the check key is generated by a cyclic algorithm. (T)

cylinder

A unit of storage on a CKD device with a fixed number of tracks.

D

DA See *device adapter*. See also *IBM Serial Storage adapter*.

daisy chain

See *serial connection*.

DASD See *direct access storage device*.

DASD fast write (DFW)

A function of a storage server in which active write data is stored in nonvolatile cache, thus avoiding exposure to data loss.

data availability

The degree to which data is available when needed, typically measured as a percentage of time that the system would be capable of responding to any data request (for example, 99.999% available).

data compression

A technique or algorithm used to encode data such that the encoded result can be stored in less space than the original data. The original data can be recovered from the encoded result through a reverse technique or reverse algorithm. See also *compression*.

Data Facility Storage Management Subsystem (DFSMS)

An operating environment that helps automate and centralize the management of storage. To manage storage, DFSMS provides the storage administrator with control over data class, storage class, management class, storage group, and automatic class selection routine definitions.

data field

The optional third field of a count key data (CKD) record. The count field specifies the length of the data field. The data field contains data that the program writes.

data record

The basic unit of zSeries storage on a DS6000, also known as a count-key-data (CKD) record. Data records are stored on a track. The records are sequentially numbered starting with 0. The first record, R0, is typically called the track descriptor record and contains data that the operating system normally uses to manage the track. See also *count-key-data* and *fixed-block architecture*.

data set FlashCopy

For zSeries hosts, a feature of FlashCopy that indicates how many partial volume FlashCopy relationships are active on a volume.

data sharing

The ability of multiple host systems to concurrently utilize data that they store on one or more storage devices. The storage unit enables configured storage to be accessible to any, or all, attached host systems. To use this capability, the host program must be designed to support data that it is sharing.

DDM See *disk drive module*.

DDM group

See *disk pack*.

dedicated storage

Storage within a storage unit that is configured such that a single host system has exclusive access to the storage.

demote

To remove a logical data unit from cache memory. A storage server demotes a data unit to make room for other logical data units in the cache or because the logical data unit is not valid. The storage unit must destage logical data units with active write units before they can be demoted. See also *destage*.

destage

To move data from an online or higher priority to an offline or lower priority

device. The storage unit stages incoming data into cache and then destages it to disk.

device

For zSeries, a disk drive.

device adapter (DA)

A physical component of the DS6000 that provides communication between the clusters and the storage devices. The DS6000 has eight device adapters that it deploys in pairs, one from each cluster. Device adapter pairing enables the DS6000 to access any disk drive from either of two paths, providing fault tolerance and enhanced availability.

device address

For zSeries, the field of an ESCON device-level frame that selects a specific device on a control-unit image.

device ID

The unique two-digit hexadecimal number that identifies the logical device.

device interface card

A physical subunit of a storage cluster that provides the communication with the attached device drive modules.

device number

For zSeries, a four-hexadecimal-character identifier, for example 13A0, that the systems administrator associates with a device to facilitate communication between the program and the host operator. The device number is associated with a subchannel.

device sparing

A subsystem function that automatically copies data from a failing device drive module to a spare device drive module. The subsystem maintains data access during the process.

DFS See *distributed file service*.

DFSMS

See *Data Facility Storage Management Subsystem*.

direct access storage device (DASD)

1) A mass storage medium on which a computer stores data.

2) A disk device.

disk cage

A container for disk drives. Each disk cage supports eight disk packs (64 disks).

disk drive

Standard term for a disk-based nonvolatile storage medium. The DS6000 uses hard disk drives as the primary nonvolatile storage media to store host data.

disk drive module (DDM)

A field replaceable unit that consists of a single disk drive and its associated packaging.

disk drive module group

See *disk pack*.

disk pack

A group of disk drive modules (DDMs) installed as a unit in a DDM bay.

disk group

A collection of 4 disk drives that are connected to the same pair of IBM Serial Storage adapters and can be used to create a RAID array. A disk group can be formatted as count key data or fixed block, and as RAID or non-RAID, or it can be left unformatted. A disk group is a logical assemblage of disk drives. Contrast with *disk pack*.

distributed file service (DFS)

A service that provides data access over IP networks.

DNS See *domain name system*.

domain

- 1) That part of a computer network in which the data processing resources are under common control.
- 2) In TCP/IP, the naming system used in hierarchical networks.
- 3) A Copy Services server group, in other words, the set of clusters the user designates to be managed by a particular Copy Services server.

domain name system (DNS)

In TCP/IP, the server program that supplies name-to-address translation by mapping domain names to internet addresses. The address of a DNS server is the internet address of the server that hosts the DNS software for the network.

dotted decimal notation

A convention used to identify IP

addresses. The notation consists of four 8-bit numbers written in base 10. For example, 9.113.76.250 is an IP address that contains the octets 9, 113, 76, and 250.

drawer

A unit that contains multiple device drive modules and provides power, cooling, and related interconnection logic to make the device drive modules accessible to attached host systems.

drive 1) A peripheral device, especially one that has addressed storage media. See also *disk drive module*.

2) The mechanism used to seek, read, and write information on a storage medium.

DS6000

See *IBM TotalStorage DS6000*.

DS6000 Batch Configuration tool

A program that automatically configures a DS6000. The configuration is based on data that IBM service personnel enter into the program.

DS Storage Manager

See *IBM TotalStorage DS Storage Manager*.

duplex

- 1) Regarding Copy Services, the state of a volume pair after Remote Mirror and Copy has completed the copy operation and the volume pair is synchronized.
- 2) In general, pertaining to a communication mode in which data can be sent and received at the same time.

dynamic sparing

The ability of a storage server to move data from a failing disk drive module (DDM) to a spare DDM while maintaining storage functions.

E

E10 The predecessor of the F10 model of the Enterprise Storage Server. See also *F10*.

E20 The predecessor of the F20 model of the Enterprise Storage Server. See also *F20*.

EBCDIC

See *extended binary-coded decimal interchange code*.

EC See *engineering change*.

ECKD See *extended count key data*.

eight pack
See *disk pack*.

electrostatic discharge (ESD)
An undesirable discharge of static electricity that can damage equipment and degrade electrical circuitry.

emergency power off (EPO)
A means of turning off power during an emergency, usually a switch.

EMIF See *ESCON multiple image facility*.

enclosure
A unit that houses the components of a storage subsystem, such as a control unit, disk drives, and power source.

end of file
A coded character recorded on a data medium to indicate the end of the medium. On a count-key-data direct access storage device, the subsystem indicates the end of a file by including a record with a data length of zero.

engineering change (EC)
An update to a machine, part, or program.

Enterprise Systems Architecture/390 (ESA/390)
An IBM architecture for mainframe computers and peripherals. Processor systems that follow the ESA/390 architecture include the ES/9000® family. See also *z/Architecture*.

Enterprise Systems Connection (ESCON)
1) A zSeries computer peripheral interface. The I/O interface uses zSeries logical protocols over a serial interface that configures attached units to a communication fabric.
2) A set of IBM products and services that provide a dynamically connected environment within an enterprise.

EPO See *emergency power off*.

ERDS See *error-recording data set*.

ERP See *error recovery procedure*.

error-recording data set (ERDS)
On zSeries hosts, a data set that records data-storage and data-retrieval errors. A

service information message (SIM) provides the error information for the ERDS.

error recovery procedure (ERP)
Procedures designed to help isolate and, where possible, to recover from errors in equipment. The procedures are often used in conjunction with programs that record information on machine malfunctions.

ESA/390
See *Enterprise Systems Architecture/390*.

ESCD See *ESCON director*.

ESCON
See *Enterprise System Connection*.

ESCON channel
A zSeries channel that supports ESCON protocols.

ESCON director (ESCD)
An I/O interface switch that allows the interconnection of multiple ESCON interfaces in a distributed-star topology.

ESCON host systems
zSeries hosts that attach to the DS6000 with an ESCON adapter. Such host systems run on operating systems that include MVS, VSE, TPF, or versions of VM.

ESCON multiple image facility (EMIF)
For zSeries, a function that enables LPARs to share an ESCON channel path by providing each LPAR with its own channel-subsystem image.

EsconNet
In the DS Storage Manager, the label on a pseudo host icon that represents a host connection that uses the ESCON protocol and that is not completely defined on the DS6000. See also *pseudo host* and *access-any mode*.

ESD See *electrostatic discharge*.

eserver
See *IBM e(logo)server*.

ESSNet
See *IBM TotalStorage Enterprise Storage Server Network*.

express configuration
A method for configuring a storage complex, where the storage server

simplifies the task by making several configuration decisions for the user.

extended binary-coded decimal interchange code (EBCDIC)

An IBM-developed coding scheme used to represent various alphabetic, numeric, and special symbols with a coded character set of 256 eight-bit codes.

extended count key data (ECKD)

An extension of the count key data (CKD) architecture.

extent A continuous space on a disk that is occupied by or reserved for a particular data set, data space, or file. The unit of increment is a track. See also *multiple allegiance* and *parallel access volumes*.

extent pool

A groups of extents. See also *extent*.

F

fabric In fibre-channel technology, a routing structure, such as a switch, receives addressed information and routes to the appropriate destination. A fabric can consist of more than one switch. When multiple fibre-channel switches are interconnected, they are said to be *cascaded*.

failback

Pertaining to a cluster recovery from failover following repair. See also *failover*.

failover

Pertaining to the process of transferring all control to a single cluster when the other cluster in the storage unit fails. See also *cluster* and *failback*.

fast write

A write operation at cache speed that does not require immediate transfer of data to a disk drive. The subsystem writes the data directly to cache, to nonvolatile storage, or to both. The data is then available for destaging. A fast-write operation reduces the time an application must wait for the I/O operation to complete.

FBA See *fixed-block architecture*.

FC See *feature code*. **Note:** *FC* is a common abbreviation for fibre channel in the

industry, but the DS6000 customer documentation library reserves *FC* for feature code.

FC-AL See *Fibre Channel-Arbitrated Loop*.

FCP See *fibre-channel protocol*.

FCS See *fibre-channel standard*.

feature code (FC)

A code that identifies a particular orderable option and that is used by service personnel to process hardware and software orders. Individual optional features are each identified by a unique feature code.

fibre channel

A data-transmission architecture based on the ANSI Fibre Channel standard, which supports full-duplex communication. The DS6000 supports data transmission over fiber-optic cable through its fibre-channel adapters. See also *fibre-channel protocol* and *fibre-channel standard*.

Fibre Channel-Arbitrated Loop (FC-AL)

An implementation of the Fibre Channel standard that uses a ring topology for the communication fabric. Refer to American National Standards Institute (ANSI) X3T11/93-275. In this topology, two or more fibre-channel end points are interconnected through a looped interface.

fibre-channel connection (FICON)

A fibre-channel communications protocol designed for IBM mainframe computers and peripherals.

fibre-channel protocol (FCP)

A protocol used in fibre-channel communications with five layers that define how fibre-channel ports interact through their physical links to communicate with other ports.

Fibre-Channel standard (FCS)

An ANSI standard for a computer peripheral interface. The I/O interface defines a protocol for communication over a serial interface that configures attached units to a communication fabric. The protocol has two layers. The IP layer defines basic interconnection protocols. The upper layer supports one or more logical protocols (for example, FCP for SCSI command protocols and SBICON for zSeries command protocols). Refer to

American National Standards Institute (ANSI) X3.230-199x. See also *fibre-channel protocol*.

fibre-channel topology

An interconnection topology supported on fibre-channel adapters. See also *point-to-point connection*, *switched fabric*, and *arbitrated loop*.

FICON

See *fibre-channel connection*.

FiconNet

In the DS Storage Manager, the label on a pseudo host icon that represents a host connection that uses the FICON protocol and that is not completely defined on the DS6000. See also *pseudo host* and *access-any mode*.

field replaceable unit (FRU)

An assembly that is replaced in its entirety when any one of its components fails. In some cases, a field replaceable unit might contain other field replaceable units. (GC)

FIFO See *first-in-first-out*.

File Transfer Protocol (FTP)

In TCP/IP, an application protocol used to transfer files to and from host computers. See also *Transmission Control Protocol/Internet Protocol*.

firewall

A protection against unauthorized connection to a computer or a data storage system. The protection is usually in the form of software on a gateway server that grants access to users who meet authorization criteria.

first-in-first-out (FIFO)

A queuing technique in which the next item to be retrieved is the item that has been in the queue for the longest time. (A)

fixed-block architecture (FBA)

An architecture for logical devices that specifies the format of and access mechanisms for the logical data units on the device. The logical data unit is a block. All blocks on the device are the same size (fixed size). The subsystem can access them independently.

fixed-block device

An architecture for logical devices that specifies the format of the logical data units on the device. The logical data unit

is a block. All blocks on the device are the same size (fixed size); the subsystem can access them independently. This is the required format of the logical data units for host systems that attach with a SCSI or fibre-channel interface. See also *fibre channel* and *small computer systems interface*.

FlashCopy

An optional feature of the DS6000 that can make an instant copy of data, that is, a point-in-time copy of a volume.

FlashCopy relationship

A mapping of a FlashCopy source volume and a FlashCopy target volume that allows a point-in-time copy of the source volume to be copied to the target volume. FlashCopy relationships exist from the time that you initiate a FlashCopy operation until the storage unit copies all data from the source volume to the target volume or until you delete the FlashCopy relationship, if it is persistent.

FRU See *field replaceable unit*.

FTP See *File Transfer Protocol*.

full duplex

See *duplex*.

fuzzy copy

A function of the Global Copy feature wherein modifications to the primary logical volume are performed on the secondary logical volume at a later time. The original order of update is not strictly maintained. See also *Global Copy*.

G

GB See *gigabyte*.

GDPS See *Geographically Dispersed Parallel Sysplex*.

Geographically Dispersed Parallel Sysplex (GDPS)

A zSeries multisite application-availability solution.

gigabyte (GB)

A gigabyte of storage is 10^9 bytes. A gigabyte of memory is 2^{30} bytes.

Global Copy

An optional capability of the DS6000 remote mirror and copy feature that maintains a fuzzy copy of a logical volume

on the same DS6000 or on another DS6000. In other words, all modifications that any attached host performs on the primary logical volume are also performed on the secondary logical volume at a later point in time. The original order of update is not strictly maintained. See also *Remote Mirror and Copy* and *Metro Mirror*.

Global Mirror

An optional capability of the DS6000 remote mirror and copy feature that provides a 2-site extended distance remote copy. Data that is written by the host to the storage unit at the local site is automatically maintained at the remote site. See also *Metro Mirror* and *Remote Mirror and Copy*.

group In DS6000 documentation, a nickname for two different kinds of groups, depending on the context. See *disk pack* or *Copy Services server group*.

H

HA See *host adapter*.

HACMP

See *High-Availability Cluster Multi-Processing*.

hard disk drive (HDD)

- 1) A storage medium within a storage server used to maintain information that the storage server requires.
- 2) A mass storage medium for computers that is typically available as a fixed disk (such as the disks used in system units of personal computers or in drives that are external to a personal computer) or a removable cartridge.

hardware service manager (HSM)

An option on an AS/400 or iSeries host that enables the user to display and work with system hardware resources and to debug input-output processors (IOP), input-output adapters (IOA), and devices.

HCD See *Hardware Configuration Data*.

HDA See *head and disk assembly*.

HDD See *hard disk drive*.

hdisk An AIX term for storage space.

head and disk assembly (HDA)

The portion of an HDD associated with the medium and the read/write head.

heartbeat

A status report sent at regular intervals from the DS6000. The service provider uses this report to monitor the health of the call home process. See also *call home*, *heartbeat call home record*, and *remote technical assistance information network*.

heartbeat call home record

Machine operating and service information sent to a service machine. These records might include such information as feature code information and product logical configuration information.

hierarchical storage management

- 1) A function in storage management software, such as Tivoli Storage Management or Data Facility Storage Management Subsystem/MVS (DFSMS/MVS), that automatically manages free space based on the policy that the storage administrator sets.
- 2) In AS/400 storage management, an automatic method to manage and distribute data between the different storage layers, such as disk units and tape library devices.

High-Availability Cluster Multi-Processing (HACMP)

Software that provides host clustering, so that a failure of one host is recovered by moving jobs to other hosts within the cluster.

high-speed link (HSL)

A hardware connectivity architecture that links system processors to system input/output buses and other system units.

home address

A nine-byte field at the beginning of a track that contains information that identifies the physical track and its association with a cylinder.

hop

Interswitch connection. A hop count is the number of connections that a particular block of data traverses between source and destination. For example, data traveling from one hub over a wire to another hub traverses one hop.

host See *host system*.

host adapter

A physical subunit of a storage server that provides the ability to attach to one or more host I/O interfaces.

host name

The Internet address of a machine in the network. The host name can be entered in the host definition as the fully qualified domain name of the attached host system, such as *mycomputer.city.company.com*, or as the subname of the fully qualified domain name, for example, *mycomputer*. See also *host system*.

host processor

A processor that controls all or part of a user application network. In a network, the processing unit in which the data communication access method resides. See also *host system*.

host system

A computer, either of the mainframe (for example, zSeries) or of the open-systems type, that is connected to the DS6000. zSeries hosts are connected to the DS6000 through ESCON interfaces. Open-systems hosts are connected to the DS6000 by SCSI or fibre-channel interfaces.

hot plug

Pertaining to the ability to add or remove a hardware facility or resource to a unit while power is on.

HSL See *high-speed link*.

HSM See *hierarchical storage management* or *Hardware Service Manager*.

I

i5/OS The IBM operating system that runs the IBM i5/OS and e(logo)Server i5 server families of servers.

IBM e(logo)server

The IBM brand name for a series of server products that are optimized for e-commerce. The products include the iSeries, pSeries, xSeries, and zSeries.

IBM product engineering (PE)

The third-level of IBM service support. Product engineering is composed of IBM engineers who have experience in

supporting a product or who are knowledgeable about the product.

IBM Serial Storage adapter

A physical adapter based on the IBM Serial Storage architecture. IBM Serial Storage adapters connect disk drive modules to DS6000 clusters.

IBM TotalStorage

The brand name used to identify storage products from IBM, including the IBM TotalStorage DS6000. See also *IBM TotalStorage DS6000* and *IBM TotalStorage DS Storage Manager*.

IBM TotalStorage DS6000

A member of the IBM TotalStorage Resiliency Family of storage servers and attached storage devices (disk drive modules). The DS6000 delivers high-performance, fault-tolerant storage and management of enterprise data, affording access through multiple concurrent operating systems and communication protocols. High performance is provided by multiple symmetrical multiprocessors, integrated caching, RAID support for the disk drive modules, and disk access through a high-speed serial storage architecture interface.

IBM TotalStorage DS CLI

The command-line interface (CLI) that is specific to the DS6000.

IBM TotalStorage DS Storage Manager (DS Storage Manager)

Software with a Web-browser interface for configuring the DS6000.

IBM TotalStorage Enterprise Storage Server Network (ESSNet)

A private network providing Web browser access to the Enterprise Storage Server. IBM installs the ESSNet software on an IBM workstation called the IBM TotalStorage ESS Master Console, supplied with the first ESS delivery.

IBM TotalStorage Management Console (MC)

An IBM workstation that acts as the focal point for configuration, Copy Services management, and maintenance for the DS6000. It includes a Web browser that provides links to the user interface, including the DS Storage Manager and the DS6000 Copy Services.

IBM TotalStorage Multipath Subsystem Device Driver (SDD)

Software that is designed to support the multipath configuration environments of the DS6000. The SDD resides in a host system with the native disk device driver.

IBM TotalStorage Resiliency Family

A set of hardware and software features and products, as well as integrated software and services that are available on the IBM TotalStorage DS6000 and the IBM TotalStorage Enterprise Storage Server, Models 750 and 800.

IML See *initial microcode load*.

implicit allegiance

In Enterprise Systems Architecture/390, a relationship that a control unit creates between a device and a channel path when the device accepts a read or write operation. The control unit guarantees access to the channel program over the set of channel paths that it associates with the allegiance.

initial microcode load (IML)

The action of loading microcode for a computer into that computer's storage.

initial program load (IPL)

The action of loading software into a computer, typically an operating system that controls the computer.

initiator

A SCSI device that communicates with and controls one or more targets. Contrast with *target*.

i-node The internal structure in an AIX operating system that describes the individual files in the operating system. It contains the code, type, location, and owner of a file.

input/output (I/O)

Pertaining to (a) input, output, or both or (b) a device, process, or channel involved in data input, data output, or both.

input/output configuration data set

A configuration definition built by the I/O configuration program (IOCP) and stored on disk files associated with the processor controller.

interleave

To automatically create two striped partitions across the drives in a RAID-5

array, both of which use the count-key-data (CKD) record format.

Internet Protocol (IP)

In the Internet suite of protocols, a protocol without connections that routes data through a network or interconnecting networks and acts as an intermediary between the higher protocol layers and the physical network. The upper layer supports one or more logical protocols (for example, a SCSI-command protocol and a zSeries command protocol). Refer to ANSI X3.230-199x. The IP acronym is the IP in TCP/IP. See also *Transmission Control Protocol/Internet Protocol*.

invalidate

To remove a logical data unit from cache memory because it cannot support continued access to the logical data unit on the device. This removal might be the result of a failure within the storage server or a storage device that is associated with the device.

I/O See *input/output*.

I/O adapter (IOA)

An input-output adapter on the PCI bus.

IOCDs

See *input/output configuration data set*.

IOCP See *I/O Configuration Program*.

I/O Configuration Program (IOCP)

A program that defines to a system all the available I/O devices and channel paths.

I/O device

An addressable read and write unit, such as a disk drive device, magnetic tape device, or printer.

I/O interface

An interface that enables a host to perform read and write operations with its associated peripheral devices.

I/O Priority Queueing

A facility in the Workload Manager of zSeries that enables the system administrator to set priorities for queueing I/Os from different system images. See also *multiple allegiance* and *parallel access volume*.

I/O processor (IOP)

Controls input-output adapters and other devices.

I/O sequential response time

The time an I/O request is queued in processor memory waiting for previous I/Os to the same volume to complete.

IOSQ See *I/O sequential response time*.

IP See *Internet Protocol*.

IPL See *initial program load*.

iSeries

An IBM e(logo)server product that emphasizes integration. It is the successor to the AS/400 family of servers.

J**Java Virtual Machine (JVM)**

A software implementation of a central processing unit (CPU) that runs compiled Java code (applets and applications). (GC)

JVM See *Java Virtual Machine*.

K

KB See *kilobyte*.

key field

The second (optional) field of a count key data record. The key length is specified in the count field. The key length determines the field length. The program writes the data in the key field and uses the key field to identify or locate a given record. The subsystem does not use the key field.

kilobyte (KB)

1) For processor storage, real, and virtual storage, and channel volume, 2^{10} or 1024 bytes.

2) For disk storage capacity and communications volume, 1000 bytes.

Korn shell

Interactive command interpreter and a command programming language.

KPOH See *thousands of power-on hours*.

L

LAN See *local area network*.

last-in first-out (LIFO)

A queuing technique in which the next item to be retrieved is the item most recently placed in the queue. (A)

LBA See *logical block address*.

LCU See *logical control unit*.

least recently used (LRU)

1) The algorithm used to identify and make available the cache space that contains the least-recently used data.

2) A policy for a caching algorithm that chooses to remove from cache the item that has the longest elapsed time since its last access.

LED See *light-emitting diode*.

LMC See *licensed machine code*.

licensed machine code (LMC)

Microcode that IBM does not sell as part of a machine, but licenses to the customer. LMC is implemented in a part of storage that is not addressable by user programs. Some IBM products use it to implement functions as an alternate to hard-wired circuitry.

LIFO See *last-in first-out*.

light-emitting diode (LED)

A semiconductor chip that gives off visible or infrared light when activated.

link address

On an ESCON interface, the portion of a source or destination address in a frame that ESCON uses to route a frame through an ESCON director. ESCON associates the link address with a specific switch port that is on the ESCON director. Equivalently, it associates the link address with the channel subsystem or control unit link-level functions that are attached to the switch port.

link-level facility

The ESCON hardware and logical functions of a control unit or channel subsystem that allow communication over an ESCON write interface and an ESCON read interface.

local area network (LAN)

A computer network located on a user's premises within a limited geographic area.

local e-mail

An e-mail configuration option for storage servers that are connected to a host-system network that does not have a domain name system (DNS) server.

logical address

On an ESCON interface, the portion of a

source or destination address in a frame used to select a specific channel-subsystem or control-unit image.

logical block address (LBA)

The address assigned by the DS6000 to a sector of a disk.

logical control unit (LCU)

See *control-unit image*.

logical data unit

A unit of storage that is accessible on a given device.

logical device

The facilities of a storage server (such as the DS6000) associated with the processing of I/O operations directed to a single host-accessible emulated I/O device. The associated storage is referred to as a logical volume. The logical device is mapped to one or more host-addressable units, such as a device on a zSeries I/O interface or a logical unit on a SCSI I/O interface, such that the host initiating I/O operations to the I/O-addressable unit interacts with the storage on the associated logical device.

logical partition (LPAR)

For zSeries, a set of functions that create the programming environment in which more than one logical partition (LPAR) is established on a processor. An LPAR is conceptually similar to a virtual machine environment except that the LPAR is a function of the processor. Also, the LPAR does not depend on an operating system to create the virtual machine environment.

logical path

1) The relationship between a channel image and a control-unit image that designates the physical path to be used for device-level communications between these images. The logical path is established as part of the channel and control-unit initialization procedures by the exchange of link-level frames.

2) With the Remote Mirror and Copy feature, the relationship between a source logical subsystem (LSS) and a target LSS that is created over a physical path through the interconnection fabric that is used for Remote Mirror and Copy

functions. An LSS is a primary control unit, which performs the functions of a channel image.

logical subsystem (LSS)

A topological construct that consists of a group of up to 256 logical devices. A DS6000 can have up to 16 CKD-formatted logical subsystems (4096 CKD logical devices) and also up to 16 fixed-block logical subsystems (4096 fixed-block logical devices). The logical subsystem facilitates configuration of the DS6000 and might have other implications relative to the operation of certain functions. There is a one-to-one mapping between a CKD logical subsystem and a zSeries control-unit image.

For zSeries hosts, a logical subsystem represents a logical control unit (LCU). Each control-unit image is associated with only one logical subsystem. See also *control-unit image*.

logical unit

In open systems, a logical disk drive.

logical unit number (LUN)

In the SCSI protocol, a unique number that is used on a SCSI bus to enable it to differentiate between separate devices, each of which is a logical unit.

logical volume

The storage medium that is associated with a logical disk drive. A logical volume typically resides on one or more storage devices. The DS6000 administrator defines this unit of storage. The logical volume, when residing on a RAID-formatted array, is spread over the drives in the array.

logical volume manager (LVM)

A set of system commands, library routines, and other tools that allow the user to establish and control logical volume storage. The LVM maps data between the logical view of storage space and the physical disk drive module.

longitudinal redundancy check (LRC)

1) A method of error checking during data transfer that involves checking parity on a row of binary digits that are members of a set that forms a matrix. Longitudinal redundancy check is also called a longitudinal parity check.

2) A mechanism that the DS6000 uses for locating errors. The LRC checks the data as it progresses from the host, through the DS6000 controller, into the device adapter, and to the array.

longwave laser adapter

A connector that is used between a host and the DS6000 to support longwave fibre-channel communication.

loop The physical connection between a pair of device adapters in the DS6000. See also *device adapter*.

LPAR See *logical partition*.

LRC See *longitudinal redundancy check*.

LRU See *least recently used*.

LSS See *logical subsystem*.

LUN See *logical unit number*.

LVM See *logical volume manager*.

M

machine level control (MLC)

A database that contains the EC level and configuration of products in the field.

machine reported product data (MRPD)

Product data gathered by a machine and sent to a destination such as an IBM support server or RETAIN. These records might include such information as feature code information and product logical configuration information.

mainframe

A computer, usually in a computer center, with extensive capabilities and resources to which other computers may be connected so that they can share facilities. (T)

maintenance analysis procedure (MAP)

A hardware maintenance document that gives an IBM service representative a step-by-step procedure for tracing a symptom to the cause of a failure.

management console

See *IBM TotalStorage Management Console*.

Management Information Base (MIB)

1) A collection of objects that can be accessed by means of a network management protocol. (GC)

2) The MIB record conforms to the Open Systems Interconnection (OSI) standard defined by the International Organization for Standardization (ISO) for the exchange of information. See also *simple network management protocol*.

MAP See *maintenance analysis procedure*.

master storage unit

The physical unit that controls the creation of consistency groups in a Global Mirror session. The master storage unit sends commands to subordinate storage units. A storage unit can be a master for only one Global Mirror session. Contrast with *subordinate storage unit*.

maximum consistency group drain time

The value in seconds that indicates the maximum time that writes from the local site are delayed to the remote site while the current consistency group is being formed at the remote site. When this time is exceeded, the current attempt to form a consistency group is ended and another attempt is started. If this time is exceeded five times, this maximum time is ignored on the next attempt to form a consistency group. The default value is the larger of four minutes or two times the consistency group interval time if this value is set to zero.

maximum coordination time

The value in milliseconds that indicates the maximum time that is allowed for host I/O to be delayed during the coordination of the primary volumes of an Global Mirror session. The default is 50 milliseconds if this value is set to zero.

MB See *megabyte*.

MC See *IBM TotalStorage Management Console*.

MCA See *Micro Channel architecture*.

MDM See *Multiple Device Manager*.

mean time between failures (MTBF)

1) A projection of the time that an individual unit remains functional. The time is based on averaging the performance, or projected performance, of a population of statistically independent units. The units operate under a set of conditions or assumptions.

2) For a stated period in the life of a functional unit, the mean value of the lengths of time between consecutive failures under stated conditions. (I) (A)

medium

For a storage unit, the disk surface on which data is stored.

megabyte (MB)

1) For processor storage, real and virtual storage, and channel volume, 2^{20} or 1 048 576 bytes.

2) For disk storage capacity and communications volume, 1 000 000 bytes.

Metro Mirror

A function of a storage server that maintains a consistent copy of a logical volume on the same storage server or on another storage server. All modifications that any attached host performs on the primary logical volume are also performed on the secondary logical volume. See also *Remote Mirror and Copy* and *Global Copy*.

MES See *miscellaneous equipment specification*.

MIB See *management information base*.

Micro Channel architecture (MCA)

The rules that define how subsystems and adapters use the Micro Channel bus in a computer. The architecture defines the services that each subsystem can or must provide.

Microsoft Internet Explorer (MSIE)

Web browser software manufactured by Microsoft.

migration

The replacement of a system or subsystem with a different type of system or subsystem, such as replacing a SCSI host adapter with a fibre-channel host adapter. In the context of data migration regarding the DS6000, the transfer of data from one storage unit to another, such as from a 3390 to the DS6000.

MIH See *missing-interrupt handler*.

mirrored pair

Two units that contain the same data. The system refers to them as one entity.

mirroring

In host systems, the process of writing the

same data to two disk units within the same auxiliary storage pool at the same time.

miscellaneous equipment specification (MES)

IBM field-installed change to a machine.

missing-interrupt handler (MIH)

An MVS and MVS/XA facility that tracks I/O interrupts. MIH informs the operator and creates a record whenever an expected interrupt fails to occur before a specified elapsed time is exceeded.

MLC See *machine level control*.

mobile solutions terminal (MoST)

The mobile terminal used by service personnel.

mode conditioning patch cable

A cable that converts a single-mode signal from a longwave adapter into a light signal that is appropriate for multimode fibre. Another mode conditioning patch cable is required at the terminating end of the multimode fibre to convert the signal back to a single-mode signal for a longwave adapter.

Model 100

A 2105 Model 100, often simply referred to as a Mod 100, is an expansion enclosure for the Enterprise Storage Server. See also *2105*.

MoST See *mobile solutions terminal*.

MRPD See *machine reported product data*.

MSA See *multiport serial adapter*.

MSIE See *Microsoft Internet Explorer*.

MTBF See *mean time between failures*.

Multipath Subsystem Device Driver

See *IBM TotalStorage DS6000 Multipath Subsystem Device Driver*.

multiple allegiance

A DS6000 hardware function that is independent of software support. This function enables multiple system images to concurrently access the same logical volume on the DS6000 as long as the system images are accessing different extents. See also *extent* and *parallel access volumes*.

Multiple Device Manager (MDM)

A component of the IBM TotalStorage Productivity Center that allows

administrators to configure, manage, and monitor the performance of SAN storage devices from a single console.

multiple relationship FlashCopy

An option of the DS6000 that creates backup copies from one source to multiple targets by simultaneously establishing multiple FlashCopy relationships.

multiple virtual storage (MVS)

Implies MVS/390, MVS/XA, MVS/ESA, and the MVS element of the zSeries operating system.

multiplex

The action of transmitting simultaneously.

multiport serial adapter (MSA)

An adapter on the IBM TotalStorage Management Console that has multiple ports to which a DS6000 can be attached.

multiprocessor

A computer that includes two or more processors that have common access to a main storage. For the DS6000, the multiprocessors operate in parallel.

MVS See *multiple virtual storage*.

N

name server

A server that stores names of the participating DS6000 clusters.

Netfinity

IBM Intel-processor-based server; predecessor to the IBM xSeries server.

Netscape Navigator

Web browser software manufactured by Netscape.

network manager

A program or group of programs that is used to monitor, manage, and diagnose the problems of a network. (GC)

node The unit that is connected in a fibre-channel network. A DS6000 is a node in a fibre-channel network.

non-RAID

A disk drive set up independently of other disk drives and not set up as part of a disk pack to store data using the redundant array of disks (RAID) data-striping methodology.

nonremovable medium

A recording medium that cannot be added to or removed from a storage device.

nonvolatile storage (NVS)

Memory that stores active write data to avoid data loss in the event of a power loss.

NVS See *nonvolatile storage*.

O

octet In Internet Protocol addressing, one of the four parts of a 32-bit integer presented in dotted decimal notation. See also *dotted decimal notation*.

OEMI See *original equipment manufacturer's information*.

open system

A system whose characteristics comply with standards made available throughout the industry and that therefore can be connected to other systems complying with the same standards. Applied to the DS6000, such systems are those hosts that connect to the DS6000 through SCSI or FCP protocols. See also *small computer system interface* and *fibre-channel protocol*.

organizationally unique identifier (OUI)

An IEEE-standards number that identifies an organization with a 24-bit globally unique assigned number referenced by various standards. OUI is used in the family of 802 LAN standards, such as Ethernet and Token Ring.

original equipment manufacturer's information (OEMI)

A reference to an IBM guideline for a computer peripheral interface. The interface uses ESA/390 logical protocols over an I/O interface that configures attached units in a multidrop bus topology.

OS/390

The IBM operating system that includes and integrates functions that many IBM software products (including the MVS operating system) previously provided for the IBM S/390 family of enterprise servers.

OUI See *organizationally unique identifier*.

P

panel The formatted display of information that appears on a display screen.

parallel access volume (PAV)

An advanced function of the DS6000 that enables OS/390 and z/OS systems to issue concurrent I/O requests against a count key data logical volume by associating multiple devices of a single control-unit image with a single logical device. Up to eight device addresses can be assigned to a PAV. The PAV function enables two or more concurrent write operations to the same logical volume, as long as the write operations are not to the same extents. See also *extent*, *I/O Priority Queueing*, and *multiple allegiance*.

parity A data checking scheme used in a computer system to ensure the integrity of the data. The RAID implementation uses parity to re-create data if a disk drive fails.

path group

In zSeries architecture, a set of channel paths that are defined to a control unit as being associated with a single logical partition (LPAR). The channel paths are in a group state and are online to the host. See also *logical partition*.

path group identifier

In zSeries architecture, the identifier that uniquely identifies a given logical partition (LPAR). The path group identifier is used in communication between the LPAR program and a device. The identifier associates the path group with one or more channel paths, thereby defining these paths to the control unit as being associated with the same LPAR. See also *logical partition*.

PAV See *parallel access volume*.

PCI See *peripheral component interconnect*.

PDU See *protocol data unit*.

PE See *IBM product engineering*.

peripheral component interconnect (PCI)

An architecture for a system bus and associated protocols that supports attachments of adapter cards to a system backplane.

persistent FlashCopy

A state where a FlashCopy relationship

remains indefinitely until the user deletes it. The relationship between the source and target volumes is maintained after a background copy completes.

physical path

A single path through the I/O interconnection fabric that attaches two units. For Copy Services, this is the path from a host adapter on one DS6000 (through cabling and switches) to a host adapter on another DS6000.

pinned data

Data that is held in cache until either an error condition is corrected and it can be moved to disk storage or until the data is discarded by a host command. Pinned data conditions can only occur on an ESS Model 800 during fast-write or dual-copy functions.

point-in-time copy

A FlashCopy option that creates an instantaneous view of original source data at a specific moment in time.

point-to-point connection

A fibre-channel topology that enables the direct interconnection of ports. See also *arbitrated loop* and *switched fabric*.

port A physical connection on a host adapter to the cable that connects the DS6000 to hosts, switches, or another DS6000. The DS6000 uses SCSI and ESCON host adapters that have two ports per adapter, and fibre-channel host adapters that have one port. See also *ESCON*, *fibre channel*, *host adapter*, and *small computer system interface*.

POST See *power-on self test*.

power-on self test (POST)

A diagnostic test that servers or computers run when they are turned on.

predictable write

A write operation that can cache without knowledge of the existing format on the medium. All write operations on FBA DASD devices are predictable. On CKD DASD devices, a write operation is predictable if it does a format write operation for the first data record on the track.

primary control unit

The DS6000 to which a Remote Mirror and Copy primary device is physically attached.

processor complex

A partition of a storage server that is capable of performing all defined functions of the storage server. Multiple processor complexes provide redundancy.

product engineering

See *IBM product engineering*.

program

On a computer, a generic term for software that controls the operation of the computer. Typically, the program is a logical assemblage of software modules that perform multiple related tasks.

program-controlled interruption

An interruption that occurs when an I/O channel fetches a channel command word with the program-controlled interruption flag on.

program temporary fix (PTF)

A temporary solution to, or bypass of, a problem diagnosed by IBM as the result of a defect in a current unaltered release of a licensed program. (GC)

promote

To add a logical data unit to cache memory.

protected volume

In AS/400, a disk storage device that is protected from data loss by RAID techniques. An AS/400 host does not mirror a volume configured as a protected volume, while it does mirror all volumes configured as unprotected volumes. The DS6000, however, can be configured to indicate that an AS/400 volume is protected or unprotected and give it RAID protection in either case.

protocol data unit (PDU)

A unit of data specified in the protocol of a given layer and consisting of protocol control information for the layer and, possibly, user data for the layer.

pSeries

The product name of an IBM e(logo)server product that emphasizes performance. It is the successor to the RS/6000 family of servers.

pseudo host

A host connection that is not explicitly defined to the DS6000 and that has access to at least one volume that is configured on the DS6000. The FiconNet pseudo host icon represents the FICON protocol. The EsconNet pseudo host icon represents the ESCON protocol. The pseudo host icon labelled Anonymous represents hosts connected through the FCP protocol. *Anonymous host* is a commonly used synonym for *pseudo host*. The DS6000 adds a pseudo host icon only when it is set to access-any mode. See also *access-any mode*.

PTF See *program temporary fix*.

PV Links

Short for Physical Volume Links, an alternate pathing solution from Hewlett-Packard that provides for multiple paths to a volume, as well as static load balancing.

R

R0 See *track-descriptor record*.

rack See *enclosure*.

RAID See *redundant array of independent disks*. RAID is also commonly expanded to redundant array of *inexpensive* disks. See also *array*.

RAID 5

A type of RAID that optimizes cost-effective performance while emphasizing use of available capacity through data striping. RAID 5 provides fault tolerance for up to two failed disk drives by distributing parity across all the drives in the array plus one parity disk drive. The DS6000 automatically reserves spare disk drives when it assigns arrays to a device adapter pair (DA pair). See also *device adapter*, *RAID 10*, and *redundant array of independent disks*.

RAID 10

A type of RAID that optimizes high performance while maintaining fault tolerance for up to two failed disk drives by striping volume data across several disk drives and mirroring the first set of disk drives on an identical set. The DS6000 automatically reserves spare disk drives when it assigns arrays to a device

adapter pair (DA pair). See also *device adapter*, *RAID 5*, and *redundant array of independent disks*.

random access

A mode of accessing data on a medium in a manner that requires the storage device to access nonconsecutive storage locations on the medium.

rank One or more arrays that are combined to create a logically contiguous storage space.

redundant array of independent disks (RAID)

A methodology of grouping disk drives for managing disk storage to insulate data from a failing disk drive.

refresh FlashCopy target volume

An option (previously called *incremental FlashCopy*) of the DS6000 that creates a point-in-time data copy without copying an entire volume for each point-in-time copy.

Remote Mirror and Copy

A feature of a storage server that constantly updates a secondary copy of a logical volume to match changes made to a primary logical volume. The primary and secondary volumes can be on the same storage server or on separate storage servers. See also *Global Mirror*, *Metro Mirror* and *Global Copy*.

remote technical assistance information network (RETAIN)

The initial service tracking system for IBM service support, which captures heartbeat and call-home records. See also *support catcher* and *support catcher telephone number*.

REQ/ACK

See *request for acknowledgment and acknowledgment*.

request for acknowledgment and acknowledgment (REQ/ACK)

A cycle of communication between two data transport devices for the purpose of verifying the connection, which starts with a request for acknowledgment from one of the devices and ends with an acknowledgment from the second device. The REQ and ACK signals help to provide uniform timing to support synchronous data transfer between an initiator and a target. The objective of a synchronous

data transfer method is to minimize the effect of device and cable delays.

reserved allegiance

For zSeries, a relationship that is created in a control unit between a device and a channel path, or path group, when the device completes a Sense Reserve command. The allegiance causes the control unit to guarantee access (that is, busy status is not presented) to the device. Access is over the set of channel paths that are associated with the allegiance; access is for one or more channel programs until the allegiance ends.

RETAIN

See *remote technical assistance information network*.

S

S/390 IBM enterprise servers based on Enterprise Systems Architecture/390 (ESA/390). *S/390* is the currently accepted shortened form of the original name *System/390*.

S/390 storage

Storage arrays and logical volumes that are defined as connected to S/390 servers. This term is synonymous with count-key-data storage.

SAID See *system adapter identification number*.

SAM See *sequential access method*.

SAN See *storage area network*.

SBCON

See *Single-Byte Command Code Sets Connection*.

screen

The physical surface of a display device upon which information is shown to users.

SCSI See *small computer system interface*.

SCSI device

A disk drive connected to a host through an I/O interface using the SCSI protocol. A SCSI device is either an initiator or a target. See also *initiator* and *small computer system interface*.

SCSI-FCP

Synonym for fibre-channel protocol, a protocol used to transport data between an open-systems host and a fibre-channel

adapter on an DS6000. See also *fibre-channel protocol* and *small computer system interface*.

SCSI host systems

Host systems that are attached to the DS6000 with a SCSI interface. Such host systems run on UNIX, i5/OS, Windows NT, Windows 2000, or Novell NetWare operating systems.

SCSI ID

A unique identifier assigned to a SCSI device that is used in protocols on the SCSI interface to identify or select the device. The number of data bits on the SCSI bus determines the number of available SCSI IDs. A wide interface has 16 bits, with 16 possible IDs.

SDD See *IBM Subsystem Multipathing Device Driver*.

secondary control unit

The DS6000 to which a Remote Mirror and Copy secondary device is physically attached.

self-timed interface (STI)

An interface that has one or more conductors that transmit information serially between two interconnected units without requiring any clock signals to recover the data. The interface performs clock recovery independently on each serial data stream and uses information in the data stream to determine character boundaries and inter-conductor synchronization.

sequential access

A mode of accessing data on a medium in a manner that requires the storage device to access consecutive storage locations on the medium.

sequential access method (SAM)

An access method for storing, deleting, or retrieving data in a continuous sequence based on the logical order of the records in the file.

serial connection

A method of device interconnection for determining interrupt priority by connecting the interrupt sources serially.

server A host that provides certain services to other hosts that are referred to as clients.

A functional unit that provides services to one or more clients over a network. (GC)

service boundary

A category that identifies a group of components that are unavailable for use when one of the components of the group is being serviced. Service boundaries are provided on the DS6000, for example, in each host bay and in each cluster.

service clearance

The area that is required to open the service covers and to pull out components for servicing.

service information message (SIM)

A message sent by a storage server to service personnel through an zSeries operating system.

service personnel

A generalization referring to individuals or companies authorized to service the DS6000. The terms *service provider*, *service representative*, and *IBM service support representative (SSR)* refer to types of service personnel. See also *service support representative*.

service processor

A dedicated processing unit that is used to service a storage unit.

service support representative (SSR)

Individuals or a company authorized to service the DS6000. This term also refers to a service provider, a service representative, or an IBM service support representative (SSR). An IBM SSR installs the DS6000.

SES SCSI Enclosure Services.

session

A collection of volumes within a logical subsystem that are managed together during the creation of consistent copies of data. All volumes in a session must transfer their data successfully to the remote site before the increment can be called complete.

SFP Small form factor pluggables.

shared storage

Storage that is configured so that multiple hosts can concurrently access the storage. The storage has a uniform appearance to all hosts. The host programs that access the storage must

have a common model for the information on a storage device. The programs must be designed to handle the effects of concurrent access.

shortwave laser adapter

A connector that is used between host and DS6000 to support shortwave fibre-channel communication.

SIM See *service information message*.

Simple Network Management Protocol (SNMP)

In the Internet suite of protocols, a network management protocol that is used to monitor routers and attached networks. SNMP is an application layer protocol. Information on devices managed is defined and stored in the application's Management Information Base (MIB). (GC) See also *management information base*.

simplex volume

A volume that is not part of a FlashCopy, XRC, or PPRC volume pair.

Single-Byte Command Code Sets Connection (SBCON)

The ANSI standard for the ESCON I/O interface.

small computer system interface (SCSI)

A standard hardware interface that enables a variety of peripheral devices to communicate with one another. (GC)

smart relay host

A mail relay or mail gateway that has the capability to correct e-mail addressing problems.

SMIT See *System Management Interface Tool*.

SMP See *symmetrical multiprocessor*.

SNMP See *Simple Network Management Protocol*.

SNMP agent

A server process that resides on a network node and is responsible for communicating with managers regarding that node. The node is represented as a managed object, which has various fields or variables that are defined in the appropriate MIB.

SNMP manager

A managing system that runs a managing application or suite of applications. These applications depend on Management

Information Base (MIB) objects for information that resides on the managed system. Managers generate requests for this MIB information, and an SNMP agent on the managed system responds to these requests. A request can either be the retrieval or modification of MIB information.

software transparency

Criteria applied to a processing environment that states that changes do not require modifications to the host software in order to continue to provide an existing function.

source device

One of the devices in a dual-copy or remote-copy volume pair. All channel commands to the logical volume are directed to the source device. The data on the source device is duplicated on the target device. See also *target device*.

spare A disk drive on the DS6000 that can replace a failed disk drive. A spare can be predesignated to allow automatic dynamic sparing. Any data preexisting on a disk drive that is invoked as a spare is destroyed by the dynamic sparing copy process.

spatial reuse

A feature of serial storage architecture that enables a device adapter loop to support many simultaneous read/write operations. See also *serial storage architecture*.

SSID See *subsystem identifier*.

SSR See *service support representative*.

stacked status

For zSeries, the condition when the control unit is in a holding status for the channel, and the last time the control unit attempted to present the status, the channel responded with the stack-status control.

stage operation

The operation of reading data from the physical disk drive into the cache.

staging

To move data from an offline or low-priority device back to an online or higher priority device, usually on demand of the system or on request of the user.

standard volume

A volume that emulates one of several zSeries volume types, including 3390-2, 3390-3, 3390-9, 3390-2 (3380-track mode), or 3390-3 (3380-track mode), by presenting the same number of cylinders and capacity to the host as provided by the native zSeries volume type of the same name.

STI See *self-timed interface*.

storage area network

A network that connects a company's heterogeneous storage resources.

storage capacity

The amount of data that a storage medium can hold; usually expressed in kilobytes, megabytes, or gigabytes.

storage complex

A configuration of one or more storage units that is managed by a management console.

storage device

A physical unit that provides a mechanism to store data on a given medium such that it can be subsequently retrieved. See also *disk drive module*.

storage extent

The minimum contiguous range of storage on a physical storage device, array, or rank that can be allocated to a local volume

storage server

A physical unit that manages attached storage devices and provides an interface between them and a host computer by providing the function of one or more logical subsystems. The storage server can provide functions that the storage device does not provide. The storage server has one or more clusters.

storage unit

A physical unit that consists of a storage server that is integrated with one or more storage devices that provide storage capability to a host computer.

storage unit identifier

A unique identifier for a storage unit that consists of a manufacturer, a model number, a type number, a plant of manufacture, and a sequence number.

striping

A technique that distributes data in bit, byte, multibyte, record, or block increments across multiple disk drives.

subagent

An extension to an SNMP agent that permits a user to dynamically add, or in some cases replace, additional management variables in the local MIB, thereby providing a means of extending the range of information that network managers can access. See also *agent*.

subchannel

A logical function of a channel subsystem associated with the management of a single device.

subordinate storage unit

The physical unit that receives commands from the master storage unit and is specified when a Global Mirror session is started. The subordinate storage unit forms consistency groups and performs other Global Mirror processing. A subordinate storage unit can be controlled by only one master storage unit. Contrast with *master storage unit*.

subsystem identifier (SSID)

A number that uniquely identifies a logical subsystem within a computer installation.

support catcher

See *catcher*.

support catcher telephone number

The telephone number that connects the support catcher server to the DS6000 to receive a trace or dump package. See also *support catcher* and *remote technical assistance information network*.

switched fabric

A fibre-channel topology in which ports are interconnected through a switch. Fabric switches can also be interconnected to support numerous ports on a single network. See also *arbitrated loop* and *point-to-point connection*.

symmetrical multiprocessor (SMP)

An implementation of a multiprocessor computer consisting of several identical processors configured in a way that any subset of the set of processors is capable of continuing the operation of the computer. The DS6000 contains four processors set up in SMP mode.

synchronous write

A write operation whose completion is indicated after the data has been stored on a storage device.

System/390

See *S/390*.

system adapter identification number (SAID)

The unique identification number that is automatically assigned to each DS6000 host adapter for use by Copy Services.

System Management Interface Tool (SMIT)

An interface tool of the AIX operating system for installing, maintaining, configuring, and diagnosing tasks.

System Modification Program

A program used to install software and software changes on MVS systems.

T

TAP See *Telocator Alphanumeric Protocol*.

target A SCSI device that acts as a subordinate to an initiator and consists of a set of one or more logical units, each with an assigned logical unit number (LUN). The logical units on the target are typically I/O devices. A SCSI target is analogous to a zSeries control unit. See also *small computer system interface*.

target device

One of the devices in a dual-copy or remote-copy volume pair that contains a duplicate of the data that is on the source device. Unlike the source device, the target device might only accept a limited subset of data. See also *source device*.

TB See *terabyte*.

TCP/IP

See *Transmission Control Protocol/Internet Protocol*.

Telocator Alphanumeric Protocol (TAP)

An industry standard protocol for the input of paging requests.

terabyte (TB)

- 1) Nominally, 1 000 000 000 000 bytes, which is accurate when speaking of bandwidth and disk storage capacity.
- 2) For DS6000 cache memory, processor storage, real and virtual storage, a terabyte refers to 2^{40} or 1 099 511 627 776 bytes.

terminal emulator

A function of the management console that allows it to emulate a terminal.

thousands of power-on hours (KPOH)

A unit of time used to measure the mean time between failures (MTBF).

time sharing option (TSO)

An operating system option that provides interactive time sharing from remote terminals.

TotalStorage

See *IBM TotalStorage*.

TPF See *transaction processing facility*.

track A unit of storage on a CKD device that can be formatted to contain a number of data records. See also *home address*, *track-descriptor record*, and *data record*.

track-descriptor record (R0)

A special record on a track that follows the home address. The control program uses it to maintain certain information about the track. The record has a count field with a key length of zero, a data length of 8, and a record number of 0. This record is sometimes referred to as R0.

transaction processing facility (TPF)

A high-availability, high-performance IBM operating system, designed to support real-time, transaction-driven applications. The specialized architecture of TPF is intended to optimize system efficiency, reliability, and responsiveness for data communication and database processing. TPF provides real-time inquiry and updates to a large, centralized database, where message length is relatively short in both directions, and response time is generally less than three seconds. Formerly known as the Airline Control Program/Transaction Processing Facility (ACP/TPF).

Transmission Control Protocol (TCP)

A communications protocol used in the Internet and in any network that follows the Internet Engineering Task Force (IETF) standards for internetwork protocol. TCP provides a reliable host-to-host protocol between hosts in packet-switched communications networks and in interconnected systems of such networks. It uses the Internet Protocol (IP) as the underlying protocol.

Transmission Control Protocol/Internet Protocol (TCP/IP)

1) A combination of data-transmission protocols that provide end-to-end connections between applications over interconnected networks of different types.

2) A suite of transport and application protocols that run over the Internet Protocol. (GC) See also *Internet Protocol* and *Transmission Control Protocol*.

transparency

See *software transparency*.

TSO See *time sharing option*.

turbo processor

A faster multiprocessor that has six processors with common access to the main storage.

U

UFS UNIX filing system.

Ultra-SCSI

An enhanced small computer system interface.

unconfigure

To delete the configuration.

unit address

For zSeries, the address associated with a device on a given control unit. On ESCON interfaces, the unit address is the same as the device address. On OEMI interfaces, the unit address specifies a control unit and device pair on the interface.

unprotected volume

An AS/400 term that indicates that the AS/400 host recognizes the volume as an unprotected device, even though the storage resides on a RAID-formatted array and is, therefore, fault tolerant by definition. The data in an unprotected volume can be mirrored. Also referred to as an *unprotected device*.

upper-layer protocol

The layer of the Internet Protocol (IP) that supports one or more logical protocols (for example, a SCSI-command protocol and an ESA/390 command protocol). Refer to ANSI X3.230-199x.

UTC See *Coordinated Universal Time*.

V

virtual machine facility

A virtual data processing machine that appears to the user to be for the exclusive use of that user, but whose functions are accomplished by sharing the resources of a shared data processing system. An alternate name for the VM/370 IBM operating system.

vital product data (VPD)

Information that uniquely defines the system, hardware, software, and microcode elements of a processing system.

VM

The root name of several IBM operating systems, such as VM/XA, VM/ESA, VM/CMS, and z/VM. See also *virtual machine facility*.

volume

For zSeries, the information recorded on a single unit of recording medium. Indirectly, it can refer to the unit of recording medium itself. On a nonremovable-medium storage device, the term can also indirectly refer to the storage device associated with the volume. When multiple volumes are stored on a single storage medium transparently to the program, the volumes can be referred to as logical volumes.

volume group

A collection of either physical or logical volumes.

volume label

A unique identifier that a user assigns to a logical volume.

VPD See *vital product data*.

VSE/ESA

An IBM operating system, the letters of which represent virtual storage extended/enterprise systems architecture.

W

weight distribution area

The area that is required to distribute the weight of the storage unit.

worldwide node name (WWNN)

A unique 64-bit identifier for a host that contains a fibre-channel port. See also *worldwide port name*.

worldwide port name (WWPN)

A unique 64-bit identifier associated with a fibre-channel adapter port. It is assigned in an implementation- and protocol-independent manner. See also *worldwide node name*

write hit

A write operation in which the requested data is in the cache.

write penalty

The performance impact of a classical RAID-5 write operation.

WWNN

See *worldwide node name*.

WWPN

See *worldwide port name*.

X**xSeries**

The product name of an IBM e(logo)server product that emphasizes industry-standard server scalability and self-managing server technologies. It is the successor to the Netfinity family of servers.

Z**z/Architecture**

An IBM architecture for mainframe computers and peripherals. The IBM e(logo)server zSeries family of servers uses the z/Architecture architecture. It is the successor to the S/390 and 9672 family of servers. See also *iSeries*.

z/OS An operating system for the IBM e(logo)server product line that supports 64-bit real storage.

z/OS Global Mirror

A function of a storage server that assists a control program to maintain a consistent copy of a logical volume on another storage unit. All modifications of the primary logical volume by any attached host are presented in order to a single host. The host then makes these modifications on the secondary logical volume. This function was formerly called extended remote copy or XRC.

zSeries

An IBM e(logo)server family of servers that emphasizes near-zero downtime.

IBM enterprise servers based on z/Architecture.

zSeries storage

Storage arrays and logical volumes that are defined in the DS6000 as connected to zSeries servers.

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IBM TotalStorage DS6000
Introduction and Planning Guide

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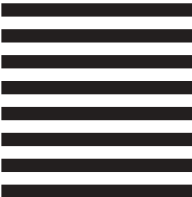
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