DISKS and FILE SYSTEMS

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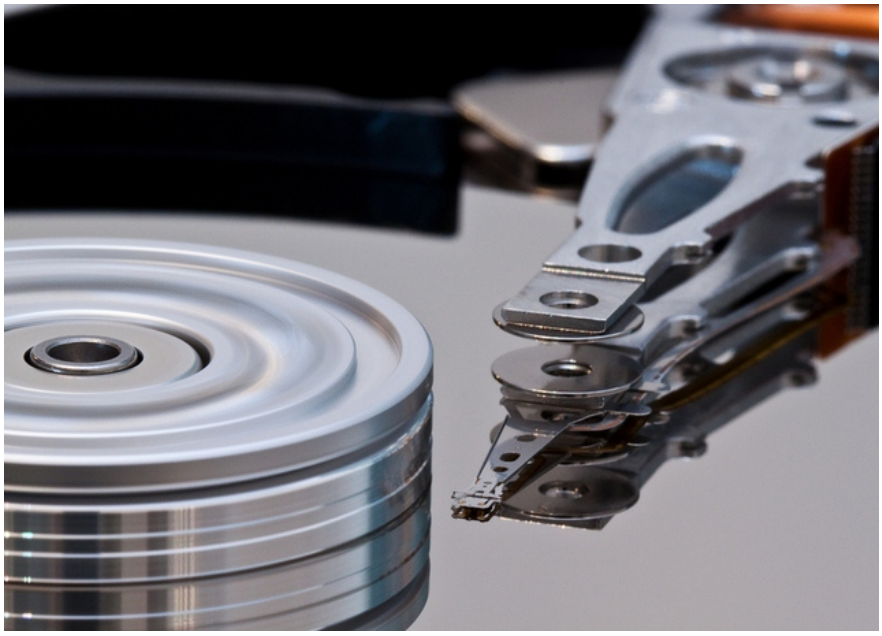

Understanding how disks and file systems are used is very essential when working with any operating system. A specific file system is used when disks need to be formatted because the file system you choose impacts its performance and security. There are several different tools included in Windows operating system that are used to manage disks. Knowing how to use these tools can overcome and address the most problems that you will encounter with any disks.

In this chapter, you will learn how to :

- Make Partition on Hard drives
- Discuss the File systems
- Manage Disk

Understanding Disks, Partitions and Volumes — Lesson 1

Hard disk drive is a physical piece of hardware with spinning platters and read/write heads. It's something you can touch. However, operating systems work with partitions or volumes, which are logical rather than physical.

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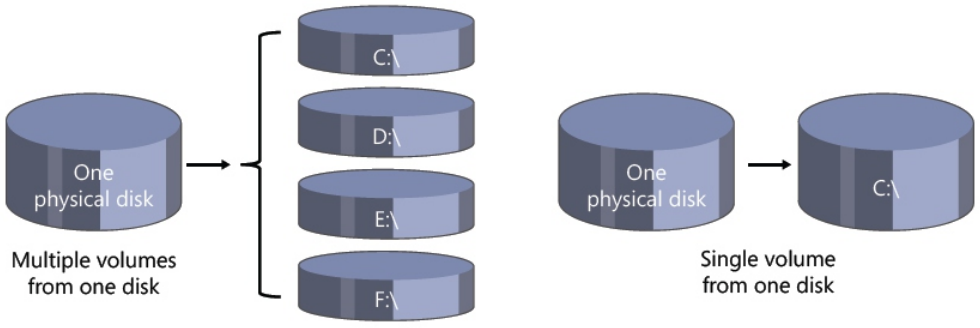


A logical question to ask is, "Why would you want multiple partitions?" It's not necessary, but some people like to have different partitions to organize their data. For example, the operating system is on the C drive, and they create a second partition to store their data. Then again, they could leave it as a single partition and create a folder named Data for their files. It's just a matter of preference.

MBR Partitions

The most common type of disk partitioning system in use is the Master Boot Record (MBR) partitioning scheme. You can divide an MBR disk into two types of partitions:

- Primary partition. A primary partition is used for a single volume, such as the C volume or D volume. One of the primary partitions is marked as active, indicating that it is bootable. During the startup process, the computer locates the active partition and attempts to boot from it. You can have as many as four primary partitions on a disk.
- Extended partition. An extended partition allows you to add multiple logical drives. For example, you can have one extended partition with three logical drives identified as G, H, and I. You can have only one extended partition on a disk. It isn't common to use extended partitions. The only reason you'd use one is to have more than four drive letters for a hard disk drive.

Only fixed disks can be configured as GPT disks. Removable disks, such as flash drives, all use the MBR partitioning scheme.

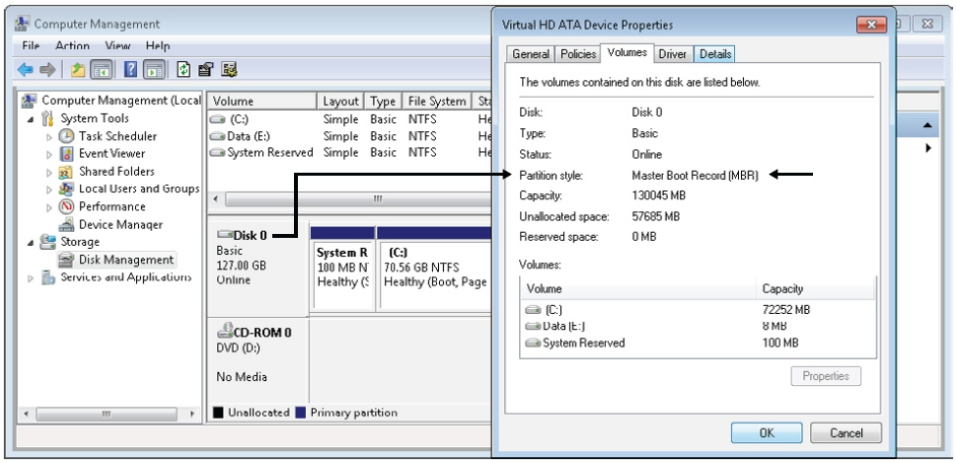
Linux-based systems can use and boot from a GPT disk. Windows-based systems from Windows XP to Windows 7 can use a GPT disk. However, only 64-bit versions of Windows 7 can boot to a GPT disk and only if the computer is an Extensible Firmware Interface (EFI)-based system.

Another benefit of GPT disks is that they are backward-compatible for applications that are expecting an MBR disk. A GPT disk includes a table called a protective MBR that simulates the MBR. Without this, older applications and disk utilities wouldn't be able to read the disk and might prompt the user to reformat it.

You can tell whether your system is using an MBR or GPT disk through the Disk Management tool by using the following steps on Windows 7:

1. Click Start, right-click Computer, and select Manage.
2. Select Disk Management.
3. Right-click a disk and select Properties. Select the Volumes tab and look at the Partition style as shown in the following graphic. The disk in the figure is an MBR disk.

You can convert an unpartitioned hard disk from MBR to GPT or from GPT to MBR from within the Disk Management console. For example, if it is an MBR disk, you can right-click the disk and select Convert To GPT. If it is a GPT disk, the option changes to Convert To MBR. These options are dimmed if the disk has any partitions on it.



Recovery Partition

Many computer manufacturers and resellers include a recovery partition with systems they sell. This is another partition on the hard drive that a user can access, often by pressing a specific key when the system starts.

If the primary partition develops a problem, the recovery partition can be used to restore the system to the exact state it was in when it was shipped. Users won't have access to any data or applications they added to their primary partition, but they will have a working system again.

Corrupted Partition

A recovery partition is often invisible to the system. It isn't assigned a drive letter and usually isn't accessible with any applications other than the vendor's recovery application. If the primary partition is corrupted, such as from a virus, you can often use the recovery partition to restore the system to its original condition. Many vendors don't include media to restore a system, so if the recovery partition is modified or deleted, users won't be able to recover it.

Basic Disks vs. Dynamic Disks

Windows-based systems since Windows 2000 have supported two types of disks: basic disks and dynamic disks. Basic disks are used most often and are the simplest to use, but dynamic disks provide some additional capabilities. Both basic and dynamic disks can use either the MBR or the GPT partitioning scheme.

Programs and applications

If you convert one disk to dynamic in a computer, you will not be able to use the system as a dual-boot system.

Unless you have a specific reason to do so, you should leave disks as basic instead of dynamic. Of course, that prompts the question, "What's a reason to upgrade a disk to dynamic?"

Dynamic disks provide several benefits, such as the ability to create as many as 2,000 volumes on a single disk. This is useful for users who want to get beyond the four-partition limit of a basic MBR disk. You can also create striped, mirrored, and spanned volumes on dynamic disks, which are discussed in the following sections.

Dynamic Disks and RAID

One of the benefits of using dynamic disks is the ability to use a redundant array of inexpensive disks (RAID). Different RAID configurations provide different benefits. A primary benefit of RAID is fault tolerance. A drive can develop a fault and fail, but the system can tolerate it and continue to operate.

However, you'll find that dynamic disks do not support all the different RAID configurations on all operating systems. Common RAID configurations are listed in Table 4-1.

If you convert the disk on any Windows-based system to dynamic disks, you can use RAID-0, but that is the only configuration that is universally supported. Only Windows 7 supports mirrored disks, and you can use RAID-5 (also called striping with parity) only on servers. Dynamic disks do not support RAID-10.

Table 4-1 Raid Configurations

RAID	Number of Disks	Fault Tolerance	Dynamic Disk Support
RAID-0 Striped	At least two	No	Yes
RAID-1 Mirrored	Only two	Yes	Windows 7 (not Windows XP and Vista)
RAID-5	At least three	Yes	Only servers
RAID-10	At least four	Yes	No

Striped Volumes (RAID-0)

You can create a striped volume (RAID-0) on any Windows-based system that supports dynamic disks. It includes space on more than one physical disk, but it appears to the operating system as a single physical volume. Dynamic disk striped volumes include at least two and up to 32 disks in the volume.

Each disk in the volume must be the same size, and data is stored in stripes on the different disks. For example, a two-disk striped volume would hold half of a file in one disk and the other half of the file in the other disk. The system can read both halves from the two disks at the same time, improving read performance. Additionally, the system can write both halves of a file to the two drives at the same time, improving write performance.

Mirrored Volumes (RAID-1)

Windows 7 supports mirrored volumes on dynamic disks. A mirrored volume includes two disks, and data written to one disk is also written to the other disk. If one of the disks fails, the system can continue to operate. Both disks must include partitions of exactly the same size.

Spanned Volumes

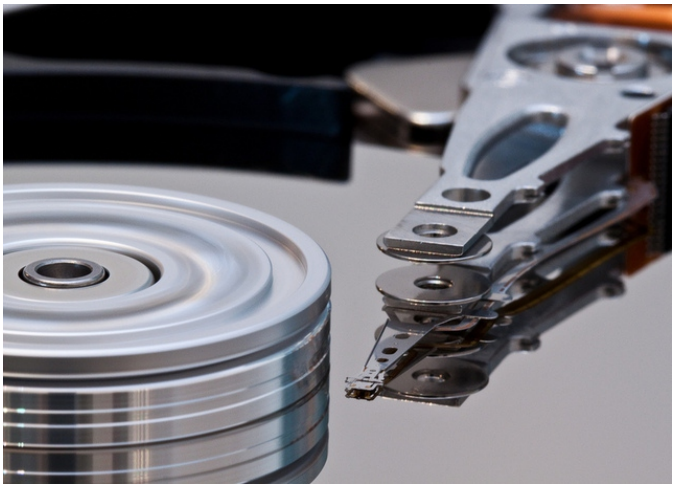
A spanned volume includes space on more than one physical disk, but it appears to the operating system as a single physical volume. For example, if you have a D volume used for data but it's running out of space, you can add another physical disk and span the D volume to the new disk. The D volume will now have the additional space available.

You cannot span a boot or system volume, but you can span other volumes, such as one used for data. The system partition is where the system boot files are located (typically C:\), and the boot partition is the location where the Windows-based system files are located (typically C:\Windows).

Spanned volumes don't provide any performance gains or fault tolerance benefits. Worse, if any physical drive in the spanned volume fails, the entire volume fails and all the data is lost. A better option is to use a mounted volume (described later in this chapter), which can be created on a basic disk.

Chapter 4
Laboratory Manual

DISK AND FILE SYSTEM



Laboratory Activities

Lab Activity 4.01 Creating and Formatting Partitions with the Windows XP and Vista/7 Installation Media

As you'll recall from the labs in Chapter 3, you have worked with a number of machines, physically installing and configuring hard drives, primarily PATA and SATA hard drives. Once these drives have been recognized in CMOS, you are only halfway to your goal of using the drives for data storage. You must now partition each drive into usable space (even if only one partition uses all of the available drive space) and then format each partition with a file system. In this lab, you will use the Windows installation media to partition and format hard drives in your system. You will be left with blank partitions, one of which needs an operating system. In the labs for Chapter 5 you will complete the process of installing the operating system.

Learning Objectives

In this exercise, you'll use the Windows installation media to partition a hard drive and format the partition for use.

At the end of this lab, you'll be able to

- set up a primary partition on a hard drive
- format the partition with the NTFS file system

Lab Materials and Setup

The materials you need for this lab are

- a PC with a primary hard drive that holds your Windows OS, and two blank hard drives that you can partition and format to your heart's content
- Optional: A system with one hard drive that you can safely erase
- the Windows XP or Vista/7 installation media

Partitioning and formatting a hard drive destroys any data on it! Practice this lab using only drives that don't store any data you need.

Let's Get the Lab Started

In this exercise, you'll start the system by booting from the Windows installation media (you will have to configure your system CMOS to boot from the optical drive or, if available, a USB device). You'll partition a portion of one of the hard drives and format it with the NTFS file system, as if you're preparing to install the operating system.

The instructions for Windows XP are first, followed immediately by the instructions for Windows Vista/7.

Step 1 Enter the CMOS setup program and configure the boot order, selecting the optical drive as the first boot device. Also make sure that the setting called "Boot Other Device" (or something similar) is enabled; otherwise, your system may not recognize the optical drive as a bootable drive.

Step 2 Place the Windows installation CD in the optical drive tray and boot the machine. Windows Setup copies a number of files and then presents you with the screen shown in Figure 4-1. Press ENTER to set up Windows now.

Step 3 Press F8 to accept the license agreement and enter the main partitioning screen.

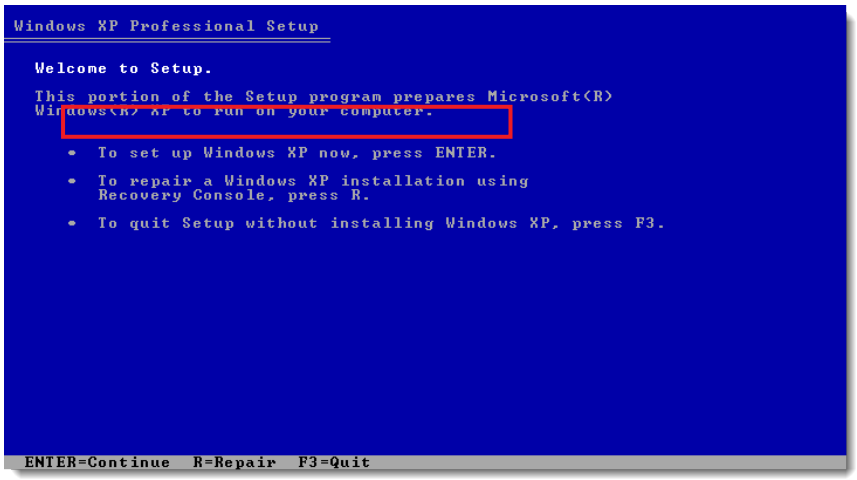


FIGURE 4-1 The first Windows XP Setup screen

The screen displays the installed drives and any partitions and/or file systems that have been configured on the drives prior to this session (see Figure 4-2).

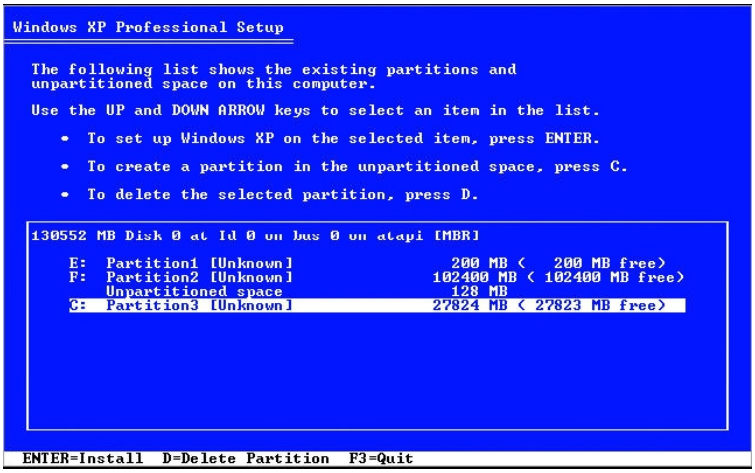


FIGURE 4-2 Partitioning screen

Step 4 If any partitions exist on the drives you have installed to practice this lab (and the data on these drives is expendable), delete them at this time.

To delete a partition, simply select the partition, press D to delete, and then press L to commit the delete process. The partition will be returned to unpartitioned space.

Step 5 To create a partition, follow these steps:

a. Press C.
b. Select the size of the partition you want to create (10 GB is a good size for a system partition or a boot partition, but you should try multiple sizes).
c. Press ENTER.
d. The new partition should appear in the partitioning screen.

Congratulations! You have created a partition.

Step 6 Press ENTER to see a list of file system options, as shown in Figure 4-3. Choose a file system (NTFS is the default) and indicate whether you will perform an exhaustive formatting process or the "Quick" formatting process.

Press ENTER. Windows formats the partition and proceeds with the operating system installation. You can shut down the PC once this step is completed.

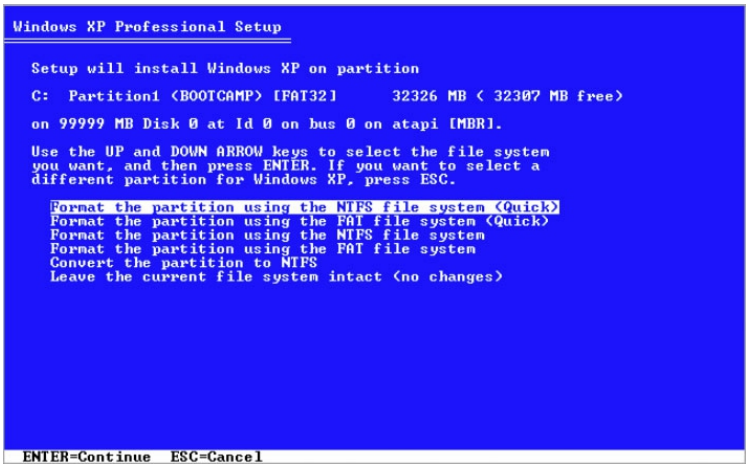


FIGURE 4-3 Format screen

Step 7 Reboot the machine and allow Windows to boot. Then use the Disk Management tool to verify the partition(s) you have created with the installation CD. Alternatively, you can verify the partitions you created and the file systems you configured when you use the GParted tool in the next lab.

Step 8 Practice deleting, creating, and formatting different combinations of partitions and file systems to become comfortable with the tools used in this exercise. Have fun!

Here are the same instructions, but for Windows Vista/7.

Step 1 Enter the CMOS setup program and configure the boot order, selecting the optical drive (or, if necessary, a USB device) as the first boot device. Also make sure that the setting called "Boot Other Device" (or something similar) is enabled; otherwise, your system may not recognize the optical drive as a bootable drive.

Step 2 Place the Windows installation media in the optical drive tray and boot the machine. Set your language and regional preferences on the first screen, and then click Next.

Step 3 Click the large Install Now button on the next page. Setup will then ask for a product key, but you do not need to enter one right now. Click Next to move on.

Step 4 Pick the edition of Vista/7 you wish to install. Your product key will only activate the edition that you purchased. Click Next to continue, and then agree to the license agreement on the next page.

Step 5 Click the Custom install button on the following screen. The screen displays the installed drives and any partitions and/or file systems that have been configured on the drives prior to this session (see Figure 4-4).

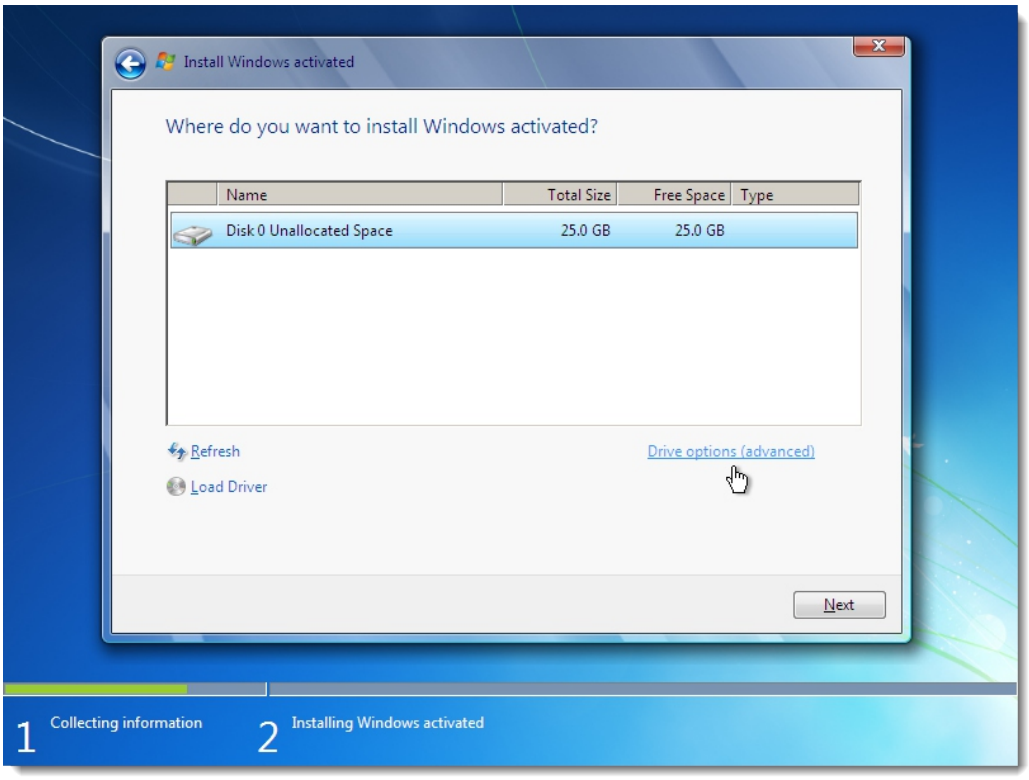


FIGURE 4-4 Where do you want to install Windows?

Step 6 If any partitions exist on the drives you have installed to practice this lab (and the data on these drives is expendable), delete them at this time.

To delete a partition, simply select the partition, click on Drive options (advanced), and then click Delete. The partition will be returned to unpartitioned space.

Step 7 To create a partition, follow these steps:

a. Click the Drive options (advanced) button

b. Click New.

c. In the Size field, type 50000 and click Apply to end up with a ~50-GB partition.

Step 8 Click the Format button. The installer will automatically set up an NTFS file system for the partition and proceed with the operating system installation.

Step 9 Reboot the machine and allow Windows to boot. Then use the Disk Management tool to verify the partition(s) you have created with the installation disc. Alternatively, you can verify the partitions you created and the file systems you configured when you use the GParted tool in the next lab.

Step 10 Practice deleting, creating, and formatting different combinations of partitions and file systems to become comfortable with the tools used in this exercise. Enjoy!