Personal Computer Operating Systems

Although personal computer users may interact less with the operating system of their computer than with other software packages such as spreadsheets and word processors, the operating system is the key software element of a computer system. Some computer vendors offer more than one operating system (IBM has 4 for its Personal Computer, for example), and purchasers of such systems should be aware of the characteristics of each alternative and the impact of that operating system on the range of software available.

This survey lists 25 popular operating systems from 17 different suppliers. The information is collected based on the technical documentation and application of the systems, and not on sales claims alone. For quick reference, the detailed material is preceded by a dot chart which shows the most critical features of operating systems and their availability in each of the products surveyed. Complete information on each operating system is provided in alphabetical order by vendor name.

PERSONAL COMPUTER OPERATING SYSTEMS OUTLINE

COMPANY • PRODUCT	COMPUTERS SUPPORTED: IBM PC	Apple	TRS-80	Other Z80-Based Systems	Other 8086/8088-Based Systems	Other MC68000-Based Systems	Other Microprocessor-Based Systems	DEVICES SUPPORTED: Floppy Disk	Hard Disk	Printer	Serial Communication	USER/TASK SUPPORT: Single User	Multiuser	Multiple Tasks	User Sign-on/Password	FILE SYSTEM SUPPORT: Directory Command	Multiple Directories	Hierarchical File Structure	Redirected I/O	File Security	SYSTEM LANGUAGES: BASIC	Assembly Language	Pascal	FORTRAN	COBOL	C	Other
Apple • DOS	–	•	–	–	–	–	–	•	–	•	•	•	–	–	–	•	–	–	–	–	•	•	•	–	–	–	•
Apple • Lisa DOS	–	•	–	–	–	–	–	•	•	•	•	•	–	•	–	•	•	•	•	–	•	•	•	–	•	–	–
Apple • MAC DOS	–	•	–	–	–	–	–	•	–	•	•	•	–	–	–	•	•	•	•	–	•	•	•	–	–	–	–
AT&T • UNIX	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	–	•	•	•	–
BOS National Inc • BOS	•	–	–	–	•	–	•	•	•	•	•	•	•	–	•	•	–	–	–	•	–	–	–	–	•	–	–
Cosmopolitan Electronics • MULTIDOS	–	–	•	–	–	–	–	•	–	–	–	•	–	–	–	•	–	–	–	–	•	–	–	–	–	–	–
Digital Research • CP/M 2.0	–	•	•	•	–	–	•	•	•	•	•	•	–	–	–	•	–	–	–	–	•	•	•	•	•	–	•
Digital Research • CP/M-86	•	–	–	–	•	–	–	•	•	•	•	•	–	–	–	•	–	–	–	–	•	•	•	•	•	–	•
Digital Research • Concurrent CP/M-86	•	–	–	–	•	–	–	•	•	•	•	•	–	•	–	•	–	–	–	–	•	•	•	•	•	–	•
Forth Inc • Polyforth	•	•	–	•	•	•	•	•	–	•	•	•	•	•	•	•	•	•	•	•	–	•	–	–	–	–	•
IBM • PC-DOS	•	–	–	–	–	–	–	•	•	•	•	•	–	–	–	•	•	•	•	–	•	•	•	•	•	–	–
IBM • PC-IX	•	–	–	–	–	–	–	•	•	•	•	•	–	•	–	•	•	•	•	•	–	–	–	–	–	•	–
Infosoft Systems • IOS	–	–	•	•	–	–	•	•	•	•	•	•	–	–	–	•	–	–	•	–	–	•	–	–	–	•	–
Infosoft Systems • MULTI/OS	–	–	•	•	–	–	•	•	•	•	•	•	•	•	•	•	•	•	•	•	–	•	–	–	–	•	–
Infosoft Systems • iRMX86	•	–	–	–	•	–	–	•	•	•	•	•	•	•	•	•	•	•	•	•	–	•	•	•	•	–	•
Microsoft • MS-DOS	•	–	–	–	•	–	–	•	•	•	•	•	–	–	–	•	•	•	•	–	•	•	•	•	•	–	•
Microsoft • XENIX	•	•	•	–	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	–
Multi-Solutions, Inc • S1	•	–	–	•	•	•	–	•	•	•	•	•	•	•	•	•	•	•	•	•	•	–	•	•	•	•	–
Phase One Systems • OASIS-16	•	–	–	–	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	–	–	–	•	–
Quantum Software Systems • QNX	•	–	–	–	•	–	–	•	•	•	•	•	•	•	•	•	•	•	•	•	–	–	–	–	–	•	–
Standard Datacom • X-SHELL	•	–	–	–	–	–	–	•	•	•	•	•	–	–	–	•	•	•	•	•	–	–	–	–	–	–	–
Softech Microsystems • P-SYSTEM	•	•	•	•	•	•	•	•	•	•	•	•	–	–	–	•	–	–	•	•	–	•	•	•	–	–	–
Software 2000 • TurboDOS	–	–	•	•	–	–	–	•	•	•	•	•	•	•	•	•	•	•	•	•	–	–	–	–	–	–	–
Tandy • TRSDOS	–	–	•	–	–	–	–	•	•	•	•	•	–	–	–	•	–	–	•	–	•	•	•	–	–	–	–
Whitesmith Ltd • IDRIS	•	–	–	–	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	–	–	•	–	–	•	–

Personal Computer Operating Systems

PERSONAL COMPUTER OPERATING SYSTEMS FEATURES

Operating systems provide the basic environment in which the user-oriented programs such as word processors, spreadsheet programs, or database programs can run. By providing these programs with simplified access to such resources as disk storage, they make the development task easier and assure a degree of commonality of data structure and command interface among the various application programs.

The most familiar operating system to business users is probably CP/M, a Control Program/Microcomputer product developed by Digital Research, Inc and used on the Intel 8080/8085 and Z80 microcomputer products. This original form of CP/M is now called CP/M-80 to distinguish it from the recent 16-bit versions for the Intel 8086 series microcomputers and the Motorola 68000 product. But other operating systems have been gaining in popularity, threatening CP/M's lead. MS-DOS, developed by MicroSoft for IBM's Personal Computer (where it is known as PC-DOS, or just DOS), has gained leadership in the 16-bit marketplace, outselling all other 16-bit products by a factor of 10 to 1. AT&T's UNIX operating system, developed for minicomputers of the DEC family but transportable to nearly any computer system, has recently gained in popularity and was recently licensed by IBM as their PC/IX operating system.

Operating systems may be classified in many ways; single user or multiuser, single task or multitask, etc. One very basic classification is "visible" or "invisible." Visible operating systems are ones with which the computer user can actually interact through a set of keyboard commands. These commands may be used to format disks, copy files, print files, etc. CP/M, MS-DOS, and UNIX are all visible operating systems. The invisible operating system is one which is insulated from direct user interaction by either a programming language or by a special set of programs which structure the more complex operating commands into user-friendly menus, prompts, etc. Invisible are ones such as the UCSD Pascal P-system, available for the IBM PC and most other popular computers, and those which are insulated from the user by a special interface are characterized by the Apple Lisa and Macintosh.

Operating systems which are vendor proprietary, such as Apple's or Tandy's TRS-80 systems, may restrict the migration of users to more powerful computer systems, unless the vendor elects to build more powerful computers which also support or are compatible with their earlier operating systems. Apple's DOS for the Apple II is not run on Macintosh. These compatibility issues may affect the user's ability to move programs and data from one system to another, and should be explored before such a system is purchased.

Even "compatible" operating systems do not assure portability, however. MS-DOS is available for many popular 8086-family computer systems, and some programs written to run under the control of MS-DOS are portable to all. Unfortunately, most programs are written to some degree dependent on the hardware as well as on the operating system. MS-DOS programs written for the DEC Rainbow may run on the IBM PC, but the disks probably cannot be transferred, so getting the program from one place to another may require data communication. Once relocated, the program may expect more than just the operating system—a common problem is the screen/display interface. Anyone purchasing an operating system for compatibility should test the compatibility to the limits required before making the deal.

There are some truly "portable" operating systems, such as UCSD Pascal's P-system and UNIX. These are often written in a high-level language and can be easily transferred from one computer to another. They often do not support any machine-dependent statements, so transfer of programs from one supporting system to another is strictly a problem of physically moving the source language and compiling it on the target system.

Users should not become preoccupied with the technical details of an operating system. Most businesses will use the operating system only as a vehicle for running application programs, and as such the only significant feature is the number of such programs the operating system will run.

In the detailed summary of personal computer operating systems which follows, significant points are highlighted in each of the following major categories:

Overview • provides a brief description in capsule form of the operating system; comparisons to other to other popular, well-known operating systems can be made here.

Computers Supported • target computer system(s) on which the operating system is designed to run.

Devices Supported • type of disk storage, printer, communication, or other hardware which is directly supported by the operating system; direct support means that programs which desire to use the hardware resource may do so through a simplified request for service to the operating system, eliminating direct hardware interface to the device; normally, operating system support for a device type will imply the existence of some type of utility program to move data to or from that device.

User & Task Support • operating systems may support either a single user or multiple users; single users may also be able to define multiple, simultaneous jobs or tasks which can be run at the same time; an example might be a print job and a database update • all types of systems may or may not offer user password or sign-on protection to prevent unauthorized access.

File System Support • type of file support provided by an operating system affects the user's control over the data being used and saved; files reside on disk, and disks normally maintain a directory of the files they contain; some systems support multiple file directories, so files can be grouped into logical combinations • other capabilities include the ability to use disk files to substitute for other devices, such as printers, which may at the time be busy • a final file system attribute is the security precautions placed on file access to prevent unauthorized use or accidental destruction of data.

System Utilities • most operating systems include special commands or programs to perform system maintenance and file initialization tasks; these include system generation, disk formatting, backup and restoration of data, printing files, displaying data to the screen, verification and comparing of data, and the copy file-to-file or file-to-device capability.

System Languages • not all operating systems support every programming language, and the lack of support for a given language makes it difficult to transport programs written in that language to the operating system; the languages indicated are those supplied by the vendor • the BASIC language is the most common used by beginner programmers, and most users intending to program should expect its support; COBOL is the most common business language, and Pascal and "C" are modern "structured" languages which are popular with professional programmers.

Retail Price • some languages are priced bundled with the computer systems, many are sold separately, and some are priced dependent on the target computer system; representative commercial prices for computers will be shown where available.

PERSONAL COMPUTER OPERATING SYSTEMS LISTINGS

■ APPLE COMPUTER

20525 Mariani Avenue, Cupertino, CA 95014 • 800-538-9696.

□ DOS

Overview • the Apple operating system, largely "hidden" from the

Personal Computer Operating Systems

user and used primarily in support of the BASIC programming language.

Computers Supported • Apple II, II+, IIe • may also run on compatible systems such as the Franklin.

Devices Supported • 1 to 6 5.25 inch floppy disks • supports serial or parallel printer • supports a modem via serial port.

User & Task Support • single user; single task • does not support user sign-on/password facility.

File System Support • Directory Command: "Catalog" with a wildcard character "?" to specify filenames • no multiple directories • no hierarchical file structure • redirected I/O-treats devices like files.

System Utilities • Copy File command copies one or more files from one disk to another (disks must be initialized); line editor capability; Disk Copy through "Copy" under Integer Basic on the Apple II+ and "CopyA" when running Applesoft Basic on the Apple IIe; Verify/Compare through the "Filem" command on all types of files • no print spooling capabilities • no file dump capabilities • frequently used set of commands can be recorded to disk; disk format utility provided.

System Languages • Integer BASIC, Applesoft BASIC • assembly language is low-level programming language in which individual machine language instructions are written in symbolic form more easily read by a person than machine language • Apple II Pascal.

Retail Price • bundled with system.

☐ System DOS

Overview • a fully hidden operating system for the support of the Lisa icon screen structure and command concept; there are some variations in the device support characteristics between Lisa and Lisa 2.

Computers Supported • Apple Lisa.

Devices Supported • 2 5.25 inch (or 3.5 inch for Lisa 2) floppy disks handling 1.7M bytes; ProFile hard disk handles 5 to 10M bytes; printer: Apple Daisywheel printer; serial communication: contains 2 RS-232 serial ports with full-duplex channels; mouse: pointer on computer screen replacing function keys.

User & Task Support • single-user, multitask support • no access security provision.

File System Support • integrated file system support • Directory Command: arrow-shaped cursor points to icons and the icons replace the file directory with a collection of objects displayed in the window of the associated mass storage device • multiple directories are supported.

System Utilities • copy file; line editor; disk copy; processor via mouse; disk format; hard disk backup/restore • also supports LISACALC, LISALIST, LISAPROJECT, LISAWRITE, LISAGRAPH, and LISADRAW for modeling, list management, project scheduling, word processing, and business graphics respectively • MACALIKE utility to run Macintosh programs on Lisa.

System Languages • BASIC; 68000 assembly language; Pascal; COBOL.

Retail Price • bundled with Lisa hardware.

☐ Macintosh System DOS

Overview • an even more mouse-oriented software system for the new Apple Macintosh computer; the operating system is totally hidden from the user.

Computers Supported • Macintosh.

Devices Supported • 1 to 2 3.25 inch floppy drives; hard disk support provided in software design but no hard disk device yet available; printer: Apple Dot Matrix Imagewriter; serial communication; 2 serial ports; mouse used as primary cursor control and command selection device; numeric keypad supported.

User & Task Support • single user, single task • no sign-on or access security features.

File System Support • directory command uses Lisa-like icons, mouse driven; multiple file directories in hierarchical file structure like MS/DOS; redirected I/O supported; no file security features.

System Utilities • copy file utility provided; line editor not provided, but word processor is sold separately; disk copy utility and verify/compare utility provided, print spooler utility not provided; file dump utility not provided; disk format utility provided; hard disk backup/restore when hard disk becomes available.

System Languages • BASIC; assembly language; Pascal; Logo.

Retail Price • bundled with hardware.

■ AT&T TECHNOLOGY

225 Schilling Circle, Cockeysville, MD 21030 • 301-666-4167.

☐ UNIX

Overview • the original "portable operating system," designed for minicomputers; UNIX has been sold for microcomputers through licensed OEM software vendors; the exact characteristics of these products vary somewhat from the basic UNIX style, but the differences lie primarily in device support; UNIX has been very popular with programmers, but has seen less business interest than many think it deserves.

Computers Supported • supports mainframes to micros • any system with a "C" compiler may be configured for UNIX support • most microcomputer products using UNIX are licensed from AT&T but distributed through a software OEM or computer manufacturer.

Devices Supported • all forms of floppy disk and hard disk storage may be supported; printer support for parallel or serial printers with custom protocols may be available; communication interface with other UNIX systems or foreign systems.

User & Task Support • multiuser; multitasking; user sign-on and password facilities are supported.

File System Support • advanced filing system: tree-structured file hierarchy; Directory Command (DIR) lists which files are a member of a hierarchy; multiple directories supported, and directories may be members of higher level directories; I/O redirection supported • file security by locking; any file or directory can be protected against unauthorized access.

System Utilities • a rich set of utilities provided so user is spared from having to create their own routines • copy file utility; line editor and screen editor standard; disk copy utility, verify/compare utility, and file dump utility provided • Command File Processor: flexible command shell lets you customize UNIX system, it is command line oriented • disk format utility provided; hard disk backup/restore utility supported • many UNIX implementations also supply a simple word processor.

System Languages • BASIC, assembler, FORTRAN, COBOL, "C" Language.

Retail Price • varies with UNIX Version, license terms; UNIX may be available through licensed OEMs.

■ COSMOPOLITAN ELECTRONICS CORP

5700 Plymouth Road, Ann Arbor, MI 48105 • 313-608-6660.

☐ MULTIDOS

Overview • a special operating system for the TRS-80 Models I and III, felt by many to be superior to the standard TRSDOS.

Computers Supported • TRS-80 Models I and III.

Devices Supported • floppy disk support; serial or parallel device support, including printers.

User & Task Support • single user.

File System Support • Directory Command (DIR) alphabetizes file names; multiple directories provide links to major DOS functions.

System Utilities • copy file utility, disk copy utility, and verify/compare utility provided • print spooler utility controls simultaneous printing; file dump utility supported; command library for entry of repetitive functions format utility commands provided.

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System Languages • SuperBASIC, BBASIC (BOSS and SuperBASIC), EBASIC.

Retail Price • $99.95.

■ DIGITAL RESEARCH

160 Central Avenue, Pacific Grove, CA 93950 • 408-375-6262.

☐ CP/M 2.X

Overview • sometimes called CP/M-80 to distinguish it from the newer 16-bit CP/M-86, CP/M 2.X is the current version of the most popular 8-bit microcomputer operating system ever developed; CP/M is normally sold to hardware developers and software OEMs, who customize it for sale to end users with their computer systems.

Computers Supported • Apple II systems with Z80 card; TRS-80 Model I, II, III; other Intel 8080/8085 microcomputers; Zilog Z80-based computers.

Devices Supported • 5.25-inch or 8-inch floppy disk drives are usually the standard storage media; support for hard disk is usually provided by the manufacturer or software OEM • printers: GSX graphics extension allows CP/M to support many printers, plotters, and graphics cards for high-resolution monitors; serial communications support not generally included, but may be available in certain versions provided by computer or disk manufacturers under license to Digital Research.

User & Task Support • single user, single task support.

File System Support • Directory command: "DIR"; multiple directories not supported; no hierarchy of files or directories; no access security.

System Utilities • copy file utility available which includes file comparison and verification; line editor provided for program entry and simple word processing; disk copy utility available; print spooler for concurrent printing and editing; file dump to printer and to screen; print screen data capability; command file processor for batch commands, disk format utility, and hard disk backup/restore utility available.

System Languages • CBASIC, CBASIC Compiler; Debugger and assembler; Pascal/MT+, PL/1; CIS COBOL, Level II COBOL; PL/1.

Retail Price • varies depending on source, but generally approximately $250.

☐ CP/M-86

Overview • the 16-bit version of CP/M, eclipsed by MS-DOS because of IBM's move to adopt that product for its Personal Computer; CP/M-86 has itself been somewhat overshadowed by its companion product Concurrent CP/M-86, and most users with a choice of the two products should unhesitatingly choose the latter • most CP/M-86 systems are sold to users by computer manufacturers or software OEMs, since Digital Research is just beginning to make libraries of supported hardware systems available.

Computers Supported • IBM PC; most 8086-family computer systems; a version for the Motorola MC68000 computer, called CP/M-68K, is also available; supplied for many popular IBM PC-compatible systems.

Devices Supported • 1 to 16 5.25- or 8-inch disk drives; hard disk supported, but may vary with source of the product; printer support for serial or parallel printers may likewise be vendor dependent; supports serial communication ports, generally asynchronous.

User & Task Support • single user, single task • no password security.

File System Support • Directory Command with wildcard characters supported; multiple directories or hierarchical structure of files not available; system independent input/output device handlers available, redirection of I/O may be vendor dependent.

System Utilities • file copy utility available; text editor with extensive commands can make text changes with single command line; disk copy utility and disk format utility available, verify/compare available through Filecopy Utility PIP; print spooler utility available; command file processor (SUBMIT) allows user to batch together a parameterized group of commands in a file for submission to the operating system; disk format utility is available, but is generally vendor specific; DDT-86 is the dynamic debugging tool that allows the user to test and debug programs interactively in a CP/M-86 environment; the user can trace program execution with full register and status display.

System Languages • CBASIC, CBASIC Compiler, Personal BASIC; ASM-86 assembler; Pascal MT/+; CIS COBOL. Level II COBOL; Digital Research "C" (UNIX compatible); PL/1.

Retail Price • dependent on the source of the product, but generally approximately $240.

☐ Concurrent CP/M-86

Overview • Digital Research views this product as its chance to regain some of the lost 16-bit market; basically compatible with CP/M-86, this product adds multitask capabilities; a version of Concurrent CP/M-86 for the IBM PC is sold directly by Digital Research.

Computers Supported • IBM PC with 256K bytes of memory required; designed for computers using Intel 8086/8088-based microprocessors.

Devices Supported • supports 2 to 16 5.25- or 8-inch disk drives; multiple drive hard disk support; printer may be parallel or serial; process synchronization and communication supported under the system • works with both high- and low-resolution monitors in color and black and white • supports a modem, console device, and a real-time clock.

User & Task Support • single-user, multitask or multiuser, multitask versions available • Multitasking: as many as four separate processes can share the system; user sign-on/password: all files (except those with password protection) are accessible to all users when desired; password usage is optional.

File System Support • operator and system commands similar to those of CP/M-80; directory command to indicate only a particular user's files; to access directory information you use familiar commands like DIR, TYPE, PIP, ERA directly; multiple directories are not provided; hierarchical file structure is not supported; redirected I/O monitor assures that 2 processes trying to use the same I/O device at the same time do not interfere; file security via record and file locking functions provided.

System Utilities • file copy utility available; text editor provided with extensive commands to make text changes with single command lines; disk copy utility available; verify/compare available through file copy utility called PIP; printing can be done in multitask mode; file dump utility available; command file processor (the SUBMIT command) allows user to batch together a parameterized group of commands in a file and submit it to the operating system; disk format utility available; hard disk backup/restore utility available.

System Languages • C-BASIC, C-BASIC Compiler, Personal BASIC assembly language; Pascal/MT+; CIS COBOL, Level II COBOL; Digital Research "C"; PL/1.

Retail Price • dependent on source; a standard version for the IBM PC retails for $350, but a special offer version for $150 may be available.

■ FORTH INC

2309 Pacific Coast Highway, Hermosa Beach, CA 90254 • 213-372-8493.

☐ Polyforth II

Overview • an operating system melded with a programming language, Polyforth provides FORTH programmers with the ability to interact with system hardware directly in the FORTH language without the filtering action of an operating system; because of its integration with the FORTH language, Polyforth II may not be suitable as a general operating system for users wishing to run commercially available software.

Computers Supported • IBM PC with 1 or 2 single-sided or

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double-sided 5.25-inch disk drives; Apple II with Microsoft Z80 card; Zilog Z80; Intel 8080/8085, 8086/8088 CPUs; Motorola 6809 and 68000 systems DEC-PDP-11 and LSI-11 systems.

Devices Supported • 5.25-inch floppy disks; hard disk support will vary with the system—generally it is not supported on microcomputers; printer and communication support is through the FORTH language.

User & Task Support • multiuser: tasks may support multiple users on even the smallest hardware configurations; multiple tasks: any number of asynchronous tasks can run concurrently; password security for access control.

File System Support • based on FORTH block structure; directory command: block number maps direct to the physical location, block access doesn't require directory or logical chaining mechanism; disk drivers optimize mapping to provide top speed to sequential block access • Multiple Directories: multiple hierarchy indexes may be established and each level may be directed or ordered depending on nature of the data • Redirected I/O and device independence for all common functions is available.

System Utilities • report generator: automatic pagination, dating, line control headings, columnar alignment, subtotalling; copy file utility line editor: string-oriented editor edits 16 lines in 64 characters each for displaying and editing • disk copy utility, verify/compare utility and print spooler utility available; file dump to screen for viewing; command file processor: over 400 resident commands; disk format utility available; string-oriented editor; math library; database support system.

System Languages • FORTH assembler, FORTH High Level Language Compiler.

Retail Price • from $300 per license; price depends on host system.

■ IBM CORPORATION

P.O. Box 1328, Boca Raton, FL 33432 • 800-447-4700.

☐ PC-DOS

Overview • sometimes called just DOS, IBM's version of MS-DOS made that product famous and established a standard for the 16-bit Intel family of computer systems; experts estimate that over 95% of the IBM Personal Computers sold run only PC-DOS.

Computers Supported • IBM PC, PC/XT, or PCjr; reported to run on many PC compatibles, but use in that mode may violate license agreement.

Devices Supported • supports 1 or 2 5.25-inch floppy drives; up to 2 hard disks supported; printer may be serial or parallel interface, but no special protocols are supported; serial communication support through utility programs.

User & Task Support • single user, single task; user sign-on/password security not provided.

File System Support • DIR lists active directory entries; 2 wildcard characters (*,?) will permit specification of general criteria for display of multiple files; multiple directories and file linking are supported • hierarchical file structure: hierarchical file structure and Pathnames used for unlimited partitioning of a disk volume in sub-directories and segregating files by function and user; redirected I/O and device independence available.

System Utilities • copy file utility; line editing functions supporting program entry are available; disk copy utility; verify/compare utility are supported; print spooling standard; file type and print support; command file processor includes conditional statements and provisions for program termination code analysis; disk format utility provided; hard disk backup/restore utility is provided; debugger and linker available.

System Languages • BASIC Interpreter and Compiler, assembler, ISO Pascal • FORTRAN, COBOL, and Logo.

Retail Price • $60.

☐ PC-IX

Overview • IBM licensed a version of UNIX for this product, the only multitask operating system available on the IBM Personal Computer through IBM; the product, unlike all the rest of the PC software, must be purchased through the IBM branch office rather than through dealers or the Product Center.

Computers Supported • IBM PC/XT with fixed disk expansion 256K bytes of storage/minimum 128K bytes for the PC/XT; 8087 math co-processor support or emulation.

Devices Supported • 1 to 3 dual-sided diskette drives; 1 to 2 10M byte hard disks; 1 to 2 graphics printers or IBM matrix printers; serial communication: 1 asynchronous communications support adapter.

User & Task Support • single user; multiple task user may print one file while editing another; execution is sequential and asynchronous; background processes are supported; user sign-on/password: user access control protected by passwords.

File System Support • flexible access to directory hierarchy; users may create and remove files from directories they own, list various information about files and directories, or search a directory hierarchy for files having particular characteristics, multiple directories may contain files and/or other directories; file linking across and within directories is available hierarchical file structure; redirected I/O: each physical I/O device from display and keyboard to main memory is treated like a file, allowing uniform file and device I/O; file security: several users (single user of one system) may utilize the IBM PC at different times, with full control to prevent unauthorized access.

System Utilities • copy file: a full range of utilities for copying, renaming, deleting, and archiving files; line editor: there are commands for locating particular strings or combinations of strings in files, finding line by line differences or common lines among files; disk copy: utility, verify/compare: this utility, and print spooler utility are included; file dump: both full and incremental dumps are supported; flexible command language; disk format utility and hard disk backup/restore utility are available • INED editor: is a full screen text editor where function keys replace typing commands; spelling error detection facilities.

System Languages • "C" Language, Compiler for C Language; assembler and Relo-loader for IBM PC, Comprehensive Runtime Library, Program for checking "C" source programs for sylistic portability and deviations.

Retail Price • $900.

■ INFOSOFT SYSTEM

80 Washington Street, Norwalk CT 06880 • 203-226-8937.

☐ IOS

Overview • another CP/M lookalike, IOS was developed as a private operating system for Cromemco, where it is still marketed and called CDOS; IOS provided users with CP/M features and functions but with configurable device support; several major manufacturers of industrial systems (such as Mostek) have used IOS as a proprietary operating system.

Computers Supported • Zilog Z80 and Intel 8080/8085 processor-based systems supported.

Devices Supported • any mix of devices and disks is supported; floppy disks: interchangeable use of 5-inch and 8-inch floppy disks; hard disk support; printers may be serial or parallel and may employ custom communication protocols; communication support via serial ports is provided within the operating system.

User & Task Support • single user; multiple tasks: multiprocessing, dual tasks handle program spooler; user sign-on/password protection for access security is not available.

File System Support • dynamic files allocation automatic creation and replacement of files; directory command: automatic menus allow full random use of disk files (even on hard disks); multiple directories are not supported; hierarchical file structure is not available.

System Utilities • copy file; line editor; disk copy; utilities are supported; command file processor: batch execution supporting

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local and multilevel batch; disk format utility available; hard disk backup/restore utility is supported.

System Languages • vendor supplied a version of the "C" compiler; structured assembler language including macro capability; most CP/M language processors and programs will run under IOS.

Retail Price • $250.

☐ Multi/OS

Overview • an ambitious multiuser version of IOS which was introduced to compete with Digital Research MP/M (itself now largely replaced by concurrent CP/M); Multi/OS became available at the same time as IBM's Personal Computer cut heavily into the 8-bit market, and was never really popular as a result.

Computers Supported • Zilog Z80 and Intel 8080/8085 processor-based systems supported.

Devices Supported • configuration library with over 70 devices and 20 disk drivers; floppy disk: will support multiple disk controllers without custom programming; hard disk support; will support most standard serial printers; serial communication: will support a modem.

User & Task Support • full single-user capabilities; multiuser capabilities: 16 users with or without active terminals; multiple tasks: multitasking and multiprocessing (1 to 16 tasks); user sign-on/password security capabilities.

File System Support • turnkey system features; directory command: sequential and random filing; multiple directories: multilevel directory is an expanded directory capability which allows an unlimited number of files; hierarchical file structure supported; redirected I/O is available with I/O multibuffering; file security available via record locking.

System Utilities • copy file; line editor; disk copy; verify/compare utilities available; print spooler with multiple printer capabilities; file dump to printer or display; command file processor: master disk search for program and back disk format utility; hard disk backup/restore utility; word processing, Data Entry, Inventory Control, Order Entry facilities available.

System Languages • runs most CP/M languages and programs; IOS-compatible languages also execute under Multi/OS.

Retail Price • dependent on source of product; original single-system licenses were $900 but lower prices are now available through authorized dealers.

■ INTEL CORP

3065 Bowers Avenue, Santa Clara, CA 95051 • 408-987-8080.

☐ iRMX-86

Overview • full-feature operating system of commercial quality, designed for Intel's line of OEM 8086-based computer systems; highly sophisticated in features and device support, iRMX-86 is an unusual operating system for broad commercial application because most software written for popular Intel-based products such as the IBM PC will not run with it; as a vehicle for custom program development, particularly where unusual devices are involved, it is uniquely capable; there are several custom implementations of iRMX-86, including at least one for the IBM PC.

Computers Supported • IBM PC; 8086/8088-ISBC86 12/A, 14 and 30.

Devices Supported • floppy disk: supports 1 to 8 drives; hard disk support; line printer connected to parallel port on SBC, support 1 to 4 printers; serial communication: keyboard terminal connected to the serial line on the SBC, modem support, and up to 4 keyboard terminals using serial ports.

User & Task Support • multiuser for up to 5 users simultaneously; multitasking and multipurpose; user/sign-on through a 1 to 8 character password associated with user.

File System Support • wildcard characters supported (*,?); user can scan one or more iRMX-86 user Directories; multiple directories: files and other directories are contained in a given directory; hierarchical file structure; redirected I/O treats all devices like files; files and devices can be protected from unauthorized access; software mechanisms make a protected environment possible.

System Utilities • copy files: reads data from specified input source or sources and writes the output to the specified destination file or files; line editor includes keying support, error correction, and control of screen display; disk copy is available; verify/compare (DISKVERIFY) verifies data structures of iRMS-86 physical and named volumes and can also reconstruct portions of volume and perform absolute editing on the volume; print spooling available; file dump: provides files in hexadecimal format; command file processor: batch language command to execute files; user can put batch commands on disk and they are read as if coming from the keyboard; disk format utility and hard disk backup/restore and available, debugs iRMX-86 application jobs in conjunction with iSBC 957-B hardware package and monitor.

System Languages • ASM-86; Pascal-86/Compiler, 87/Pascal FORTRAN 86, COBOL, PL/M-86 Language.

Retail Price • approximately $600 for the IBM PC; other versions at various prices.

■ MICROSOFT CORPORATION

10700 Northup Way, Bellevue, WA 98004 • 206-829-8086.

☐ MS-DOS

Overview • selected by IBM as the operating system for their personal computer (where it is called PC-DOS, or just DOS), MS-DOS is now the most popular operating system for the Intel 8086 family of computer systems.

Computers Supported • 100% IBM compatible, the same as PC-DOS; Columbia, Compaq, Corona, and other PC-compatible system supported; most business computers using an Intel 8086 or 8088 processor.

Devices Supported • requires at least one 5.25 inch floppy drive; hard disk can be accommodated; printer may be serial or parallel interface, but no special protocols are supported; serial communication provided support through utility programs.

User & Task Support • single user, single task; user sign-on/password security not provided.

File System Support • DIR lists active directory entries; 2 wildcard characters (*,?) will permit specification of general criteria for display of multiple files; multiple directories and file linking are supported; hierarchical file structure and pathnames used for unlimited partitioning of a disk volume in sub-directories, segregating files by function and user; redirected I/O and device independence available.

System Utilities • copy file utility; line editing functions available through EDLIN; disk copy verify/compare and print spooling utilities provided; file type to screen and print support; command file processor includes conditional statements and provisions for program termination code analysis; disk format utility provided; hard disk backup/restore utility is provided; debugger and linker.

System Languages • BASIC Interpreter and Compiler; assembler; ISO Pascal; FORTRAN; COBOL; and Logo.

Retail Price • depends on source; price varies from no charge (bundled with system) to $150.

☐ XENIX

Overview • based on but not licensed through UNIX, XENIX is felt by many to be more suited for microcomputers than its philosophical parent; until IBM moved to license UNIX from AT&T, XENIX was considered to be the sure move of IBM for multiuser, multitask PC operating system software; now, its future is uncertain • XENIX is not sold directly to end users but through hardware vendors and software OEMs • characteristics, particularly in the area of device support, may vary according to the source of the product.

Computers Supported • IBM PC; Apple II, Lisa; TRS-80 Model 16B (Based on Motorola 68000 and Zilog Z80); Zilog Z-8000; other Intel 8086/80286 family; national 16032-based products.

Devices Supported • floppy disks (number and size depend on

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hardware vendor); hard disk 10M bytes; serial printing; serial communication: 2 serial ports supporting modem; magnetic tape and other special devices may be supported.

User & Task Support • multiuser operating system in a commercial multiuser environment; orderly and centrally controlled access to disk data at the individual record level; multitasking supported; user/sign-on password security is provided for access control.

File System Support • directory list command permits file viewing in hierarchical structure; multiple directories and file linking; a file can appear in more than one directory under the same or different names; hierarchical file structure or tree structure where all file "paths" are anchored in a "root" directory; redirected I/O and device independent file programming; file security supported by locking and access protection settings.

System Utilities • copy file utility is supported and can copy groups of files or an individual file; line editor is supported as well as screen editor; disk copy support; verify/compare facilities; print spooler utility is supported; files may be dumped to the screen or printer, in display or hexadecimal form; command processor may be customized by user; disk format utility is available; generally compatible with UNIX commands and structure.

System Languages • BASIC Interpreter; assembler, Debugger, Library management; Pascal, FORTRAN 77, COBOL, "C" Language.

Retail Price • price depends on the source of the product; XENIX development system for the TRS-80 model 16B retails for $750.

■ MULTI SOLUTIONS INC

660 Whitehead Road, Lawrenceville, NJ 08648 • 609-695-1337.

☐ S1

Overview • a new product with many fine features, S1 has not yet been made available by any commercial computer vendor and is not currently sold in any user form by Multi Solutions; the success of the product will depend on its acceptance by software developers and manufacturers of hardware systems; in its present form, it is primarily an engineering/programming product.

Computers Supported • Zilog Z80, Intel 8080/8085, 8086/8088, and Motorola 68000 microprocessor-based systems.

Devices Supported • floppy disk, hard disk or other storage media may be supported by custom drivers; printer support for serial or parallel printers; customer printer protocols may be specified; serial communication support for special devices, modems, or direct system connection; custom drivers may be defined for any device type or attachment method.

User & Task Support • multiuser with shared access control; multitasking, multiprocessing with 256 processes simultaneously; file system/security passwords provided.

File System Support • file system support: building block construction and file system compatibility; directory command (LIST) with wildcard characters (*,=) permits general file specification; multiple directories and file linking provided, hierarchical file structure supported; redirected I/O is device independent; file security via record locking and password protection.

System Utilities • copy file utility permits one-to-one, many-to-many, inter- or intra-directory copies, and supports combining of several files into one; line editor is included; disk copy utility makes copies of files, disks, and directories; verify/compare can compare files and will generate a list of differences; print spooling utility is available; file dump utility is available; a command processor supports batch command generation and execution; disk format utility is available; hard disk backup/restore with selectivity in backup and restoration is supported; extensive graphics capabilities, a calculator facility, and a screen editor are also available.

System Languages • BASIC (ANSI) and extensions; Pascal (ISO compatible) and extensions; FORTRAN 77 and extensions; COBOL 74; "C" Language (Kerningham and Ritchie extensions).

Retail Price • not yet defined at the retail level; expected to be less than $800.

■ PHASE ONE

7200 Edgewater Drive, Suite 830, Oakland, CA 94621 • 415-562-8085.

☐ OASIS-16

Overview • a successor to the original 8-bit OASIS product, OASIS-16 provides users with a little more of a commercial programming environment than MS-DOS or CP/M, but at the cost of wide software availability; many manufacturers do make OASIS versions of their programs available, but the average user may find the offerings restrictive; OASIS is often sold directly by computer manufacturers, and characteristics of device support may vary.

Computers Supported • 8086/8088 CPUs, 16000, and 68000 microprocessor-based system.

Devices Supported • 1 to 26 drives can be attached per user; hard disk storage support available subject to variations in supplier systems; up to 4 printers are supported; serial device driver performs all communication and data transfer between the operating system and the serial input/output port; a modem is also supported; multiple printer support.

User & Task Support • single user support; multiuser and multitasking; user sign-on/password is supported.

File System Support • file list command displays directory for a file, group of files, disk, volumes, etc; multiple directories supported as well as file linking; hierarchical file structure through multilevel directories; redirected I/O and hardware-independent program interface; the device driver contains all of the device dependent code; I/O multibuffer; file security is supported through password and access level protection.

System Utilities • copy file is directory independent; line edit mode commands available; disk copy utility is available; the verify/compare utility will cause entire contents of disk designated to be verified for readability, and can compare 2 files and report any differences; multiple print spooling through the spooler command which controls and directs basic operations of the printer and the spooler; file dump utilities are available; batch command language for disk-based procedures; hard disk backup/restore utility is supported.

System Languages • BASIC Interpreter; Macro Assembler; "C" Compiler; OASIS-16 Exec Language (like JCL).

Retail Price • $1495.

■ QUANTUM SOFTWARE SYSTEMS INC

6940 Santa Teresa Boulevard, Suite 6, Lupa Plaza, San Jose, CA 95119 • 408-281-1586.

☐ QNX

Overview • for those who love UNIX but want to run standard PC-DOS programs, QNX may be an answer; this product provides a UNIX structure and a PC-DOS emulator for compatibility.

Computers Supported • IBM PC and PC compatibles; Intel 8087 coprocessors for floating-point calculations.

Devices Supported • supports a wide variety of 5.25-inch floppy drives (up to 5); supports a RAMDISK; serial and parallel printer support; serial communication via a wide variety of modems.

User & Task Support • multiuser (4 to 16) multitasking (up to 250 simultaneous tasks); password security for up to 255 users with login password directory and file ownership protection mechanisms.

File System Support • multiple directories; separate compilation and cross linking from different languages for rapid system development; hierarchical file structure limited only by disk storage availability; device independent I/O random file I/O; file security via "Agent" tasks; 1 user can prevent other users from reading, changing, or executing private files and protect the information on a private disk by using a password.

System Utilities • copy file utility is available; line editor, disk copy utility, verify/compare utility, and print spooler are available; file dump in hexadecimal; command processor with online command

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syntax help; the system can be personalized to fit user needs by writing new commands and combining old ones; disk format utility is available; hard disk backup/restore is available.

System Languages • "C" compiler; compatible with PC-DOS languages and programs.

Retail Price • $650.

■ STANDARD DATACOM INC

Suite 6195, 1550 California Street, San Francisco, CA 94109• 415-775-8882.

☐ X-Shell

Overview • another approach to the desire to gain UNIX features while retaining PC-DOS compatibility, X-Shell provides a command overlay to PC-DOS which simulates UNIX commands and structures in a PC-DOS environment.

Computers Supported • IBM PC, XT or compatible system.

Devices Supported • 1 to 2 5.25-inch floppy drives supported; hard disk access through PC-DOS; supports printers compatible with PC and XT; serial communication support; RAMDISK support.

User & Task Support • single user; no multiple tasking capabilities.

File System Support • directory commands to give directory names, to list directories, and to give the first few lines of a file; multiple directories are available and sub-directories can be created; hierarchical file structure is supported; input/output redirection is available; UNIX-style passwords and sign-on security.

System Utilities • copy file utility is available; line editor includes sort to sort lines of a file and a word count to count lines, words, and characters; disk copy utility is available; verify/compare utility compares 2 files, and displays differences or lines common to 2 files; print spooler buffer in memory; file dump utility, command processor utility, disk format utility, and hard disk backup/restore utility are available.

System Languages • PC languages are used.

Retail Price • $225.

■ SOFTECH MICROSYSTEMS

9494 Black Mountain Road, San Diego, CA 92926 • 714-578-6105.

☐ UCSD P-System

Overview • Softech was licensed by the Regents of the University of California, San Diego, to offer the popular UCSD P-System commercially for microcomputers; the P-System is another form of "transparent" operating system, where the conventional programming facilities are accessible only through the vehicle of the programming language and utility programs written in the language; the P-System is primarily a Pascal vehicle, but recent support for assembler language and FORTRAN have been added; this is perhaps the most portable of all microcomputer operating systems, but definitely less popular on most of its target computers than other operating systems such as MS-DOS.

Computers Supported • IBM PC and XT; Apple II, IIe; most PC-compatible systems such as Columbia, Compaq, etc; PDP-11 and LSI-11 computers; most 8-bit and 16-bit microcompusupport floppy disks; printer support (serial or parallel); communication or serial device support • device support may vary depending on the source of the P-System; users should consult their suppliers.

User & Task Support • single user support; multiple tasks may be supported under some implementation; consult the supplier.

File System Support • filer program provides for user disk management and file management; directory of files may be listed.

System Utilities • copy file, recover file, and mark bad block utilities; line editor/screen editor for word processing in basic forms or for program entry; file dump to screen or printer; hard disk backup and restore may operate on entire volumes or selectively; programmable function key support.

System Languages • BASIC; Macro Assembler (may be optional with some systems); FORTRAN 77 compiler (optional with most systems); UCSD Pascal (main language).

Retail Price • the P-System is normally supplied through OEM vendors or computer vendors; prices vary depending on source, but for the IBM PC a Pascal-only or FORTRAN-only product retails for $625; the other language is available for an additional $175.

■ SOFTWARE 2000

Distributed through: MUSYS Corporation, 1752 Langley Street, Irving, CA 95714 • 714-662-7387.

☐ TurboDOS

Overview • a high-speed version of 8-bit CP/M designed especially for the Z80 microprocessor chip; this product is normally marketed directly to computer manufacturers or software OEMs rather than sold to an end user; specific characteristics of the product may vary depending on the source.

Computers Supported • any Z80 microcomputer with at least 64K bytes of RAM; networking support for sharing of resources among clusters of Z80 systems.

Devices Supported • modular device architecture; floppy disk support for one to almost unlimited number, depending on source; support for all sizes of hard disk, including very large drives (up to over 100M bytes); shared disk facilities for multisystem clusters; up to 16 concurrent printers; communication driver for customized serial interface and modem support.

User & Task Support • single- or multi-user systems available; single-task or multitask support; password provided at logon provides access security; multisystem cluster architectures supported.

File System Support • generally CP/M compatible; directory command displays files allocated by volume; limited device independence for printers and serial devices; file and record locking; access specification for files may indicate a file as shared, read-only, exclusive, or permissive.

System Utilities • generally CP/M compatible; peripheral interchange program provides file and file/device copying; file compare and copy verification; high-performance print spooling; command file processor for execution of commands saved to disk; file print and display; disk formatting with capacity increases of 25% to 35% possible; hard disk backup and restore.

System Languages • most CP/M language processors from other sources will execute under TurboDOS, and programs created with these processors will also execute.

Retail Price • price depends on system source; TurboDOS is usually bundled with or sold with the hardware for the Televideo 806 computers, TurboDOS retails for $750, while for the model 816 it is $850 and for the Model 816/23 $950.

■ TANDY CORP/RADIO SHACK

One Tandy Center, Fort Worth, TX 76102 • 817-390-3011.

☐ TRSDOS

Overview • like Apple's DOS for its popular Apple II computers, TRSDOS has its roots in a BASIC programming environment; as new TRS-80 systems have been introduced, TRSDOS has evolved into a family of operating systems, whose specifications vary somewhat according to the model of computer.

Computers Supported • all TRS-80 computer systems except the Tandy 2000 (an MS-DOS system).

Devices Supported • floppy disk support as primary storage device; hard disk support for some models (Model 11, 12, 16); serial or parallel printer support; serial communication port and modem support; local network support through Arcnet (a Datapoint product), available at extra cost.

User & Task Support • single-user, single-task structure; no password or sign-on security.

File System Support • directory list command allows viewing files

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on a volume; multiple directories and hierarchical structure of files is not available; access protection not supported.

System Utilities • file copy utility; file move command supports transfer of files or file groups to another volume; basic line editor support; file dump to terminal or printer; communication support; disk format utility for initialization of disk media; hard disk backup and restore.

System Languages • BASIC; Pascal; assembly language.

Retail Price • bundled with hardware; extra copy prices vary with system; $24 is typical.

■ WHITESMITHS, LTD

97 Lowell Road, Concord, MA 01742 • 617-369-8499.

☐ IDRIS

Overview • a portable operating system with UNIX-like features but not licensed from AT&T; IDRIS may be used by computer manufacturers or purchased directly by end users.

Computers Supported • most popular 16-bit microprocessors can be supported on an OEM basis, but directly sold versions are available for the DEC Professional CT-325 and CT-350; Motorola MC68000 for the DEC Professional CT-325 and CT-350; Motorola MC68000 versions are also available; DEC PDP-11 and VAX minicomputers are also supported; IBM PC version will run under PC-DOS 2.0 or MS-DOS 2.0.

Devices Supported • requires a minimum of two diskette drives or a hard disk; device support will vary according to product source and hardware requirements; minimum 128K bytes of RAM required; hard disk supported, including multiple volumes; serial or parallel printer support; asynchronous serial communication support.

User & Task Support • full multiuser support subject to hardware limitations; no limit to number of simultaneous tasks; processes may share data segments; user password entry at sign-on for access security.

File System Support • full hierarchical file structure; compatible with AT&T UNIX version 6 for all object and other file formats; tree structured, nodal directories; device-independent input/output with redirection; file linking provided.

System Utilities • all UNIX command supported; file and device copy capability; editor and basic word processor included; file verification and comparison; dump file to screen or printer in display ASCII or hexadecimal form; pipe and filter support for process communication; command shell may be user-modified.

System Languages • supports and is written in "C" language.

Retail Price • price depends on program source.

• END