

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

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Lecture-30 By Vivek Dubey

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COMPUTER SCIENCE AND ENGINEERING

CS403PC

COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

CS403PC

BHARAT INSTITUTE OF ENGINEERING AND TECHNOLOGY

Scheme of Operating System

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S. No.	Course Code	Course Title	L	T	P	Credits
3	CS403PC	Operating Systems	3	0	0	3
6	CS406PC	Operating Systems Lab	0	0	3	1.5

UNIT-5: File System Interface and Operations



- Access methods,
- Directory Structure,
- Protection,
- File System Structure,
 - Allocation methods,
 - Free-space Management.
- Usage of open, create, read, write, close, lseek, stat, ioctl system calls.

What is a file in computer system?

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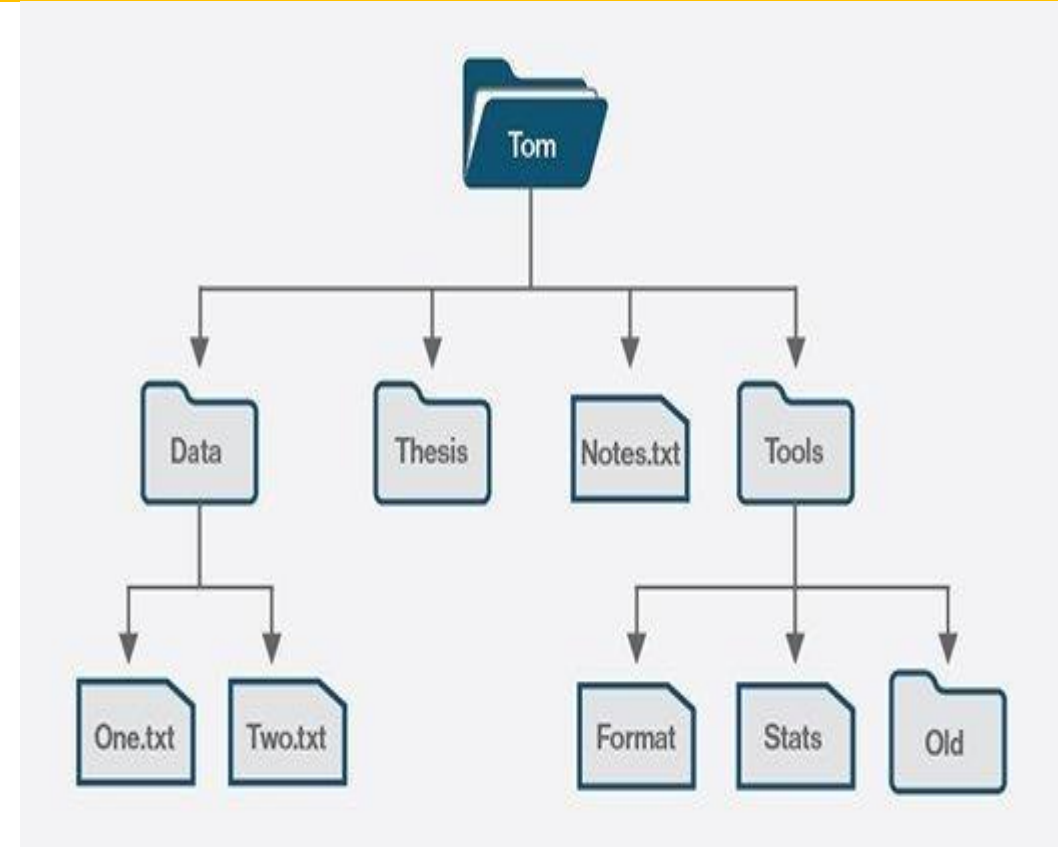


- A **file** is an abstract data type.
- A **file** is a container in a computer system for storing information and data.
- Normally, **variable** contains data instantly and **such data** will be lost on off Computer System, since **variable data** are storing in RAM of Computer system.
- However, **contains of file** can be used after off of computer system, **since file can be stored on** secondary storage such as HDD, Pen Drive, Google Drive.
- A file is usually stored in Folder/Directory.

A view of File and Folder in Computer System

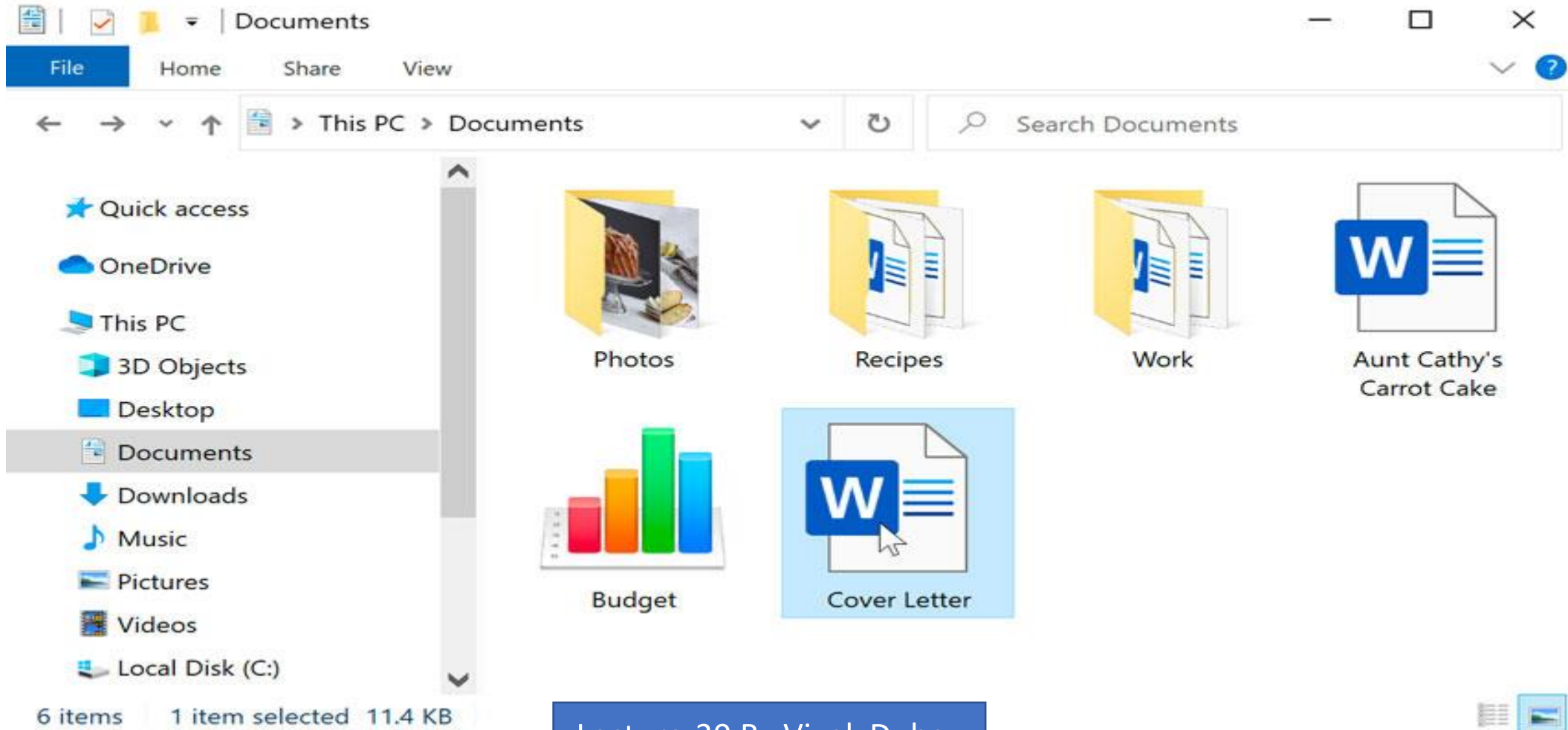


- Tom is a folder consists of three folders named as Data, Thesis and Tools and one file named as Notes.txt
- Data folder consists of two files named as One.txt and Two.txt.
- Tools folder consists of three files named as Format, Stats and Old.



Example of Folder and Files

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What is a need of file in computer system?

- The most important purpose of a file system is to manage user data. This includes storing, retrieving and updating data.
- Files are used for all input and output (I/O) of information in the operating system, to standardize access to both software and hardware.
- Mainly, file provide an efficient method to locate records needed for processing and to facilitate file creation and it's updating in future.

What are the applications of Computer File?

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- A file may be designed to store *an Image, a written message, a video, a computer program, or any wide variety of other kinds of data.*
- **Certain files** can store multiple data types at once.
- *By using computer programs, a person can open, read, change, save, and close a computer file.*

What are the types of Computer Files?



- JPEG (Joint Photographic Experts Group)
- PNG (Portable Network Graphics)
- GIF (Graphics Interchange Format)
- PDF (Portable Document Format)
- SVG (Scalable Vector Graphics)
- MP4 (Moving Picture Experts Group)
- Audio video interleave (AVI)
- Portable document format (PDF)
- C Program File (C)
- C Plus Plus Program File (CPP)
- Java Program File (JAVA)
- Python File (PY)
- Word document (DOC and DOCX)
- Hypertext markup language (HTML and HTM)
- Microsoft excel spreadsheet file (XLS and XLSX)
- Text file (TXT)
- Flash video format (FLV)
- PowerPoint presentation (PPT or PPTX)
- Open document presentation (ODP)
- MPEG layer audio 3 (MP3)
- Waveform audio file (WAV)

What are types of File Operations?



- **Creating a file** – means create a new empty file in computer system to store information.
- **Opening a file** – means opening old existing file in computer system to read or update information.
- **Closing a file** – means termination or deallocating file.
- **Deleting a file** – means dropping file from computer system.
- **Reading a file** – means read contain of file
- **Writing a file** – means write contain into a file
- **Appending a file** – means add new contains at end of file.
- **Copy a file** – means making duplicating of a existing file.
- **Merage a file** – means combining two or more files.
- **Repositioning a file** – means changing location of a file.

The concept of a file

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- **Computers can store information on various storage media such as magnetic disks, magnetic tapes and optical disks. OS provides a uniform logical view of information storage. OS abstracts from the physical properties of its storage devices to define a logical storage unit called a file. Files are mapped by OS onto physical devices. These storage devices are non volatile so the contents are persistent through power failures and system reboots.**
- **A file is a named collection of related information that is recorded on secondary storage. A file is the smallest allotment of logical secondary storage; that is data cannot be written to secondary storage unless they are within a file. Files represent programs and data. Data files may be numeric, alphabetic, alphanumeric or binary. Files may be free form such as text files or may be formatted rigidly.**
- **A file is a sequence of bits, bytes, lines or records.**

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- **Information in a file** *is defined by its creator*. Many different types of information *may be stored in a file* – source programs, object programs, executable programs, numeric data, text etc
- **A file** *has a certain defined structure* which depends on its type.
 - **Text file** – *sequence of characters organized into lines*
 - **Source file** – *sequence of sub routines and functions each of which is further organized as declarations followed by executable statements.*
 - **Object file** – *sequence of bytes organized into blocks understandable by the system's linker*
 - **Executable file** – *series of code sections that the loader can bring into memory and execute.*

Information Associated with a File



- **File pointer** – System must keep track of the last read – write location as a *current file position pointer*.
- **File open count** – As files are closed, OS must reuse its open file entries or it could run out of space in the table. **File open counter** tracks the number of opens and closes and reaches zero on the last close.
- **Disk location of the file** – The information needed to locate the file on disk is kept in memory so that the system does not have to read it from disk for each operation.
- **Access rights** – Each process opens a file in an access mode. This information is stored on the per process table so the OS can allow or deny subsequent I/O requests.

File Name Format

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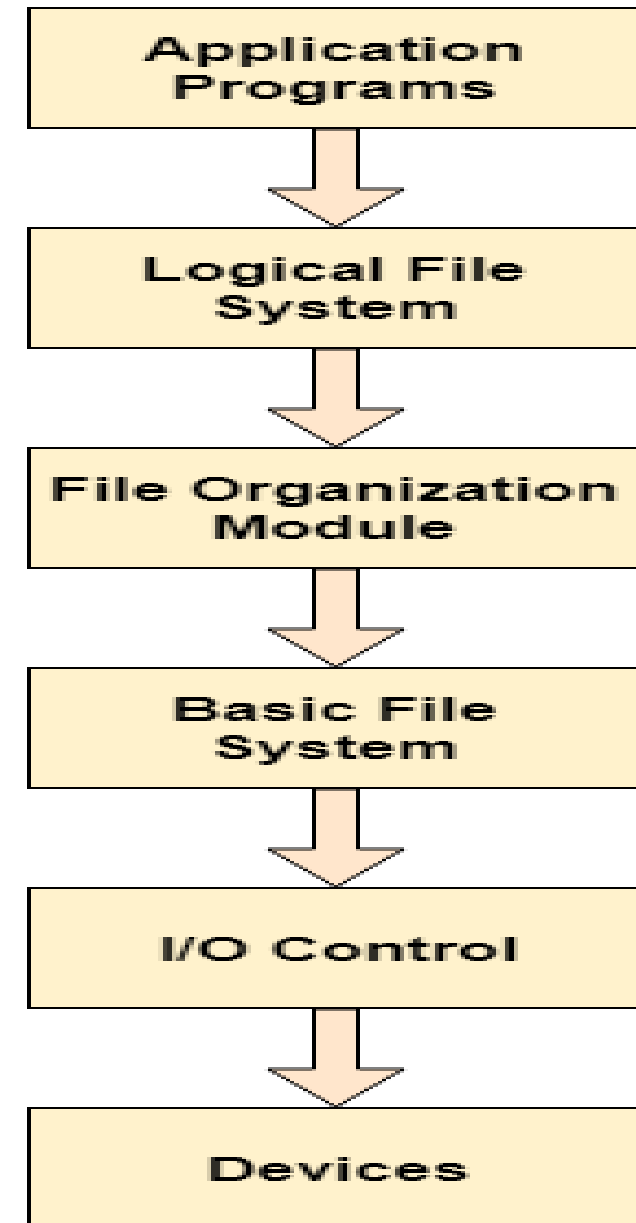
- A common technique for implementing file types is to include *the type as part of the file name.*
- The name is split into two parts – a name and an extension separated by a period character.
- The system uses the extension *to indicate the type of the file and the type of operations that can be done on that file.*

File System Structure

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- **File System** provide efficient access to the disk by allowing data to be stored, located and retrieved in a convenient way. A file System must be able to store the file, locate the file and retrieve the file.
- **Most of the Operating Systems** use layering approach for every task including file systems. **Every layer of the file system** is responsible for some activities.



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- **I/O Control level –**

- **Device drivers** acts as interface between devices and OS, they help to transfer data between disk and main memory. It takes block number as input and as output it gives low level hardware specific instruction.

- **Basic file system –**

- **It Issues general commands to device driver to read and write physical blocks on disk. It manages the memory buffers and caches. A block in buffer can hold the contents of the disk block and cache stores frequently used file system metadata.**

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- **File organization Module –**

- It has information about files, location of files and **their logical and physical blocks**. **Physical blocks do not match with logical numbers of logical block numbered from 0 to N.** It also has a free space which tracks unallocated blocks.

- **Logical file system –**

- It manages metadata information about a file *i.e includes all details about a file except the actual contents of file*. It also maintains via file control blocks. File control block (FCB) has information about a file – owner, size, permissions, location of file contents.

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Advantages :

- Duplication of code *is minimized.*
- Each file system *can have its own logical file system.*

Disadvantages :

- If we access many files at same time *then it results in low performance.*

Implement file system in Computer



- File System can be **implemented** by using two types data structures :
 - On-disk Structures
 - In-Memory Structure

On-Disk Structures –

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Generally, they contain information about total number of disk blocks, free disk blocks, location of them and etc. Below given are different on-disk structures :

1. Boot Control Block –

It is usually the first block of volume, and it contains information needed to boot an operating system. In UNIX it is called boot block and in NTFS it is called as partition boot sector.

2. Volume Control Block –

It has information about a particular partition exp:- free block count, block size and block pointers etc. In UNIX it is called super block and in NTFS it is stored in master file table.

3. Directory Structure –

They store file names and associated inode numbers. In UNIX, includes file names and associated file names and in NTFS, it is stored in master file table.

4. Per-File FCB –

It contains details about files and it has a unique identifier number to allow association with directory entry. In NTFS it is stored in master file table.

In-Memory Structure

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They are maintained in main-memory and these are helpful for file system management for caching.

Several in-memory structures given below :

1. Mount Table

It contains information *about each mounted volume*.

2. Directory-Structure cache

This cache holds the directory information *of recently accessed directories*.

3. System wide open-file table

It contains the copy of FCB *of each open file*.

4. Per-process open-file table

It contains information opened by that particular process *and it maps with appropriate system wide open-file*.

File Access Methods/Mechanisms

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- **File Access Mechanism** refers to the manner *in which the records of a file may be accessed*.
- There are several **ways to access files** –
 - Sequential access
 - Direct/Random access
 - Indexed sequential access

Sequential Access

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- A sequential access is that in which the records are accessed in some sequence, i.e., the information in the file is processed in order, one record after the other.
- This access method is the most primitive one.
- Example: Compilers usually access files in this fashion.

Direct/Random Access

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- **Random Access file organization** provides, accessing the records directly.
- **Each record has its own address on the file with *by the help of which* it can be directly accessed for reading or writing.**
- **The records need not be in any sequence within the file and they need not be in adjacent locations on the storage medium.**

Indexed Sequential Access

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- This mechanism is built up on base of sequential access.
- An index is created for each file which contains pointers to various blocks.
- Index is searched sequentially and its pointer is used to access the file directly.