Storage Devices

Chapter 7

This presentation covers:

- In-person and Phone Skills
- Storage Devices and Drives Overview
- Storage Device Configuration Overview
- Partitioning
- High-Level Formatting
- Windows Disk Management
- Slow Performance

Qualities of a Good Technician

"Soft skills" as they are known across many industries are essential

In-person Communication Skills

When dealing with someone in person, you can use some of the following techniques:

- Gesture to emphasize points
- Draw a graphic to illustrate a concept
- Perform steps needed for troubleshooting faster because you can do them rather than step someone through them
- Show empathy more easily with your body language, actions, and voice

Phone Communication Skills

When dealing with someone on the phone, the following pointers can help:

- Identify yourself clearly and pleasantly
- Avoid using a condescending tone
- Be patient and speak slowly when giving directions
- Use active listening skills; avoid doing other tasks when on a call with someone
- Avoid using acronyms and technical jargon

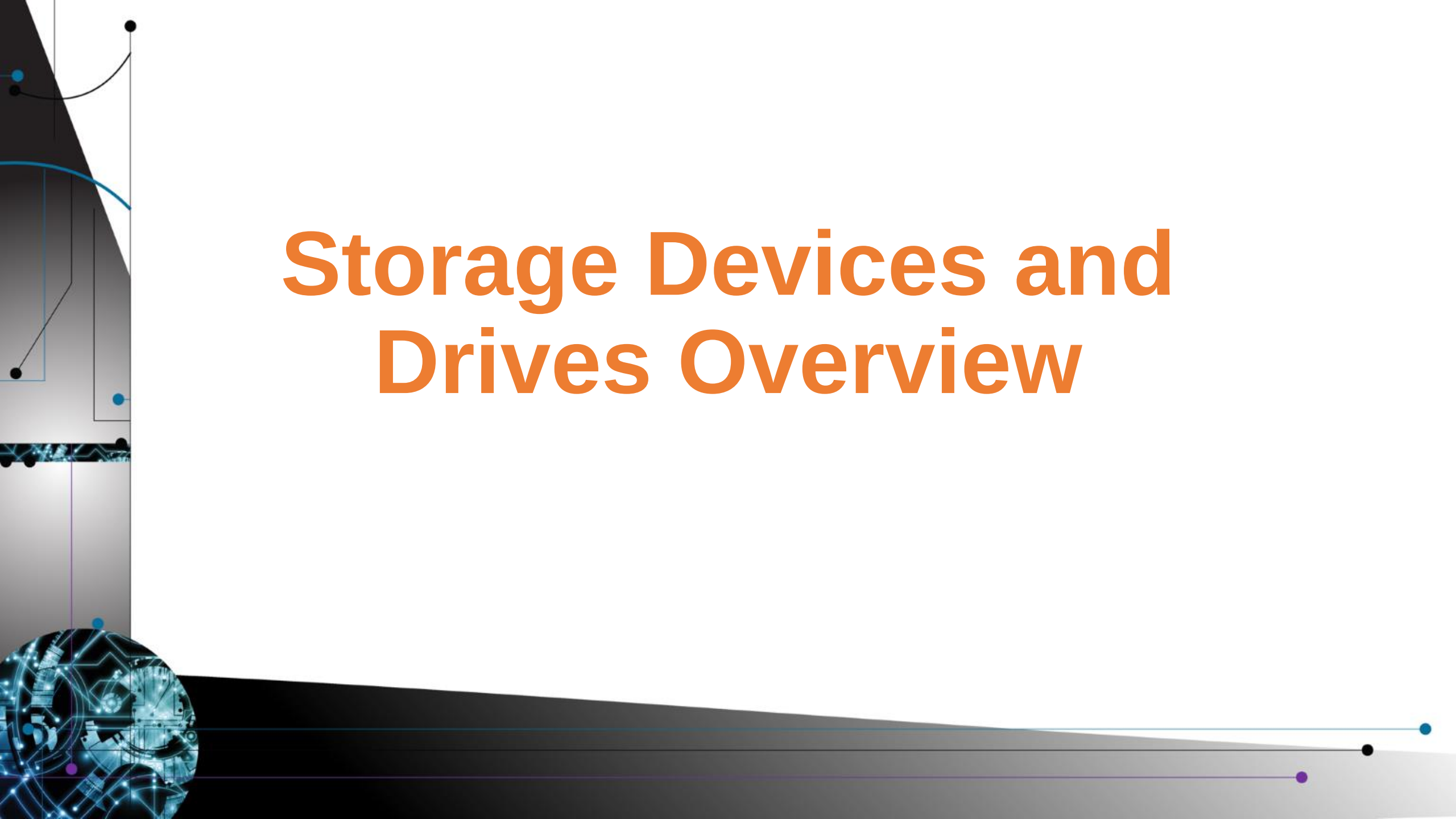
Phone Communication Skills, cont'd

- Avoid being accusatory or threatening.
- If the customer is irate, try to calm the customer down and help him or her; however, if the customer continues to be belligerent, turn the call over to your supervisor
- Escalate the problem if it is beyond your skill level; do not waste the customer's time
- Do not leave people on hold for extended periods without checking back with them and updating them
- Speak clearly and loud enough to be heard easily

Phone Communication Skills, cont'd

- Avoid having a headset microphone pulled away so it is hard to hear you; if you are asked to repeat something, speak louder or adjust the microphone or handset
- Avoid eating, drinking, or chewing gum when on the phone

Storage Devices and Drives Overview



Storage Devices Overview

- Storage devices hold the data (e.g. photos, PDFs, movies, word processing documents, spreadsheets, etc.)
- Data is stored on optical media, flash media, and magnetic media such as hard drives
- Data may also be store “in the cloud” which means storage devices are available through the Internet to store data

Storage Devices

Hard Drive Overview

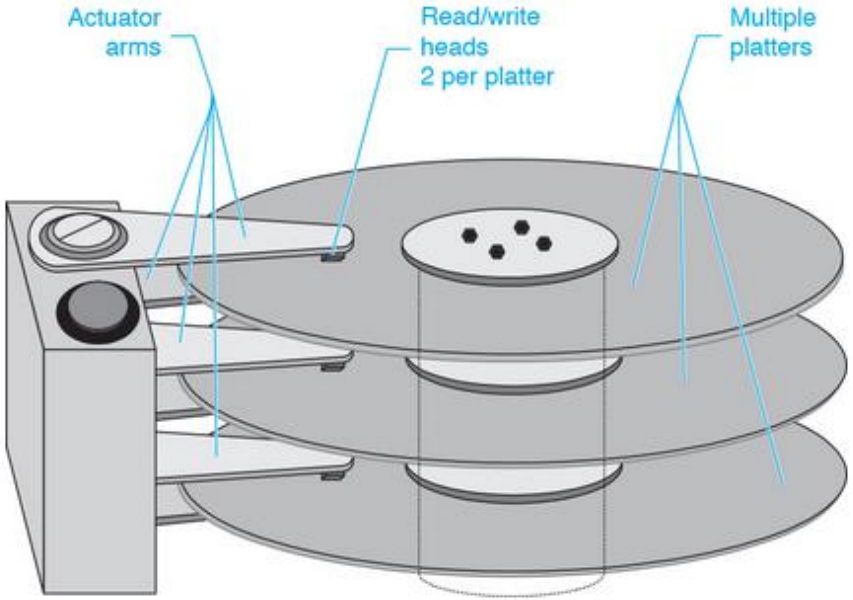
- Hard drives store data
- Can be mounted inside the computer case or attached externally
- Store more data than flash drives and move data faster than tape drives
- Today's hard drive capacities extend into the terabytes

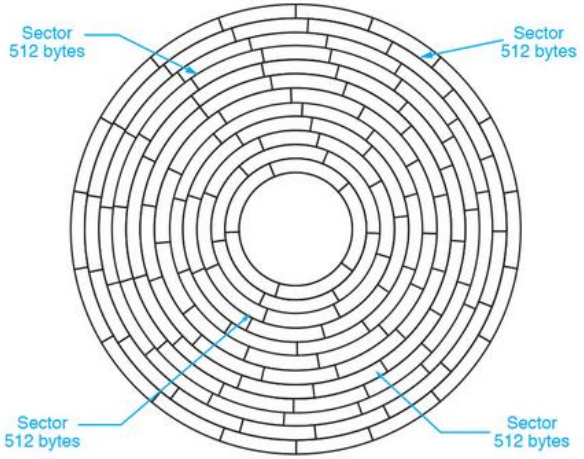
Desktop Hard Drive

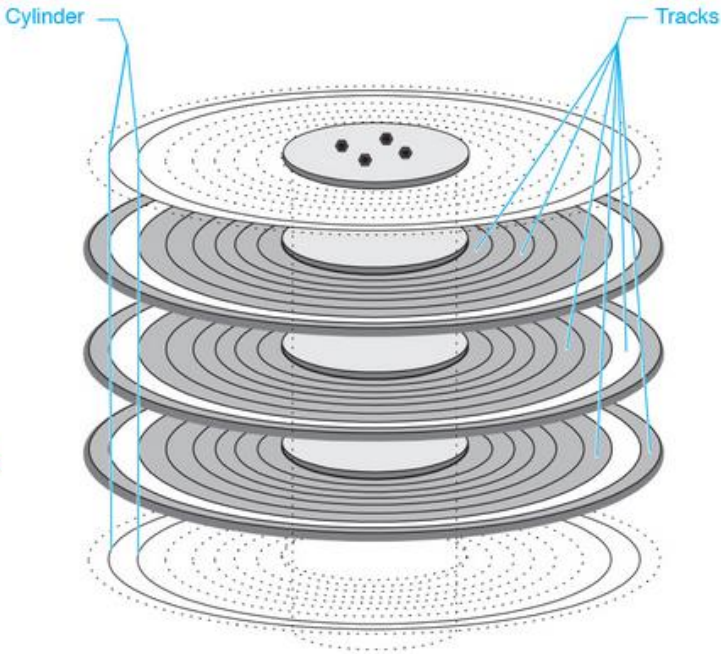
Magnetic Hard Drive Overview

- Hard disk drive (magnetic drives)
- Platters
  - Each platter holds data on both sides
  - 2 read/write heads
    - 1 for top and 1 for bottom
- Data written using electromagnetism
  - Charge applied to the read/write head
- Platter has magnetic particles affected by the read/write head's magnetic field
- Two motors
  - 1 turn platter and 1 to move read/write heads

Magnetic Hard Drive Overview







Solid State Drive (SSD) Overview

- Older SSDs use DRAM
- Newer SSDs use nonvolatile flash memory
- No moving parts
- Produce little heat, are reliable, quiet, secure, long-lasting and fast
- Common in laptops, desktops, tablets and some mobile devices
- Write amplification
- Wear leveling

Hard Drive Interfaces Overview

- Hard drive interfaces need a set of rules to operate
- The rules specify the number of heads on the drive, what commands the drive responds to, the cables used with the drive, the number of devices supported, the number of data bits transferred at one time, and so on
- There are two major hard drive interfaces:
  - Integrated drive electronics (IDE)—also known as the AT Attachment (ATA) or Enhanced IDE (EIDE) standard (most common in home and office computers)
  - Small Computer System Interface (SCSI) (commonly found in network servers)

Hard Drive – PATA/SATA

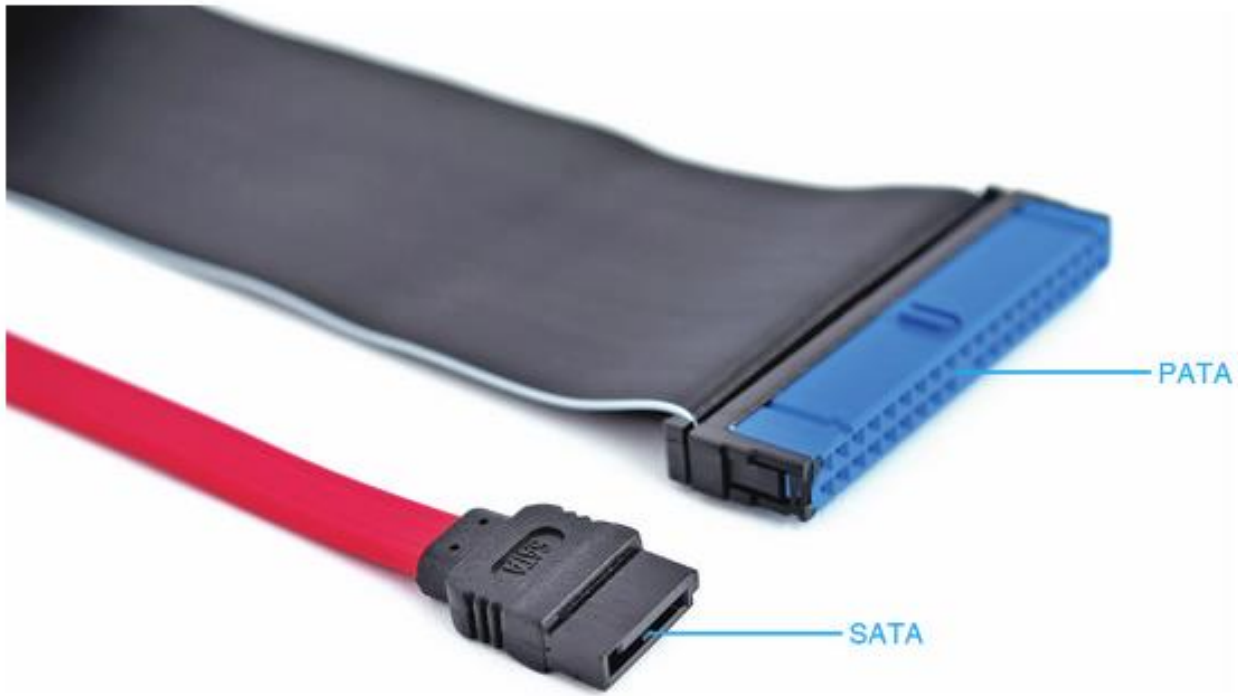
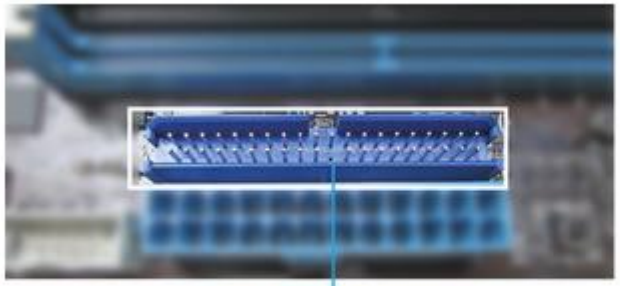


Figure 7.15 SATA and PATA data cables

Hard Drive – PATA/SATA

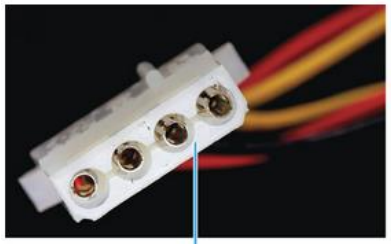
Figure 7.19 shows PATA IDE hard drive connectors. Notice the 40-pin connector on the far left and the power connector on the far right.



PATA motherboard connector

SATA motherboard connectors

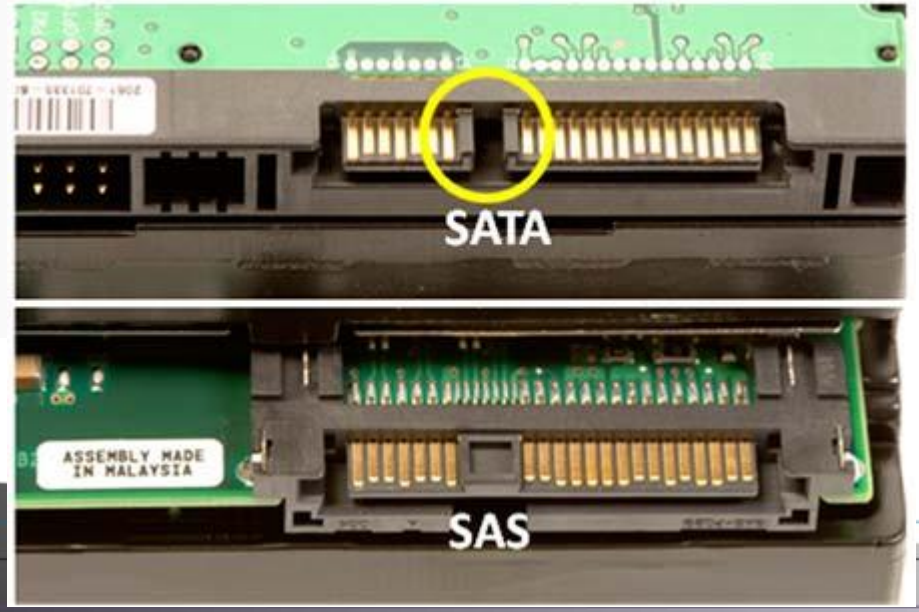
Figure 7.20 shows an internal SATA drive with the cable attached. The data connector is to the left of the power connector.



Molex

Internal SATA

Hard Drive – SAS



Storage Device Configuration Overview

The overall steps for installing a storage device are as follows:

- Step 1. Keep the drive in the protective anti-static container until you are ready to install.
- Step 2. Use proper anti-static handling procedures when installing the drive and handle the
- drive by the edges; avoid touching the drive electronics and connectors.
- Step 3. Turn off and remove the computer power cord when installing the drive.

Storage Device Configuration Overview, cont'd

- Step 4. Physically mount and secure the device in the computer and attach the proper cable.
- Step 5. Configure the BIOS/UEFI, if necessary.
- Step 6. Reconnect the power cord and power on the computer. If a hard drive, prepare the drive for data as described later in the chapter.

System BIOS/UEFI Configuration for Hard Drives

- Hard drive is configured through the system BIOS/UEFI Setup program
- Accessed during the boot process
- BIOS/UEFI automatically detects the hard drive type
  - Drive type info saved in CMOS

Hard Drive Preparation Overview

The two steps of hard drive preparation are as follows:

- Step 1. Partition the drive
- Step 2. High-level format the hard drive

Hard Drive Partitioning

- Partitioning a hard drive means dividing the drive into separate sections so the computer system sees the hard drive as more than one drive
  - Each drive gets a drive letter
- Use Windows Disk Management
- Divide hard drive into separate subunits and assign them a drive letter
- Organize the hard drive to separate multiple operating systems, applications and data
- Provide data security by placing data in a different partition to allow ease of backup as well as protection
- Using the hard drive to its fullest capacity

Hard Drive Partitioning

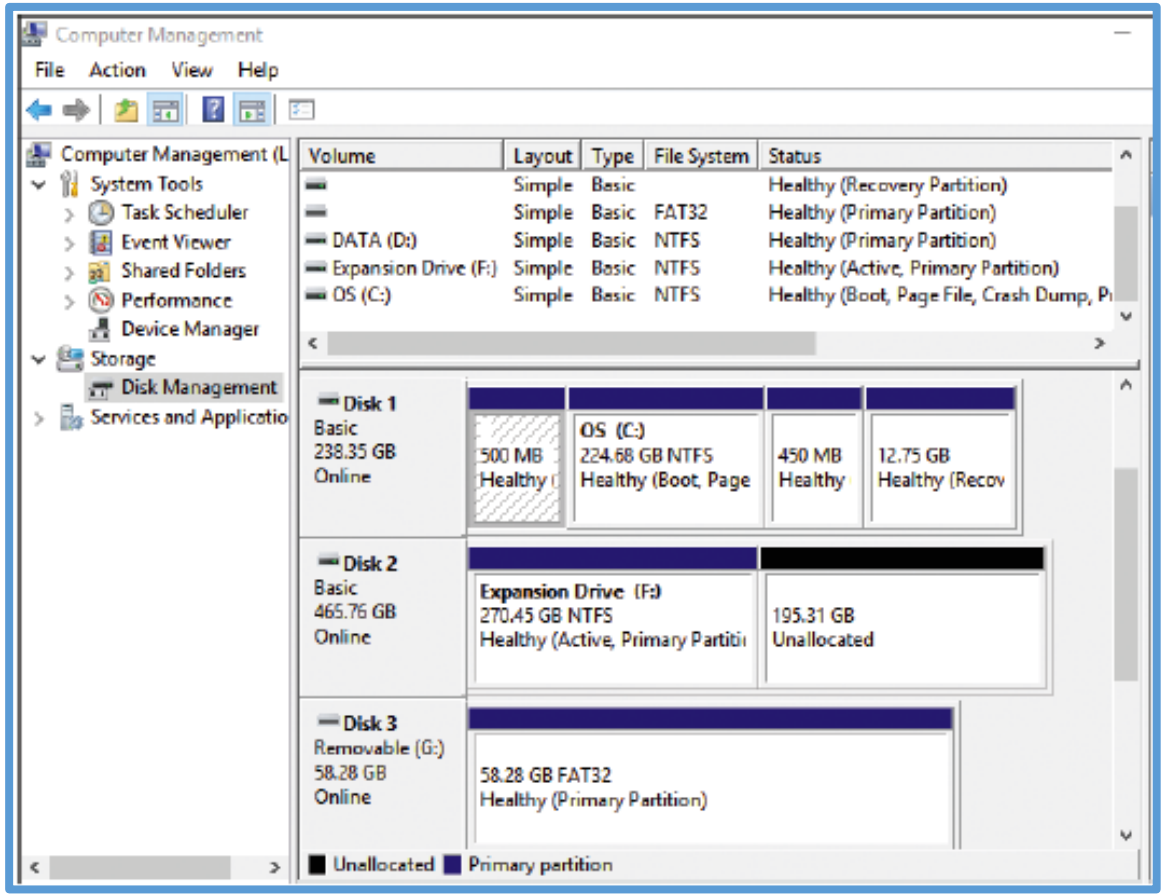
A file system defines how data is stored on a drive – what file system can be used depends on the OS that's installed, if the device is internal/external and whether files are to be shared

Table 7.2 **File systems**

File system type	Description
Compact Disk File System (CDFS)	A file system for optical media.
FAT	Also called FAT16. Used with all versions of Windows. 2 GB partition limitation with old operating systems. 4 GB partition limitation with XP and higher versions of Windows.
FAT32	Supported with all versions of Windows. Commonly used with removable flash drives. Supports drives up to 2 TB. Can recognize volumes greater than 32 GB but cannot create them that big.
exFAT	Commonly called FAT64. A file system made for removable media (such as flash drives and SD cards) that extends drive size support up to 64 ZB in theory, but 512 TB is the recommended max. Made for copying large files such as disk images and media files. Supported by all versions of Windows.
NTFS	Used with Windows 7, 8, and 10. Supports drives up to 16 EB (16 exabytes, which equals 16 billion gigabytes), but in practice is only 16 TB. Supports file compression and file security (encryption). NTFS allows faster file access and uses hard drive space more efficiently. Supports individual file compression and has the best file security.
Hierarchical File System (HFS)	Used with Apple computers. Was been upgraded to HFS+ and then later upgraded to Apple File System (APFS) in 2017.
Network File System (NFS)	An open source file system developed by Sun Microsystems that is used in Linux-based systems. Allows access to remote files over a network.
ext3	Also known as third extended file system. Used in Linux-based operating systems and is a journaling file system (which means it tracks changes in case the operating system crashes, allowing it to be restarted without reloading).
ext4	An update to ext3 that allows for larger volumes and file sizes within Linux-based operating systems.

Partitioning

- Partitioning can be done in two ways
  - Through the operating system installation process
  - If an operating system is already installed, through the Windows Disk Management utility



High-Level Formatting

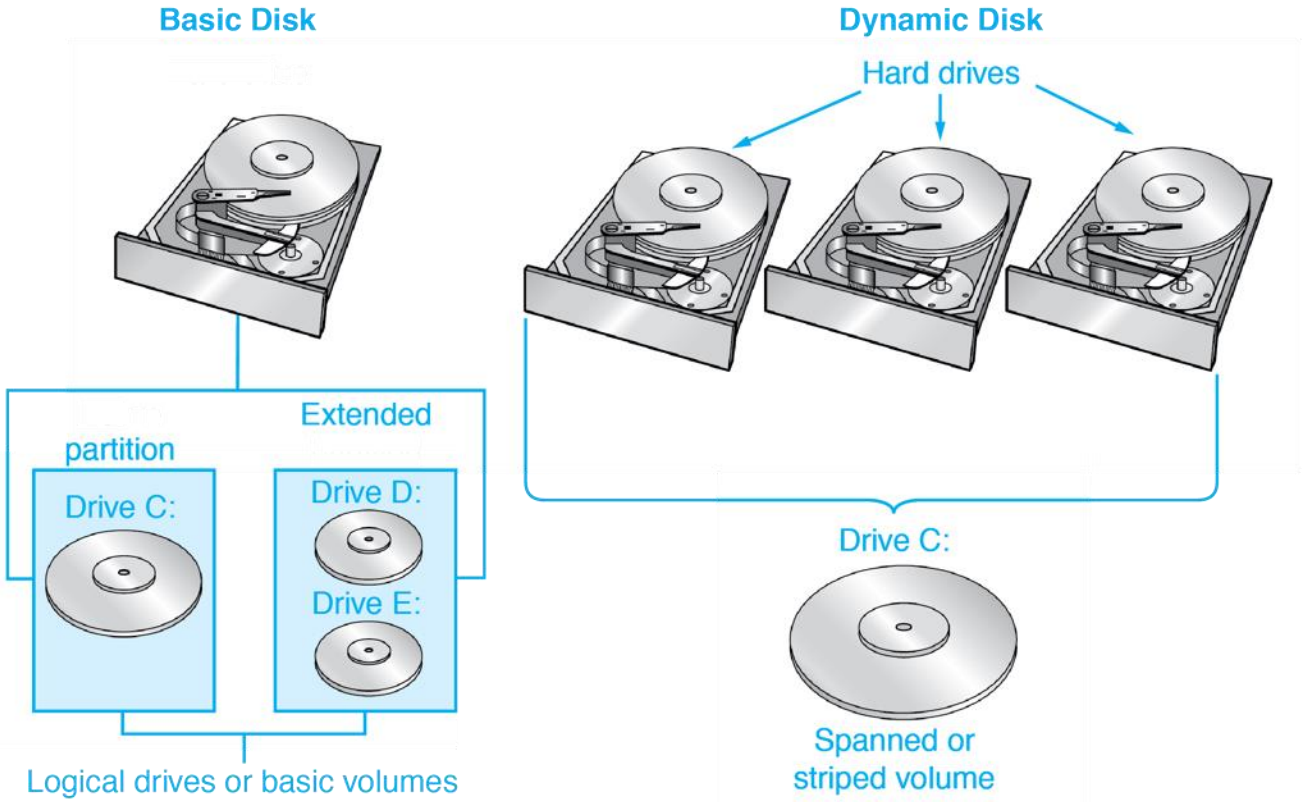
- The second step in preparing a hard drive for use is high-level formatting
- A high-level format must be performed on all primary partitions, logical drives located within extended partitions, and GPT partitions before data can be written to the hard drive
- The high-level format creates two file allocation tables (FATs): one primary and one secondary

Windows Disk Management

Table 7.6 **Logical disk management terms**

Term	Description
Basic storage	One of the two types of storage. This is what has traditionally been known as a partition. It is the default that is used by all operating systems.
Basic disk	Any drive that has been partitioned and set up for writing files. A basic disk has primary partitions, extended partitions, and logical drives contained within the extended partitions.
Dynamic storage	The second type of storage; contrast with basic storage. Allows you to create primary partitions, logical drives, and dynamic volumes on storage devices. More powerful than basic storage in that it allows creation of simple, spanned, or striped volumes using dynamic disks.
Dynamic disk	A disk made up of volumes. A volume can be the entire hard disk, parts of the hard disk combined into one unit, and other specific types of volumes, such as single, spanned, or striped volumes. Cannot be on a removable drive.
Simple volume	Disk space allocated from one hard drive. The space does not have to be contiguous.
Spanned volume	Disk space created from multiple hard drives. Also known as "just a bunch of disks" (**JBOD**). Windows writes data to a spanned volume in such a way that the first hard drive is used until the space is filled. Then, the second hard drive's space is used for writing. This continues until all hard drives in the spanned volume are utilized.
Striped volume	Disk space in which data is written across 2 to 32 hard drives. It is different from a spanned volume in that the drives are used alternately. Another name for this is striping, or RAID 0 (covered in the next section).
System volume	Disk space that holds the files needed to boot the operating system.
Boot volume	Disk space that holds the remaining operating system files. Can be the same volume as the system volume.
RAW volume	A volume that has never had high-level formatting performed and that does not contain a file system.

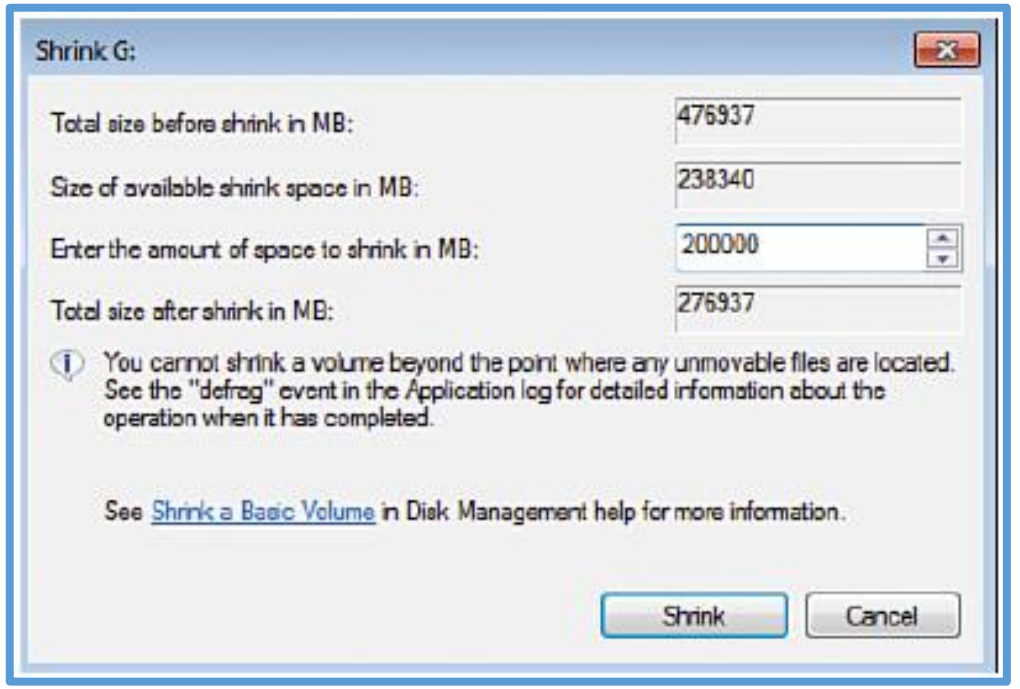
Windows Disk Management



Disk management concepts

Changing Drive Partitions

- A partition can be extended, split, or shrunk using Windows *Disk Management* utility
  - Right-click (or tap and briefly hold on) the drive volume
  - Select an option



Fault Tolerance

- A drive array involves using two or more hard drives configured for speed, redundancy, or both.
- RAID (Redundant Array of Independent or Inexpensive Disks) allows reading from and writing to multiple hard drives for larger storage areas, better performance, and fault tolerance.
- Fault tolerance – the ability to continue functioning after a hardware or software failure

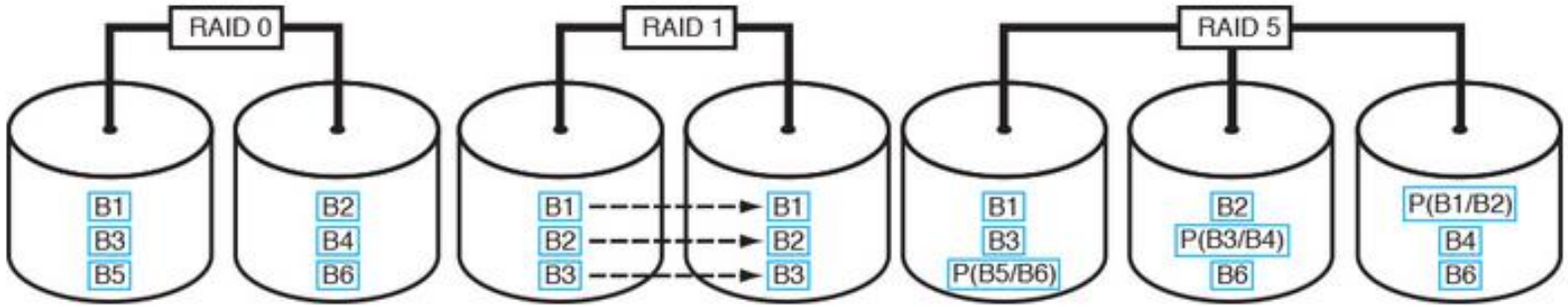
Configure Hardware RAID

1. Ensure that the motherboard ports that you want to use are enabled
2. Ensure that you have RAID drivers for that hard drives used in the RAID
3. Physically install and cable the hard drives
4. Enter BIOS/UEFI and enable RAID
5. Configure RAID in BIOS/UEFI or through a special key sequence to enter the RIAD BIOS configuration
6. Install Windows on a RAID by using the Custom (Advanced) Installation option

RAID Levels

Table 7.7 RAID

RAID level	Description
0	Also called **disk striping** or disk striping without parity. Data is alternately written on two or more hard drives, which increases system performance. These drives are seen by the system as one logical drive. **RAID 0** does not protect data when a hard drive fails. It is not considered fault tolerant. It has the fastest read and write performance.
1	Also called disk mirroring or disk duplexing. **RAID 1** protects against hard drive failure. **Disk mirroring** uses two or more hard drives and one disk controller. The same data is written to two drives so that if one drive fails, the system continues to function. Disk duplexing is similar except that two disk controllers are used. With disk duplexing, performance is slightly degraded when writing data because it has to be written to two drives.
0+1	A striped set and a mirrored set combined. At least four hard drives are required, and they need to have an even number of disks. A second striped set mirrors a primary striped set of disks. Also called RAID 01, this mode can read from the drive quickly, but there is a slight degradation when writing.
1+0	A mirrored set and a striped set combined with at least four hard drives. The difference between 1+0 and 0+1 is that 1+0 has a striped set from a set of mirrored drives. This mode, also called **RAID 10**, can read from the drive quickly but has a slight degradation when writing.
5	Also called disk striping with parity. **RAID 5** writes data to three or more hard drives. Included with the data is parity information. If a drive fails, the data can be rebuilt based on the information from the other two drives. This level can read and write data quickly.



RAID BIOS/UEFI Config Settings

Table 7.8 **RAID BIOS/UEFI configuration settings**

BIOS/UEFI setting	Description
SATA mode: AHCI Mode	A mode that may mean that hot swapping is supported. A set of commands can be used to increase storage performance.
SATA mode: RAID Mode or Discrete SATA Mode	Allows you to select a particular RAID level and the drives associated with the RAID.
SATA drives: Detected RAID Volume	Usually an information screen that shows the type of RAID configured, if any.
SATA drives: eSATA Controller Mode	Allows configuration of RAID through the eSATA port.
SATA drives: eSATA Port x Hot Plug Capability	Allows hot swapping to be enabled or disabled for eSATA ports.

Computer Terms

Refer to the glossary terms at the end of the textbook chapter. Review Chapter 7 and become familiar with the terms.

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