Disk management

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Learning Objective

- Understand difference between
  - Basic disk
  - Dynamic disk
- Understand difference between
  - Spanned volume, Striped volume, Mirrored volume, RAID-5 volume
- Learn about W2003 Disk Backup procedure
- Understand UPS Fault-Tolerance configuration

Preparing a Disk for use

Preparation tasks:

- Initializing the disk, i.e. defining disk's storage structure
  - Basic disk storage vs. Dynamic disk storage
- Creating partitions or volumes
- Formatting the disk
  - Using FAT16, FAT32, or NTFS

W2003 and Storage types

- W2003 supports two types of data storage:
  - Basic disk storage
  - Dynamic disk storage
- When W2003 is installed, all existing physical disks are initialized as basic disks
- New physical disks added to a computer running W2003 are recognized basic disks

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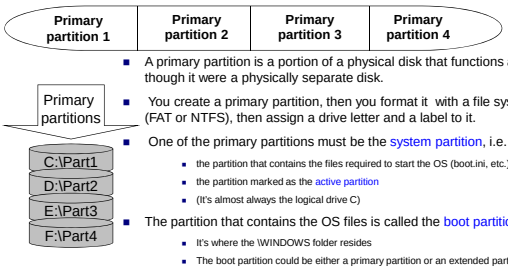
Basic disk: Primary partitions

- A basic disk uses traditional disk management techniques
- Data on basic disks can be accessed by all operating systems
- A basic disk can contain up to 4 primary partitions



- A primary partition is a portion of a physical disk that functions as though it were a physically separate disk.
- You create a primary partition, then you format it with a file system (FAT or NTFS), then assign a drive letter and a label to it.
- One of the primary partitions must be the system partition, i.e.
  - the partition that contains the files required to start the OS (boot.ini, etc.)
  - the partition marked as the active partition
  - (It's almost always the logical drive C)
- The partition that contains the OS files is called the boot partition
  - It's where the \WINDOWS folder resides
  - The boot partition could be either a primary partition or an extended partition

Note: With GPT (GUID partition table) disk-partitioning scheme that is used by the Extensible Firmware Interface (EFI) in Itanium-based computers, we can create up to 128 (primary) partitions per disk

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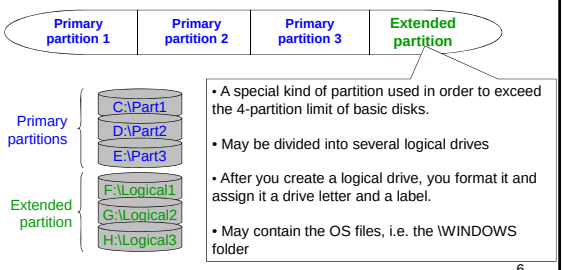
Basic disk: Extended partition

- A Basic disk may also contain
  - **Up to 3** primary partitions AND
  - **1** extended partition that could be divided in multiple logical drives.



- A special kind of partition used in order to exceed the 4-partition limit of basic disks.
- May be divided into several logical drives
- After you create a logical drive, you format it and assign it a drive letter and a label.
- May contain the OS files, i.e. the \WINDOWS folder

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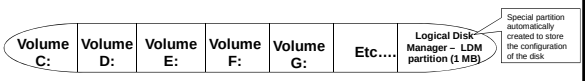
Dynamic disk

- Created by upgrading a Basic disk using the Disk Management tool
- Logical representation of the basic disk that can be divided in units called volumes
- One could virtually create an **unlimited number of volumes**
- Volumes are similar to partitions with additional capabilities



- Advantages of Dynamic disks over basic disk:
  - Volumes could be extended/resized*
  - Ability to create fault-tolerant volumes.
  - Could reactivate missing or offline disks
  - Disk settings could be changed without restarting computer.

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* Except the system volume and the boot volume. NTFS file system required for extending resizable volumes.

Types of Dynamic disks' volumes

- Simple volume
- Spanned volume
- Striped volume (RAID-0)
- Mirrored volume (RAID-1)
- RAID-5 volume

RAID = Redundant Array of Independent Disks

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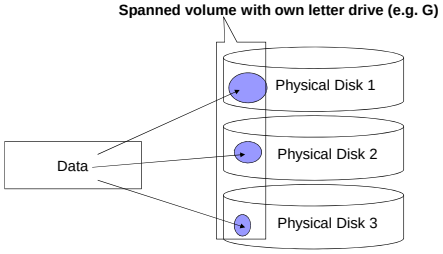
Spanned volume

- Consists of disk space on 2 to up to 32 physical disks
- Space on 1st disk filled. Then, space on 2nd disk, etc.
- Not fault-tolerant and cannot be mirrored.



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Striped volume (RAID 0)

- Stores data in stripes on 2 to up to 32 physical disks.
- Same as Spanned volume, but W2003 optimize performance by writing data to all disks at the same time.
- Data is written in 64 KB blocks across rows in the volume
- Striped volumes are not fault-tolerant. If a disk in a striped volume fails, the data in the entire volume is lost.

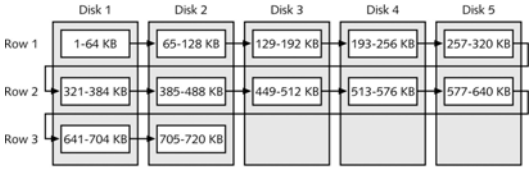

Figure 6-4 Disks in a striped volume

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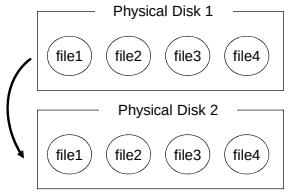
Mirrored volume (RAID 1)

- Duplicates data on 2 physical disks
- Fault-tolerant volume:
  - If one of the physical disks fails, same data available on second disk
- Disk read performance is equal to non-mirrored disk
- Disk write time is doubled



Using Disk Management tool for creating a mirrored volume

1) Right-click free space on one disk
2) Click Create volume
3) Choose the Mirrored volume option in the Create Volume Wizard

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RAID-5 volume

- Fault-tolerant volume that requires a minimum of 3 disks
- Data is written in 64 KB blocks across rows in the volume
- Uses Parity; i.e. a calculated value used to reconstruct data after a failure
- Write speed slower than with a striped volume. Read speed is same.
  - b/c for writing, parity information must be computed, and then written.
- Actual storage space for data is n-1/n where n = number of disks

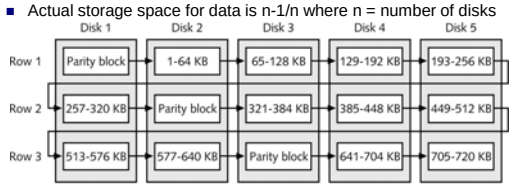

Figure 6-11 Disks in a RAID-5 volume

Disk 1	Parity	Data	Data	Data	Data
Disk 2	Data	Parity	Data	Data	Data
Disk 3	Data	Data	Parity	Data	Data
Disk 4	Data	Data	Data	Parity	Data
Disk 5	Data	Data	Data	Data	Parity

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Converting Basic disk to Dynamic disk

- For the conversion to succeed:
  - Any disks to be converted must contain at least 1 MB.
- Once converted:
  - a dynamic disk will not contain primary partitions or logical drives
  - a dynamic disk cannot be accessed by MS-DOS, Windows 95, Windows 98, Windows Millennium Edition, Windows NT, or Windows XP Home Edition
- When you convert a basic disk to a dynamic disk:
  - any existing partitions or logical drives on the basic disk become simple volumes on the dynamic disk.

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Converting Basic to Dynamic disk

Using Disk Management tool for conversion

1) Right-click the Basic disk
2) Click Upgrade to Dynamic disk

	Basic Disk organization	Dynamic disk organization
	System partition	Simple volume (not extensible)
	Boot partition	Simple volume (not extensible)
	Primary partition	Simple volume
	Extended partition	Simple volume for each logical drive and any remaining allocated space.
Win. NT 4.0	Volume set	Simple volume
Win. NT 4.0	Stripe set	Striped volume
Win. NT 4.0	Mirror set	Mirror volume
Win. NT 4.0	Stripe set with parity	RAID-5 volume

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Converting Dynamic to Basic disk

- The disk must be empty before you can change it back to a basic disk
- Converting a Dynamic disk to Basic disk causes all data to be lost
- If you want to keep your data, back it up or move it to another storage device

Using Disk Management tool for conversion

1) Right-click the Dynamic disk (unallocated space)
2) Click Revert to Basic disk

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Limitations of Dynamic disk

- Dynamic disks are not supported on:
  - Portable computers
  - Removable disks
  - Detachable disks that use Universal Serial Bus (USB) or IEEE 1394 (also called FireWire) interfaces,
  - Disks connected to shared SCSI buses
- Dynamic volumes (and the data they contain) cannot be accessed by, or created on:
  - Computers running MS-DOS, Windows 95, Windows 98, Windows Millennium Edition, Windows NT 4.0, or Windows XP Home Edition

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Disk Management tools

- Tools used to:
  - view/manage disk properties
  - create, format, delete, extend, and resize partitions/volumes
  - convert basic disk to dynamic or do the reverse
  - import foreign disks
- Tools available in W2003:
  - Disk Management utility
  - DISKPART**,** CHKDSK, CONVERT, DEFRAG, FORMAT command-line utilities (can be scripted)
- Must be a member of the Backup Operators group or Administrators group to manage disks.

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Disk data Backup

- User data and System State data can be protected from losses using Windows Backup utility

Types of backups		
Normal	All selected files/folders are backed up **whether or not they have the archive attribute**.	Archive attribute is removed
Differential	Only selected files/folders **with archive attribute** are backed up.	Archive attribute is not removed
Incremental	Only selected files/folders **with archive attribute** are backed up.	Archive attribute is removed
Copy	All selected files/folders are backed up **whether or not they have the archive attribute**.	Archive attribute is not removed
Daily	All selected files/folders that have been **modified that day** are backed up.	Archive attribute is not removed

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UPS fault-tolerance

- Uninterruptible Power Supply = Best fault-tolerance method to prevent data lost due to power problem

Online UPS systems	Offline UPS systems
Provide power directly from their batteries	Equipment connected directly to city power until UPS senses sudden reduction of power
Batteries always charging from city power until power failure	UPS switches to batteries when sudden reduction of power sensed
Batteries don't last long	Batteries last longer
More expensive	Less expensive, but less reliable

- UPS options can be configured through Power Options icon in Control Panel

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Hands-on Exercise

- Week9 Hands-on: Using the Windows Backup Utility and UPS configuration.

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Summary Questions

1. On a W2003 system, the boot volume can be extended*	T	F
2. On a W2003 system, the system volume can be extended*	T	F
3. A volume formatted using NTFS could be extended, but a volume formatted using FAT cannot.	T	F

* Answer on slide 7 (check the note on the footnote of slide 7)

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Summary Questions

- How much free space is needed on a basic disk to convert it to a dynamic disk?
  a. At least 1 MB
  b. At least 15 MB
  c. At least 10 MB
- How many partitions can you put on a dynamic disk ?
  a. 1
  b. 2
  c. 4
  d. none
- How many extended partitions can be on one basic disk?

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Summary Questions

- Which of the following is/are true about basic and dynamic disks?
  a. Dynamic disks can be partitioned, but basic disks cannot.
  b. Dynamic disks can be set as spanned volumes.
  c. Basic disks are formatted, but dynamic discs are not
- You want to set up two disks so they are mirrored (RAID 1), but there is no option to do this in the Disk Management utility. What is the problem?
  a. Windows 2003 no longer supports mirroring.
  b. You are working with basic disks and need to convert them to dynamic disks.
  c. You must stripe the disk first
  d. The disks must contain over 2 GB to mirror them.

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Summary Questions

- You are setting up a server for a customer service organization that needs fast access to its data, but that is not as concerned about how fast information is updated on disk. The organization wants fault tolerance for data storage. Which of the following options would you recommend?
  a. A spanned volume
  b. A stripped volume
  c. A RAID-5 volume
- You have created a RAID-5 volume that consists of seven 9-GB disks. How much disk space is usable to store files?
  a. 54 GB
  b. 62 GB
  c. 60 GB

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