

Module 1

File Systems

CompTIA A+ Certification

1. The latest version is CompTIA A+ requires two exams to become certified:
 - A. **CompTIA A+ Exam #1** covers the fundamentals of computer technology, installation and configuration of PCs, laptops and related hardware, and basic networking.
 - B. **CompTIA A+ Exam #2** covers the skills required to install and configure PC operating systems, as well as configuring common features for mobile operating systems.
2. Certifications are valid for three years from the date the candidate becomes certified.

Exam #1

1. This exam will cover:

Exam Domains	Percentage
PC Hardware	40%
Networking	27%
Laptops	11%
Printers	11%
Operational Procedures	11%
	100%

Exam #2

1. This exam will cover:

Exam Domains	Percentage
Operating Systems	33%
Security	22%
Mobile Devices	9%
Troubleshooting	36%
	100%

Objectives

1. 1.2 Partitioning

2. 1.2 File System Types and Formatting

PARTITIONING

Partitions

Two types of disk level formatting:

1. Low-level formatting

- A. Done at the factory
- B. Defines sectors, cylinders, and their placement on the disk

2. High-level formatting

- A. Done by the user
- B. Divides the disk into partitions
- C. Hold the data you want to store
- D. Defines indexing system to track the locations of that data

3. **FDISK** (Windows DOS+) or **Format** (Windows NT+)

- A. Used to partition a hard drive (High-level)
- B. Third party applications can also be used

Types of Partitioning

Basic disk

1. Contains primary partitions and logical drives
2. Formatted with a file system to become a volume for file storage
3. Most often used with Windows
4. Operations only performed on basic disks:
 - A. Create and delete primary and extended partitions
 - B. Create and delete logical drives within an extended partition
 - C. Format a partition and mark it as active

Types of Partitioning

Dynamic disks

1. Offer greater flexibility for volume management
2. Use a database to track information about dynamic volumes on the disk in the computer
3. Each dynamic disk in a computer stores a replica of the dynamic disk database
4. Easily repairs each others database
5. Operations performed on dynamic disks:
 - A. Create and delete simple, spanned, striped, mirrored, and RAID-5 volumes
 - B. Create volumes that span multiple disks (spanned and striped volumes)
 - C. Create fault-tolerant volumes (mirrored and RAID-5 volumes)
 - D. Extend a simple or spanned volume
 - E. Repair mirrored or RAID-5 volumes
 - F. Reactivate a missing or offline disk

Partitioning a Hard Drive

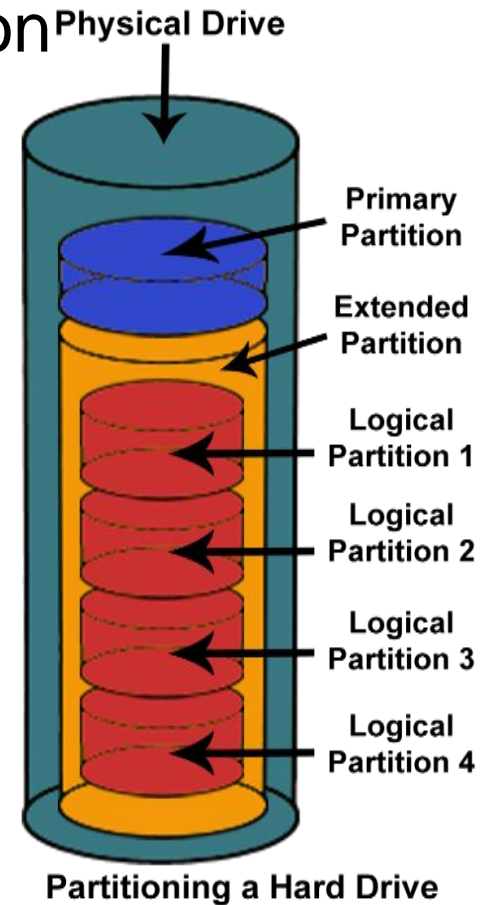
Can be divided into more than one partition

1. Primary partition

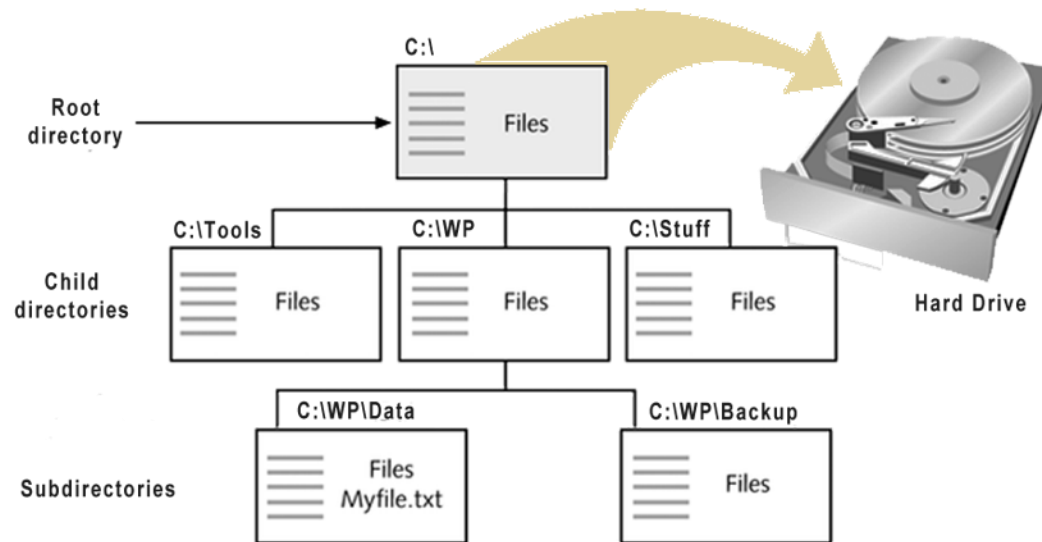
- A. **Active** partition or bootup partition
- B. Only a primary partition can be designated as active

2. Extended partition

- A. Can have up to 4 separate primary partitions or 3 primary and 1 extended
- B. Only 1 extended partition per disk
- C. Can be subdivided into a maximum of 23 sections called **logical drives**



Hard Drive Organization



1. Organized into groups of files stored in **directories**
2. The first directory is called the **root directory**
3. All directories can have child directories or sub directories
4. Under Windows, a directory is called a **folder**

FILE SYSTEM FORMATS

What Is a File System?

1. Organizational method used by an OS to store files and folders on a secondary storage device
2. Support both MBR and GPT partition styles
3. Check disk properties (capacity, available free space, and current status)
4. Establish drive-letter assignments for disk volumes or partitions, and optical devices
5. Organizes files and directories
6. Establish file naming conventions
7. File systems used in computers:
 - FAT16
 - FAT32
 - NTFS
 - FAT12
 - HFS (Apple)
 - HPFS (os/2)
 - ext2 (Linux)
 - UDF (Optical)
 - FFS (Flash)

FILE ALLOCATION TABLE (FAT) FILE SYSTEM

FAT File System (FAT16)

1. Designed for small disks and simple folder structures
2. Named for its method of organization
3. Resides at the beginning of the volume
4. To protect the volume, two copies of the table are kept
5. File allocation tables and the root folder must be stored in a fixed location
6. Allocated in clusters
7. Cluster sizes of 2KB to 32KB
8. Default cluster size is determined by the size of the volume
9. Maximum of 65,526 clusters
10. Supports drives up to 2GB

Master Boot Record (MBR)

1. Created when you create the first partition
2. Most important data structure on the disk
3. Is the first sector on every disk
4. Located at track (cylinder) 0, side (head) 0, and sector 1
5. Contains the Partition Table
6. Contains a small amount of executable code

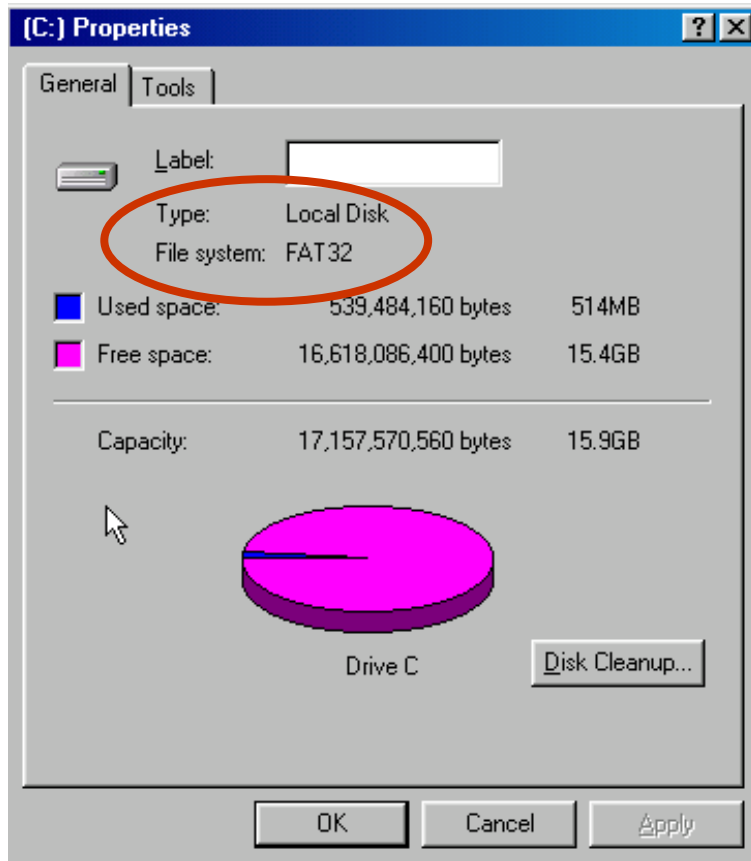
FAT32 File System

1. Derivative from the File Allocation Table (FAT) file system
2. Supports drives with over 2GB
3. Can contain up to 268,435,456 clusters
4. Cluster sizes (4KB-32KB)
5. 4GB minus 2 bytes maximum file size

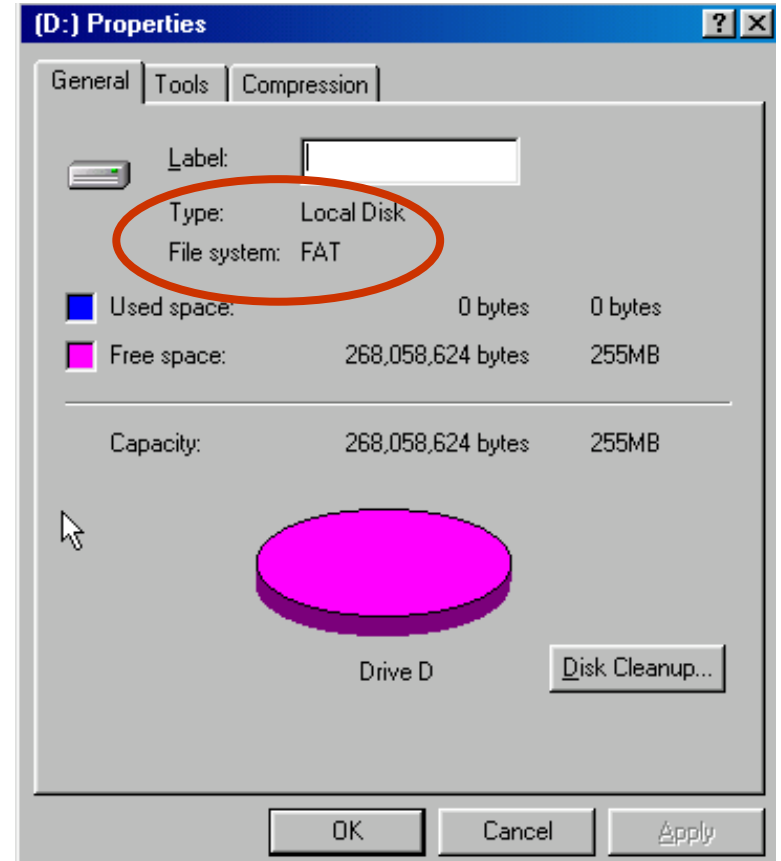
FAT Type	Partition Size	Cluster Size
FAT16	32MB	2048 B
FAT16	128MB	2048 B
FAT16	256MB	4096 B
FAT16	512MB	8192 B
FAT16	1GB	16384 B
FAT16	2GB	62768 B
FAT32	<260MB	512 B
FAT32	8GB	4096 B
FAT32	16GB	8192 B
FAT32	32GB	16384 B
FAT32	>32GB	32768 B

File System Types

FAT32 in the HDD Properties Window



FAT16 in the HDD Properties Window



NEW TECHNOLOGY FILE SYSTEM (NTFS)

NTFS System Files

1. High-performance and self-healing file system
2. Proprietary to Windows NT, 2000, XP Vista, 7, and 8
3. Features include:
 - A. File-level security, compression and auditing
 - B. Supports large volumes
 - C. Built-in RAID support
 - D. Ability to encrypt files and folders
 - E. More efficient drive management due to its smaller cluster size capabilities
 - F. Recoverable file system capabilities

Master File Table

1. Replaces FAT file system
2. Contains information about each file being stored on the disk:

A. Header information

B. Standard information

C. Filename

D. Security information

E. Data

Partition Size	Sectors/Cluster	Cluster Size
<512MB	1	512B
512MB-1GB	2	1KB
1-GB-2GB	4	2KB
2GB-4GB	8	4KB
4GB-8GB	16	8KB
8GB-16GB	32	16KB
16GB-32GB	64	32KB
>32GB	128	64KB

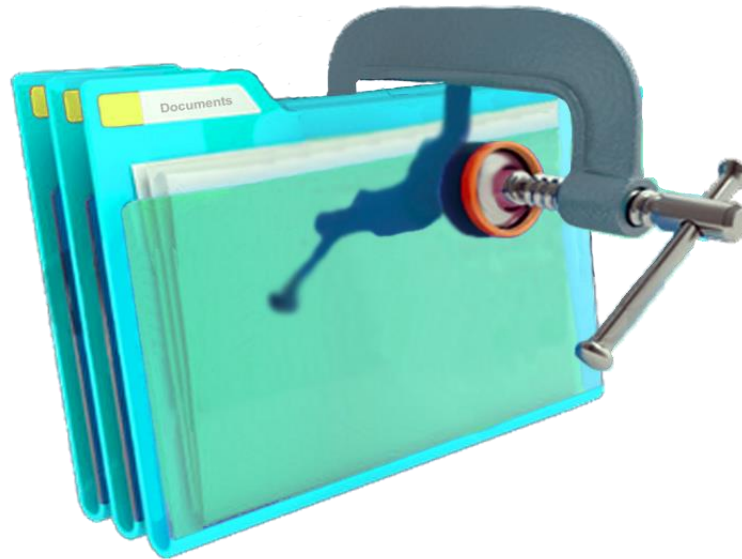
3. Not located in a predefined sector

Windows Volumes

1. Two types of logical disks:
 - A. Basic (Primary)
 - B. Dynamic
2. Five types of dynamic volumes:
 - A. Simple
 - B. Spanned
 - C. Mirrored
 - D. Striped
 - E. RAID 5

NTFS File Compression

1. Supports compression on individual files, folders, and entire NTFS volumes



File Compression

NTFS Encryption File System (EFS)

1. Keeps files safe from intruders
2. Transparent to the user who encrypted the file
3. Automatically encrypts and decrypts the files or folders
4. Turned on through Windows Explorer or by using a command-line utility called **cipher.exe**

NTFS Security

1. Provides security for each file in the system
2. Access to auditing information by the system administrator
3. Can have permissions assigned to them whether they are shared or not
4. Enable permission levels to be assigned to individual files and folders

Standard NTFS permissions

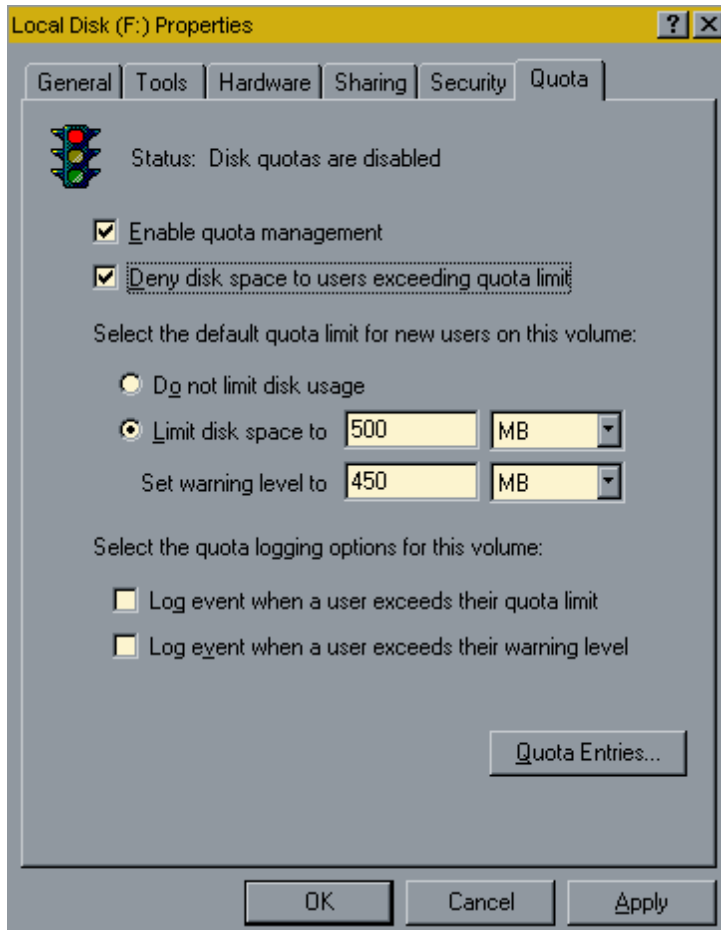
1. **Read (R)** - Enables the file or folder to be displayed along with its attributes and permissions
2. **Write (W)** - Enables the user to add files or folders, change file and folder attributes, add data to an existing file, and change display attributes
3. **Execute (X)** - Enables users to make changes to subfolders, display attributes and permissions, as well as to run executable file types
4. **Delete (D)** - Makes it possible for users to remove files and folders
5. **Change Permission (P)** - Enables users to change permission assignments of files and folders
6. **Take Ownership (O)** - Enables the user to take ownership of the file or folder

NTFS Files Attributes

Permissions are grouped together at different levels:

1. No Access (none). File and Folder level
2. Read (RX). File and Folder level
3. Change (RWXD). File and Folder level
4. Add (WX). Folder level only
5. Add & Read (RWX). Folder level (RX) File level
6. List (RX). Folder level only
7. Full Control (RWXDPO). File and Folder level

Disk Quotas



1. Limits how much disk space a user can access
2. Does not specify location of files, just total space allowed
3. Can be set only on NTFS

Disk Management

1. Must be logged on as an administrator or a member of the Administrators group
2. Network policy settings may prevent access
3. **Quick format**
 - A. Removes the file allocation table (index) but leaves the files on the disk
 - B. Does not scan the disk for bad sectors
 - C. Use this option only if this disk has not been previously formatted and you are sure the disk is not damaged
4. **Full format**
 - A. Removes the file allocation table (index)
 - B. Erases the files
 - C. Scans for bad sectors

Converting FAT16 to FAT32

1. Convert a FAT16 file system to a FAT32 system without losing any data:
 - A. Open command prompt
 - B. Type `cvt1.exe`

Converting FAT to NTFS

2. Convert a FAT16 or FAT32 file system to a NTFS system without losing any data:
 - A. Open command prompt
 - B. Type `convert.exe`

Partition Recovery Concepts

1. FDISK

- A. Standard utility included in MS-DOS, Windows 95, 98, ME
- B. Simplest way to repair or re-create MBR
- C. Startup from disk
- D. Open command line interface
- E. Type **FDISK.EXE /MBR**

2. Recovery Console

- A. Standard utility included in Windows NT, 2000, XP, Vista, 7, 8
- B. Boot from startup floppy disks or CD-ROM
- C. Choose repair option during setup
- D. Run Recovery Console
- E. Logged on
- F. Type **FIXMBR**

Summary

In this module we discussed:

1. The types of partitions
2. File and directory structure
3. Types of file systems
4. FAT16 and FAT32
5. NTFS Features
6. How to convert between file systems
7. How to recover partitions

Glossary & Terms

- **Low-level Formatting** - Defines sectors, cylinders, and their placement on the disk that is done at the factory.
- **High-level formatting** - Done by the user to define the indexing system to track the locations and hold data.
- **Partitioning** - Dividing a disk (formatting) into multiple logical storage units.
- **Fdisk Command** – DOS system program used for high-level formatting.
- **Format Command** – Windows NT system used for high-level formatting.
- **Basic Disk** – A Drive that contains primary partitions and logical drives.
- **Dynamic Disk** – A Drive that creates simple, spanned, striped, mirrored, and RAID drives.
- **Primary Partition** – An Active or bootup partition .
- **Extended Partition** – A drive that can be subdivided into a maximum of 23 logical drives.
- **Active Partition** – Drive used to start Windows.
- **Logical Drive** – Drives contained in an extended partition.

Glossary & Terms

- **Directories** – A Folder that organizes files.
- **Root Directory** – The first or main directory on a drive.
- **Folder** – Another name for a directory.
- **FAT12** – The file system of a floppy disk.
- **FAT16** – The file system of DOS up to 2 GB.
- **FAT32** – The file system of Windows 98 over 2 GB.
- **NTFS** – The file system of Windows NT and greater.
- **GUID** - Globally Unique Identifier
- **GPT** – GUID Partition Table
- **MBR** – Master Boot Record
- **MFT** – Master File Table

Glossary & Terms

- **Simple Volume** – A single independent partition.
- **Spanned Volume** – A partition that spans two or more physical drives.
- **Mirrored Volume** – A partition that makes an exact copy of itself on another drive.
- **Striped Volume** – A partition that uses two or more drives to divide up data.
- **EFS** - Encryption File System
- **File Attributes** – Permission of a file or folder.
- **Disk Quota** – The amount of space a user can access in a partition.
- **Quick Format** – Rewrites the file system and index without erasing the rest of the drive.
- **Full Format** – Rewrites the file system and erases the disk while checking for bad sectors.
- **FIXMBR** – Command used to fix the master boot record.