

Hands-On Microsoft Windows Server 2008

Chapter 7

Configuring and Managing Data Storage

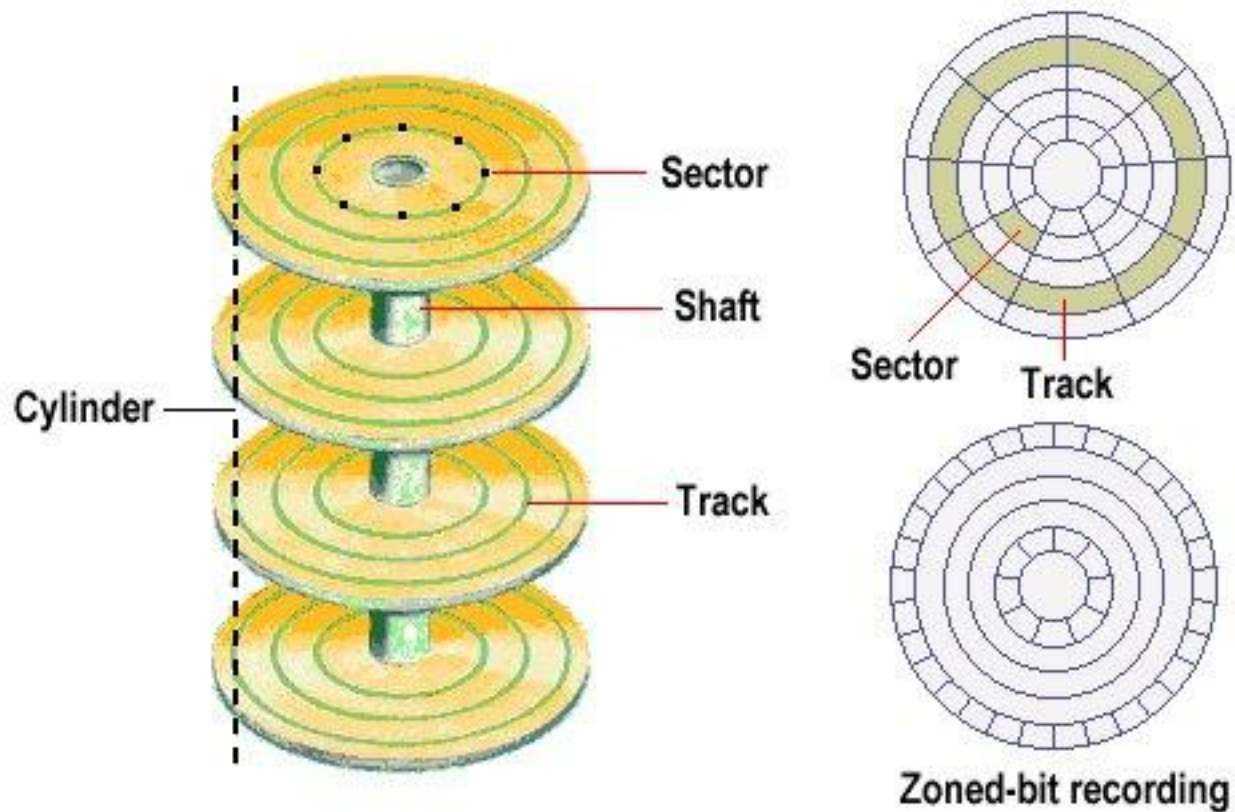
Objectives

- Understand storage options for Windows Server 2008
- Understand the tools available to configure and manage storage
- Explain and configure RAID disk storage fault tolerance
- Back up disk storage

Terminology

- **Partitioning**
 - A process that blocks a group of tracks and sectors to be used by a particular file system, such as NTFS
- **Formatting**
 - A process that creates a table (File Allocation Table) containing file and folder information for a specific file system in a partition
- **Volume**
 - A logical designation of disk storage that is created out of one or more physical disks
 - Is partitioned and formatted with one file system
- **RAID** stands for redundant array of inexpensive (or independent) disks
 - A set of standards for lengthening disk life and preventing data loss

Disk Components

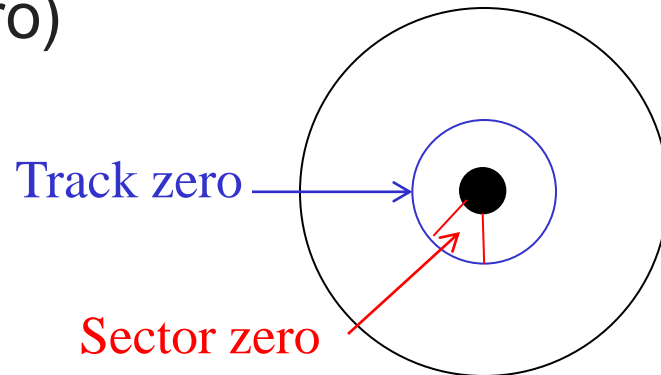


Partition Styles

- MBR – Master Boot Record
- GPT – GUID (globally unique identifier) Partition Table

Master Boot Record (MBR)

- **Master Boot Record (MBR)** and a **partition table** are created when a drive is partitioned
- located in the first sector and track of the hard disk (**sector zero** and track zero)



- Contains startup information about partitions and how to access the disk

Master Boot Record (MBR)

- The partition table stores drive geometry (example: type of partition, size, location)
- Uses Hidden sectors to store system information
- Supports volumes up to 2 terabytes (1 terabyte = 10^{12} bytes)
- Supports up to 4 primary partitions or up to 3 primary partitions and one extended partition per disk

GUID Partition Table - GPT

- Default partition style for x64 systems
- Uses partitions rather than hidden sectors to store system information
- Uses EFI (Extensible Firmware Interface) to boot the drive (<http://www.intel.com/technology/efi/>)
- Uses primary and backup partition tables to improve integrity
- Supports up to 128 partitions
- Supports Volumes up to 18 exabytes

Disk Storage

- Basic Storage – compatible with older OS
 - Consists of primary and extended partitions
 - Supports up to four partitions (per single hard drive)
 - Basic disks also can be configured for any of three RAID levels:
 - Disk striping (RAID level 0)
 - Disk mirroring (RAID level 1)
 - Disk striping with parity (RAID level 5)
- Dynamic Storage – supported by Windows 2000 and up
 - Does not use traditional partitioning
 - Dynamic disks can combine two or more physical disks into one dynamic disk
 - Dynamic disks divided into volumes

Primary and Extended Partitions

PRIMARY

- Functions as a physically separate disk
- Can host an OS
- Can be marked as active (and used to boot from)
- Up to 4 are supported or 3 + 1 Extended
- Each is formatted and assigned a drive letter

EXTENDED

- Cannot host an OS
- Cannot be active partition
- Basic disk can only host 1 Extended but unlimited logical partitions
- Used to overcome the limit of 4 primary partitions

Primary and Extended Partitions

- **The active partition (System partition):**
 - is a primary partition where your computer will automatically look for to start the computer (contains hardware specific files.
 - The system partition has to be on a primary partition
- **The boot partition:**
 - is the partition that contains the operating system files located in the \Windows folder.
 - The boot partition can be installed on either a primary or extended partition.

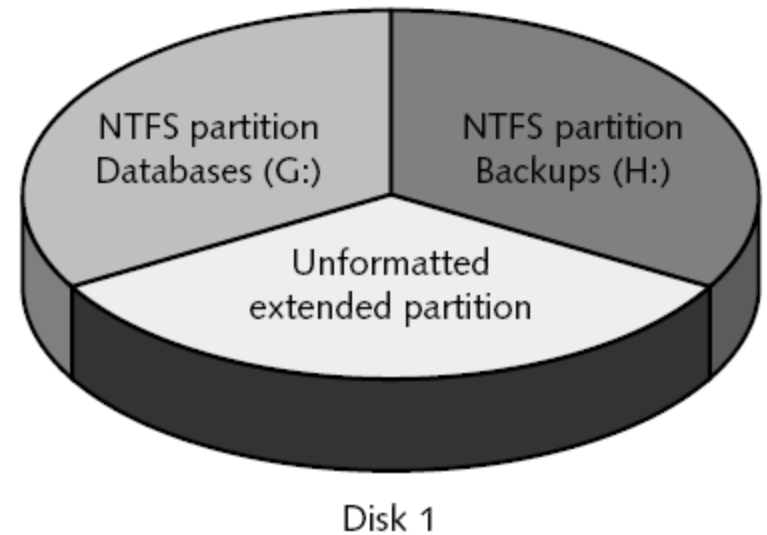
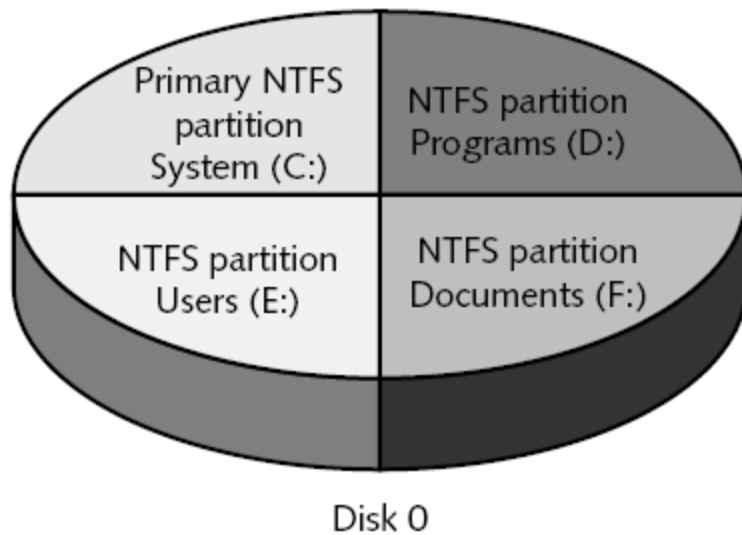


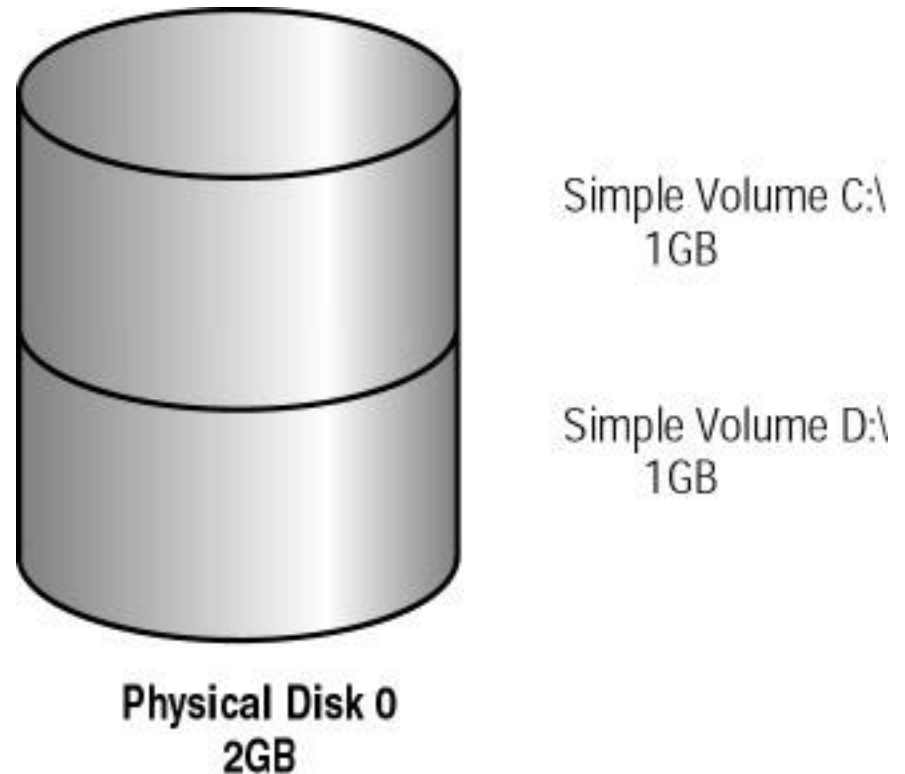
Figure 7-1 Partitions on two disk drives

Dynamic Disks

- A dynamic disk does not use traditional partitioning
 - Makes it possible to set up a large number of volumes on one disk
 - Provides the ability to extend volumes onto additional physical disks
- Can incorporate up to 32 disks into one spanned volume
- Plan to convert basic disks to dynamic disks after you install Windows Server 2008
- Types of the dynamic disk configurations are:
 - 1) simple volumes
 - 2) spanned volumes
 - 3) mirrored volumes
 - 4) striped volumes
 - 5) RAID-5 volumes

Simple Volume

- A portion of a disk or an entire disk that is set up as a dynamic disk
- Can be extended onto multiple sections of the same disk



Spanned Volume

- Stored on 2 to 32 dynamic disks that are treated as one volume
- As you add new disks, the spanned volume can be extended to include each disk

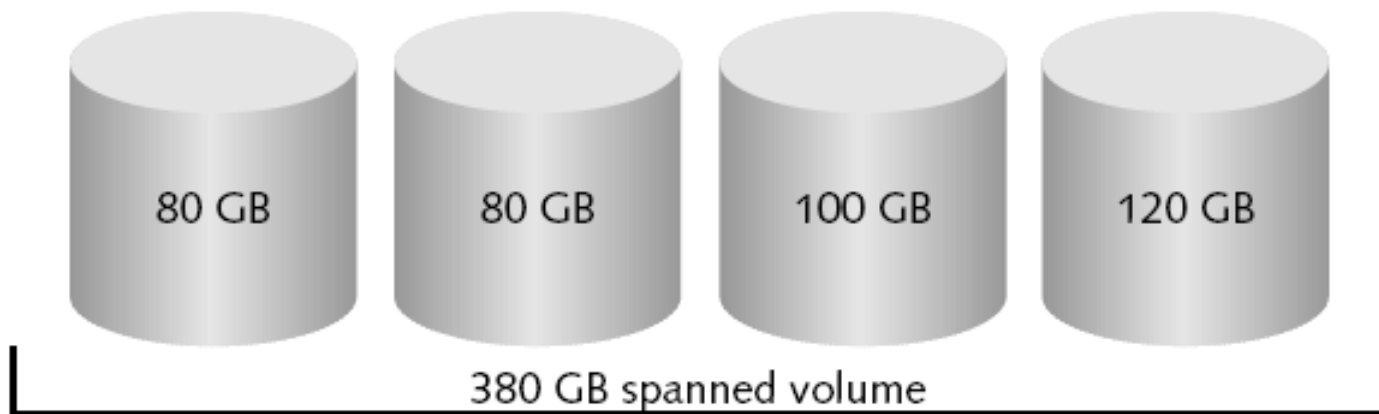
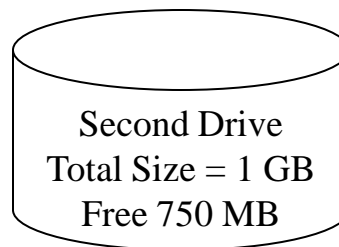
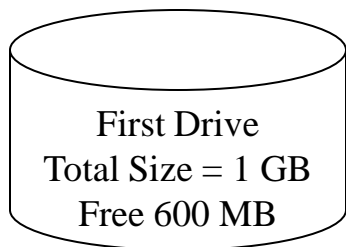


Figure 7-4 Creating one spanned volume from four disks

Example: Spanned Volume

- You might have 600 MB of free space on one drive, 750 MB on another, and 424 MB on a third.
- All of these free areas can be combined into a single 1774 MB spanned volume with its own drive letter



Striped Volumes

- Often referred to as RAID-0
- Extend the life of hard disk drives by spreading data equally over two or more drives – up to 32
- Increases disk performance
- Useful to store large databases.
- Best feature of striped volume is the fast access to read and write data in disk.
- Data can be lost when one or more disks in the striped volume fail
- No Fault tolerance.

Example Stripped Volumes

- Consider that you have set up striping across five hard disks and are working with a 720 KB data file.
 - The first 64 KB portion of the file is written to disk 1,
 - The next 64 KB portion is written to disk 2,
 - The third portion is written to disk 3, and so on.
 - next 320 KB are written in 64 KB blocks in the second row across the disks then the third row until we store all the 720 KB data..

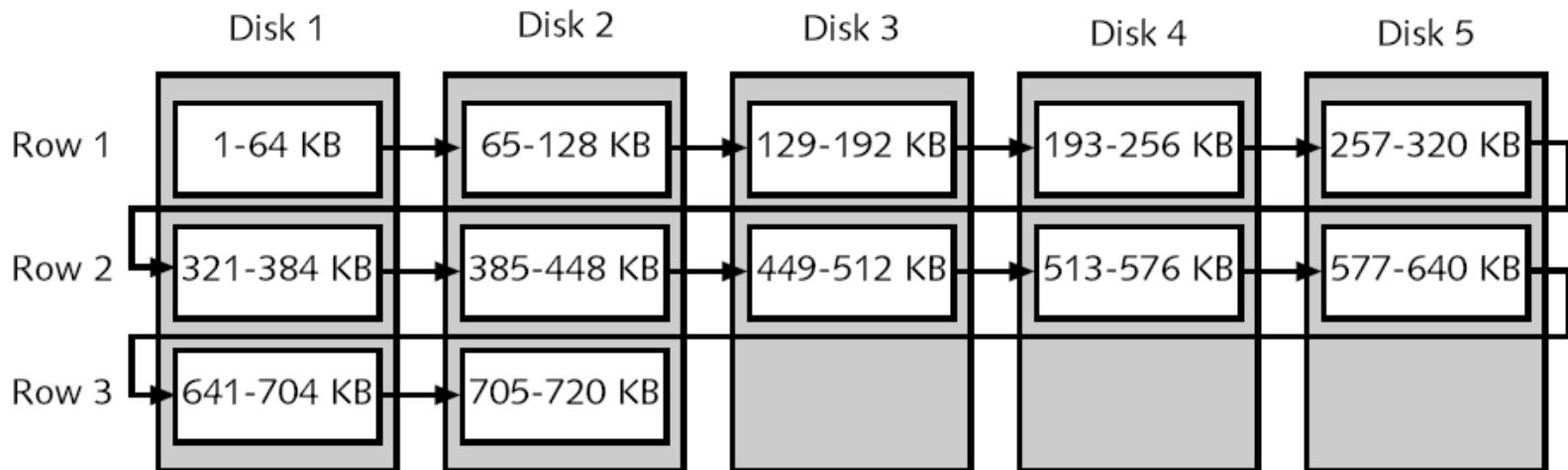


Figure 7-5 Disks in a striped volume

Disk Management (diskmgmt.msc)

- Disk Management tool (Graphical)
 - Provides a central location for viewing disk information and performing tasks such as creating and deleting partitions and volumes
- Diskpart.exe (command line)
 - More powerful tool than Disk Management
 - Does not contain features that limit you from performing tasks that should not be done

Tools to Manage Disks

- Disk Defragmenter
 - Locates fragmented folders and files and moves them to a location on the physical disk so they are in contiguous order
- Disk Check
 - The Disk Check tool allows you to scan your disk for bad sectors and file system errors
- Chkdsk
 - Checks your disk for errors. In NTFS, *chkdsk* checks files, folders, indexes, security descriptors, user files, sectors, and disk allocation units

Introduction to Fault Tolerance

- **Fault tolerance**
 - The ability of a system to smoothly recover from hardware or software failure
- With fault tolerance, data is written to more than one drive
 - In the event one drive fails, data can still be accessed from one of the remaining drives
- Windows Server 2008 supports RAID levels 0, 1, and 5 for disk fault tolerance

RAID Volumes

- RAID is a set of standards for lengthening disk life, preventing data loss, and enabling relatively uninterrupted access to data
- RAID level 0
 - Striping with no other redundancy features is RAID level 0
- RAID level 1
 - Disk duplexing is the same as disk mirroring, with the exception that it places the backup disk on a different controller or adapter than is used by the main disk
- RAID level 5
 - Combines the best features of RAID, including striping, error correction, and checksum verification

Using a Mirrored Volume (RAID-1)

- Disk mirroring involves creating a shadow copy of data on a backup disk
- Only dynamic disks can be set up as a mirrored volume in Windows Server 2008
- One of the most guaranteed forms of disk fault tolerance
- Disk read performance is the same as reading data from any single disk drive
- A mirrored volume is created through the Disk Management tool

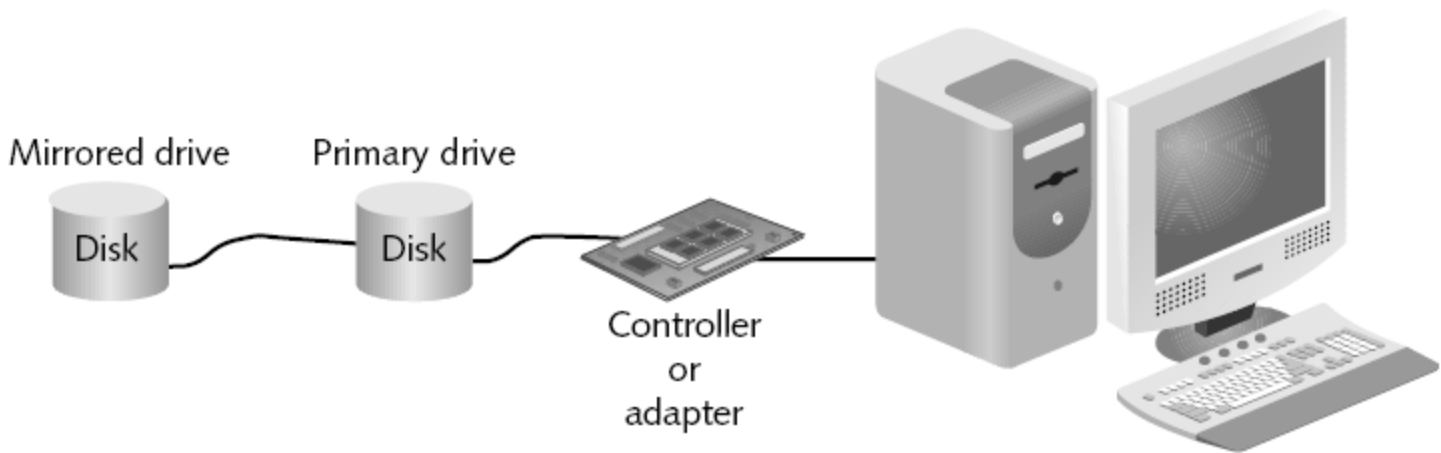


Figure 7-13 Disk mirroring

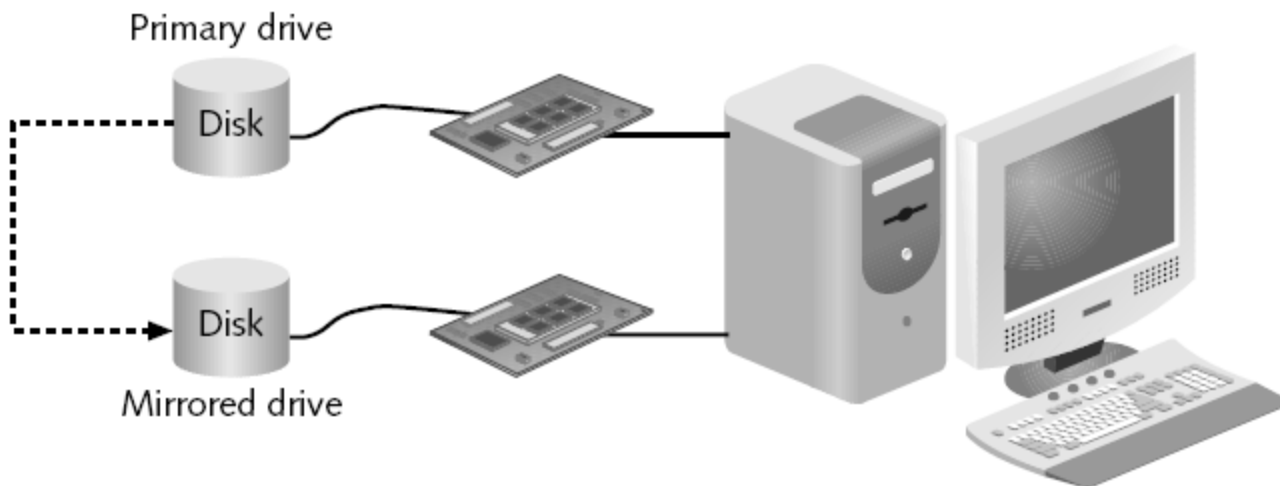


Figure 7-14 Disk duplexing

Using a RAID-5 Volume

- Fault tolerance is better for a RAID-5 volume
- A RAID-5 volume requires a **minimum** of three disk drives (maximum disks = 32)
- Parity information is distributed on each disk
 - If one disk fails, the information on that disk can be reconstructed
- The performance is not as fast as with a striped volume
 - Takes longer to write the data and calculate the parity block for each row
- RAID level 5 requires more memory than RAID level 1

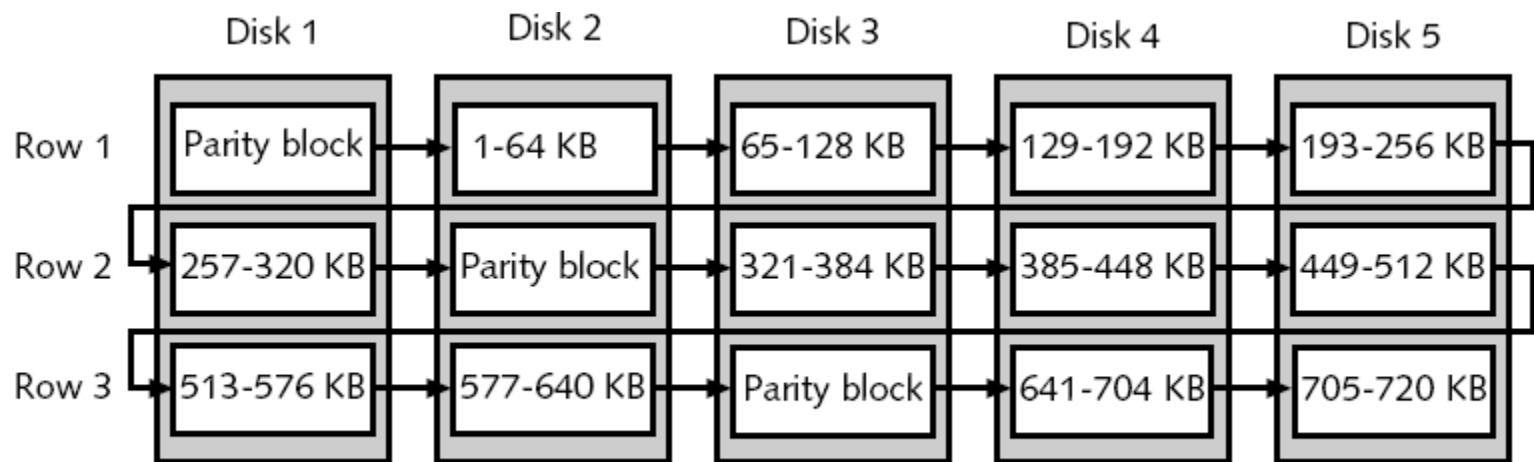


Figure 7-15 Disks in a RAID-5 volume

Software RAID vs. Hardware RAID

- Software RAID implements fault tolerance through the server's operating system
- Hardware RAID is implemented through the server hardware (recommended)
 - Independent of the operating system
- Advantages of Hardware RAID over software RAID:
 - Faster read and write response
 - The ability to place boot and system files on different RAID levels
 - The ability to “hot-swap” a failed disk
 - More setup options to retrieve damaged data

Disk Backup

- One of the best ways to make sure you do not lose valuable information on a hard disk is to fully back up information on a regular basis
 - These backups can be performed from the server or from a workstation on the network
- Performing backups from a backup device installed on the server has several advantages:
 - No extra load is produced on the network
 - Perform backups on a multiple-server network
 - Provides more assurance that the Registry is backed up

Disk Backup (continued)

- The advantages of performing a network backup
 - Backup jobs can be stored on a single backup media
 - One administrator can be responsible for backing up multiple servers
- The main disadvantages
 - The increase in network traffic
 - The Registry cannot be backed up from across the network

Registry: is the database where most Windows-based operating systems use to keep track of the settings for the operating system and all installed programs