

An *operating system* is a complex set of programs that are designed to allow users easy access to program and data files. The operating system must be designed to meet these needs. It sets the environment in which your programs and applications will work by establishing the overall "character" of your system and the rules by which hardware and software interact.

Without an operating system your computer will do nothing. The operating system supervises and controls the operation of the microcomputer system. It provides the interface between the hardware and the user by the management of the hardware and software resources available in the system.

Since disk storage is the most common form of external storage, most operating systems are designed to work with information stored on disk. This is called a *disk operating system* (or *DOS*). Disk operating systems are programmed to manipulate collections of related information (either program or data information) stored on a disk.

To understand the tasks done by the operating system, consider the sequence of steps that must be taken to transfer a file of data from primary memory to disk storage. It is first necessary to make certain there is enough space on the disk to hold the entire file. For the transfer itself, sequential portions of the file must be called up from the primary memory and combined with "housekeeping" information to form a block of data that will exactly fill a sector. Each block must be assigned a sector address and transmitted to the disk. Numbers called checksums that allow errors in storage or transmission to be detected (and sometimes corrected) are calculated. Finally, some record must be kept of where the file of information has been "stored".

If all these tasks had to be done under the direct supervision of the user, the storage of information in a computer would not be worth the trouble. Actually, the entire procedure can be handled by the operating system; the user merely issues a single command, such as "save file".

Starting MS-DOS

When the system is first powered up, a starter program in ROM memory, called the *bootstrap loader*, is executed. This program, also known as the BIOS (Binary Input/Output System), normally includes some system tests (such as a memory test) and then reads the disk to load the operating system's start-up routine into memory. This routine then pulls the remainder of the operating system into memory and begins execution. The start-up routine is not ROM based to allow the use of different operating systems, and to allow the quick and easy upgrades to new releases of the same operating system.

When DOS is loaded, it begins execution by displaying a starting message which is typically of the following form:

THE SLCC COMPUTER SYSTEM DOS
VERSION 9.59
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If a disk that does not have DOS on it is in the default drive you will get the message "**NON SYSTEM DISK - REPLACE AND PRESS ANY KEY TO CONTINUE**". Most systems have a built in clock/calendar which can recall the correct date and time. Pressing the {Enter} key at each prompt will accept the current date and time unchanged. To enter a new date use the MM/DD/YYYY format. To enter a new time use twenty-four hour time with HH:MM:SS format.

The DOS prompt

The operating system will now indicate that it is ready by displaying a DOS prompt. The prompt is of the style **A:\>** or **C:\>** depending upon which drive is the power-on default drive. The flashing underscore after the DOS prompt is the cursor. It marks the active position on the screen. When a character is typed, it appears at the cursor position on the screen.

The DOS prompt indicates that DOS is ready to act upon a DOS command, the name of a executable program file (.COM or .EXE extensions), or a DOS batch file name (.BAT extension). Simply select the correct command or file name and press {Enter} to perform the desired operation.

The DOS prompt indicates the default drive. The default drive is where DOS looks for files if you do not specify a different drive name. To change the default drive you enter the letter of the disk drive you want followed by a colon (**A:** for example) at the current DOS prompt.

DOS file names

A file is a collection of related information, named and saved (usually to a disk). IBM-PCS use two general types of files, program (or command) files that contain the instructions for how the system is to perform some operation, and data files which contain the information that is changed, manipulated or operated on.

Each file is identified by a unique *filename*. DOS *filenames* consist of two parts, the *name* and the *extension*. The extension is separated by a period from the name and is usually used to indicate the category of the file (text, command, etc.). The word *filename* (no space!) means the *name* and *extension* taken together, such as **README.TXT**.

A name is one to eight characters in length consisting of the letters of the alphabet (**A-Z**), digits (**0-9**), and selected national characters (**! @ # \$ % & () - _ { } ' `**). Spaces and other punctuation are *not* allowed!

The extension, which is optional in some software programs, may consist of up to three characters. It is made up using the same legal characters listed above for the name. If an extension is used, a separating period is placed between the name and the extension (**FILENAME.EXT**). The period is omitted if the filename has no extension.

Any legal character may be used at any position within the filename. Characters may be keyed

either upper or lower case (it doesn't matter). Do not place spaces within the filename. Do not use characters not in the above list of legal characters, and do not make names longer than the maximum permitted DOS size unless the operating system (such as Windows 95) permits.

Special extensions and file names

In many cases, the software application assigns an extension automatically. The extension helps to identify the type of file. The most commonly seen extensions are:

ASM assembly source code	HLP help information
BAK text backup file	HTM World Wide Web hypertext file
BAS BASIC program	NDX data base indexed file
BAT batch processing file	PAS Pascal program
COM executable program	SYS system parameters
DBF data base file	TXT ASCII text file
DGN Intergraph design file	TMP temporary work file
DOC Microsoft word processing document	WB3 QuattroPro notebook
DWG AutoCAD drawing file	WK1 Lotus 1-2-3 worksheet
DXF data exchange file	WPD WordPerfect document
EXE executable file	\$\$\$ temporary work file

Some filenames have special meaning to DOS. Three special filenames are:

COMMAND.COM is the DOS command handler.

AUTOEXEC.BAT contains the custom commands that are AUTOMATICALLY EXECUTED when the system is turned on.

CONFIG.SYS contains the customized CONFIGURATION of how the SYSTEM's hardware is assigned.

The AUTOEXEC.BAT and CONFIG.SYS files are normally set up by a expert user for you. Do not erase or modify them unless you know *exactly* what you are doing.

Wild cards and pattern matching

The asterisk wild-card character {*} is helpful in manipulating groups of files with the DOS commands. By using an {*}, you specify that the remainder of the file's name or extension is non-specific (you don't care to type it in, or you desire a whole group of files). For example, to COPY all of the document (.DOC) files from C: to A: you would enter:

COPY C:* .DOC A:

which copies all the files with the .DOC extension. The asterisk will match any character or combination of characters in that position *and the following positions* in the rest of the file's name or extension (separately).

The question mark {?} is another type of wild-card character. But unlike the asterisk, the question mark only replaces exactly one character of a file name. It means that any character in

only that specific position of the file's name (or extension) will match.

In other words, ***.DOC** will match *any* file with the .DOC extension, but **?DOC** will only match files with the .DOC extension and a *one character* name.

DOS commands

DOS provides many features for the user. If all of these features were placed in the system's RAM memory, not much room would be left for the user's application programs. DOS places the smallest and most useful features, or DOS commands, in memory all the time. These are called internal commands. The remainder of the features are stored on the disk and loaded into memory only when needed (just like application programs!). These are called external commands.

DOS commands structure

The structure of all DOS commands is simple... the command, parameter(s), and switch(es). Commands, parameter(s), and switch(es) are always separated from each other by blanks (or commas). All switches start with a *forward slash* { / } (or a hyphen in some mutant variations of DOS). And DOS commands may be entered in either upper or lower case.

Commands indicate the operation to be accomplished.

Parameters indicate what the command is to be performed on (source and target).

Switches indicate any special options that are to be used when the command is performed.

Guidelines for DOS commands

1. Commands are usually followed by one or more parameters and switches.
2. Commands may be entered either in lowercase or uppercase.
3. Commands, parameters, and switches are separated from each other by *delimiters*. The most commonly used delimiter is a *blank space*.
4. If a filename has an extension, you must include the extension when using that filename as a command parameter.
5. Do not place blank spaces within the path name or file specifications (or they will act like delimiters).
6. Commands will only be performed after you press the {Enter} key.
7. When the system prompts with the "Press any key" message, it is safest and easiest to press the space bar.
8. Most commands may be aborted with {Control-C}.
9. As DOS is updated, new commands may be added or old commands modified. Check a DOS manual for the version you are using, or enter **HELP {command name}** or **{command name} /?** for the most recent information.

Simple commands

DATE (internal): Displays or sets the system date.

TIME (internal): Displays or sets the system time.

CLS (internal): Clears the display screen. No parameters or switches.

VER (internal): Displays the version number of DOS currently in use.

Looking at the disk

DIR (internal): Lists the names of the files in a directory. Displayed information includes the volume label of the disk, the directory displayed, and the remaining free space on the disk.

If the **/W** switch is not used, the size of each file and the date and time stamps are also displayed showing when the file was created or last modified.

Filename specifications and wild cards may be used to display selected parts of the directory. To display an entire directory:

DIR A:

To display the specific information for a designated file:

DIR THISFILE.EXT

To display information on a specific category of files:

DIR *.DOC

Two switches are also available. **/P** pauses when the screen is full and waits for a keypress before continuing. **/W** eliminates the file size and time and date stamps to provide a more compact (five-wide) display format (this shows more file names at one time on the screen).

CHKDSK (ext): Reports the status of a disk. It first checks the space on a disk, the amount used, and reconciles discrepancies. It then reports the total space, the amount in use, the number of files, the number and size of any hidden files, and reports the amount of system memory (not disk space) and system memory free (after subtracting the space taken by the operating system and any resident utilities).

To check on drive A: :

CHKDSK A:

It is recommended that `chkdsk` be run occasionally on each disk to check for errors in the directory.

PROMPT (int): Changes the DOS prompt. Entering the command without parameters changes the prompt to the standard style (drive letter followed by a greater-than sign).

VOL (internal): Displays the disk volume label on the specified drive.

Disk preparation

FORMAT (ext): Formats the disk in the specified drive to accept DOS files. It provides basic disk preparation and checks for defects on the disk. **FORMAT** eliminates any information which may have been stored on the disk.

Warning! Failure to specify the disk drive may cause the command to default to the hard disk drive, erasing all the information on the hard disk. *Always specify the drive to be formatted.*

The **/S** switch adds the system files which permit this disk to boot up the computer.

To format a new, blank disk in drive A: and make it a system disk:

FORMAT A: /S

SYS (external): Transfers DOS to a previously formatted disk. This is typically used for copy-protected software where space has been explicitly reserved for the operating system. It transfers only the DOS hidden files. It may be used to upgrade disks to a new version of the operating system.

To transfer the operating system from a disk in drive C: to a newly formatted disk in drive A:, simply enter the following:

SYS C: A:

DISKCOPY (ext): Makes an exact duplicate of a non-protected disks. **DISKCOPY** only duplicates floppy disks. It is faster than copying individual files, but there are many disadvantages to its use:

- 1) It may not be in your DOS version.
- 2) It may waste time and effort by requiring separate disk formatting first.
- 3) It does not allow for bad areas on the disk.
- 4) It does not improve space usage like **COPY** does (fragmented disks can cause poor performance due to delays involving finding, reading or writing a file).
- 5) It erases all old data on the disk.

DISKCOPY does have two useful purposes. It can check for physical damage to a disk (if the **DISKCOPY** works without errors, the disk is not damaged) and it can test if a piece of commercial software is copy-protected (if it doesn't copy it is copy-protected). Otherwise, it is

best to use COPY for everything except entire disk backups (and sometimes then).

LABEL (internal): Creates or changes a volume label on a disk.

LABEL NEWNAME

DISKCOMP (ext): Compares the contents of one diskette to another.

DISKCOMP A: B:

Working with files

COPY (internal): COPY provides three important functions. It allows the duplication or transfer of files (copy) between disks:

COPY C:FILE.EXT A: COPY C:*. * A:

It allows a duplication of a file with a different filename:

COPY THISFILE THATFILE

And it allows the combination of the contents of two or more files:

COPY AFILE+BFILE CFILE

The first parameter is the source file, the second is the target file.

DEL (internal): **ERASE** (internal): DEL and ERASE destroy files. They delete files from the disk. These commands (along with FORMAT) must be used with extreme caution to prevent destroying valuable information.

DEL NOGOOD.DOC

REN (internal): Renames existing files. The first parameter is the old name. The second is the new name.

REN SAM.DOC MARY.DOC

TYPE (internal): Displays a quick look at the contents of a file. It must be a text or data file if you want to see anything recognizable. TYPE operates by transferring the contents of a file to the display screen.

TYPE SAMPLE.TXT

If you desire to print a plain (ASCII) text file, the easiest method is to use the TYPE command. The system printer is called **PRN**. To make a printed output, simply enter:

TYPE SAMPLE.TXT > PRN

Printing a file

PrintScreen (int): Keying the {Shift} and {PrintScrn} keys together produces a printout of the text displayed on the DOS screen. See also "GRAPHICS". Different rules apply in Windows.

PRINT (external): Sends data files to a printer while you are doing other tasks.

PRINT FILENAME.EXT

Hanging from the tree

Use a backslash { \ } to separate directories. **C:\WINDOWS\FONTS** is the FONTS subdirectory in the WINDOWS directory on drive C:.

CD (internal): Changes the directory by following the command with a new path name:

CD \DOS\MOUSE

CD also displays the current directory by entering the command without a path name.

MD (internal): Creates a new subdirectory.

MD \DOCS

PATH (internal): Searches specified directories for .COM, .EXE, and .BAT files not found in a search of the current directory. If the DOS external commands are stored on hard disk **C:** in a subdirectory **\DOS** (off the root directory), the following command would be placed in the AUTOEXEC.BAT (commands automatically executed at start-up) file:

PATH C:\;C:\DOS

Entering PATH without parameters displays the current path.

RD (internal): Removes (deletes) an existing subdirectory that has no files or other subdirectories in it.

RD \DOCS

TREE (external): Displays all of the subdirectories on the specified drive. The **/F** switch lists all the files in each subdirectory as well.

TREE C: /F

Other commands (for advanced users)

ASSIGN (external): Redirects requests to a disk drive to a different drive. This is necessary for those software products designed to operate on specific drives. To redirect requests from **A:** to **B:**, use

ASSIGN A=B

The command ASSIGN without parameters undoes any assignments.

BACKUP (ext): Allegedly produces a backup of one or more files to a disk. Known to be difficult to use successfully. Numerous options are available through the use of switches. To backup all the files with the extension .DOC on the hard disk to a floppy:

BACKUP C:* .DOC A:

See also RESTORE.

DISKCOMP (ext): Compares two disks to see if DISKCOPY was successful.

DISKCOMP A: B:

COMP (external): Compares the contents of two files to determine their differences.

COMP A:JET.DWG B:JET2.DWG

EDLIN (ext): A very low-level, command-type text editor used primarily to prepare batch files. It can also be used to enter and revise written text. It is a complex utility confusing to most users. It is not supplied with DOS 6 or above.

EXE2BIN (ext): Converts ready-to-run programs in the .EXE (relocation) format to the .COM (memory-image) format (for addicted programmers).

DEBUG (ext): Provides assistance to advanced programmers. All display is normally in hexadecimal. It allows:

- 1) The display of part of RAM or ROM memory,
- 2) Modification of RAM memory,
- 3) Reading of a disk file into RAM memory,
- 4) Writing of a modified version onto disk,
- 5) Reading and writing to registers and ports,
- 6) Disassembling machine code in RAM memory,
- 7) Tracing of the operation of a program.

FIND (external): A *filter* which searches for a specific string of text.

GRAPHICS (ext): If run before {Shift-PrintScrn} is keyed, enables printing the contents of a graphic display screen to a printer. Supported printers and video types vary with DOS version.

JOIN (external): Removes the distinction that physical drives are separately addressable by a drive name. It joins a disk drive to a specific pathname.

LINK (external): Combines program segments into one program and reconciles their variable references and subroutine calls.

MASM (external): A macro assembler which allows the development of machine language programs (for addicted programmers).

MODE (external): Sets the mode of operation of the serial port, printer, and display; and can redirect printer output to the serial port. This will be needed if you plan to connect a laser printer or plotter on the serial port.

MORE (external): A *filter* which displays output one screen at a time similar to the /P switch for DIR.

TYPE README.DOC | MORE

PRINT (external): Enables "background printing". Requires that a printer is attached and operating.

RECOVER (ext): Supposedly recovers a disk containing bad sectors. Most users do more damage than they repair with this command.

RESTORE (ext): Transfers files from a disk created with the BACKUP command to a working disk. Many, many switches. Rarely works right.

SORT (external): A *filter* that sorts information in a file at a specified column number.

Remember that not all of these commands will be available in all versions of DOS. Many of them, for example, have not been included with the DOS versions 7 and above which are shipped with Windows 95 and newer. If in doubt, enter {**command name**} /? at a command prompt.

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