CP/M Operating System

System description
Basic operation
Implementation on various
8 bit computers

Introduction

In 1974, Dr. Gary A. Kildall, while working for Intel Corporation, created CP/M as the first operating system for the new microprocessor. By 1977, CP/M had become the most popular operating system (OS) in the fledgling microcomputer (PC) industry. The largest Digital Research licensee of CP/M was a small company which had started life as Traf-0-Data, and is now known as Microsoft. In 1981, Microsoft paid Seattle Software Works for an unauthorized clone of CP/M, and Microsoft licensed this clone to IBM which marketed it as PC-DOS on the first IBM PC in 1981, and Microsoft marketed it to all other PC OEMs as MS-DOS.

Company

Versions and branches

- First version CP/M 1.4 - not widely used (1973-74)
- November 1977 gave the product's name as "Control Program for Microcomputers"
- Second version CP/M 2.2 became an industry standard
- CP/M Plus (version 3.0) 1983 - latest version for 8080/Z80
- CP/M-86 (original 8-bit CP/M got retronym CP/M-80)
- CP/M-68k (Motorola 68000)
- CP/M-8000 (Zilog Z-8000)
- MP/M -> Multiuser CP/M

MP/M

The following basic facilities are provided:

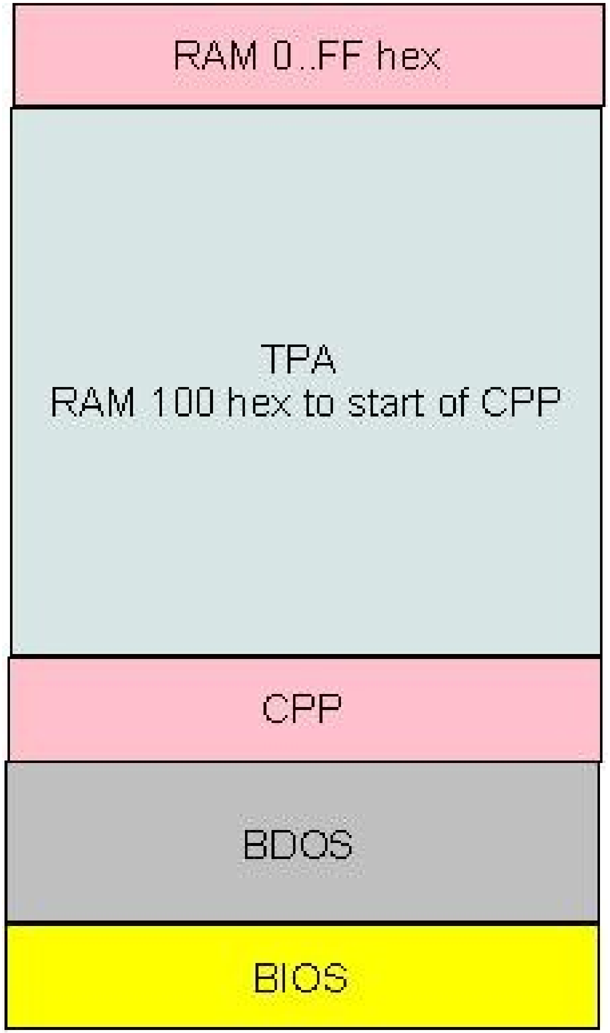
- Multi-terminal support
- Multi-Programming at each terminal
- Support for bank switched memory and memory protection
- Concurrency of I/0 and CPU operations
- Interprocess communication, mutual exclusion and synchronization
- Ability to operate in sequential, polled or interrupt driven environments
- System timing functions
- Logical interrupt system utilizing flags
- Selection of system options at system generation time
- Dynamic system configuration at load time

CP/M minimum requirements

- 8-bit CPU - I8080/8085/Z80 or equivalent
- 16k RAM available from 0x0000
- Console = keyboard + CRT
- I/O subsystem for peripherals (serial port, punches...)
- At least one floppy drive
- Bootstrap ROM able to boot from floppy

Structure

CP/M is logically divided into several distinct parts:
-BIOS (Basic I/O System), hardware-dependent
-BDOS (Basic Disk Operating System)
-CCP (Console Command Processor)
-TPA (Transient Program Area)



BIOS

The BIOS provides the primitive operations necessary to access the disk drives and to interface standard peripherals: teletype, CRT, paper tape reader/punch, and user-defined peripherals.

You can tailor peripherals for any particular hardware environment by patching this portion of CP/M.

BDOS

The BDOS has entry points that include the following primitive operations, which the program accesses:

-SEARCH looks for a particular disk file by name.
-OPEN opens a file for further operations.
-CLOSE closes a file after processing.
-RENAME changes the name of a particular file.
-READ reads a record from a particular file.
-WRITE writes a record to a particular file.
-SELECT selects a particular disk drive for further operations.

CCP

You interact with CP/M primarily through the CCP, which reads and interprets commands entered through the console. In general, the CCP addresses one of several disks that are on-line.

The standard system addresses up to **sixteen different disk drives.** These disk drives are labeled A through P.

Built-in Commands

Built-in commands are a part of the CCP program, while transient commands are loaded into the TPA from disk and executed. The following are built-in commands:
-ERA erases specified files.
-DIR lists filenames in the directory.
-REN renames the specified file.
-SAVE saves memory contents in a file.
-TYPE types the contents of a file on the logged disk.
-USER allows maintenance of separate files in the same directory.

Transient Commands (1)

- STAT Lists the number of bytes of storage remaining on the currently logged disk, provides statistical information about particular files, and displays or alters device assignment.
- ASM Loads the CP/M assembler and assembles the specified program from disk.
- LOAD Loads the file in Intel HEX machine code format and produces a file in machine executable form which can be loaded into the TPA. This loaded program becomes a new command under the CCP.

Transient Commands (2)

- DDT Loads the CP/M debugger into TPA and starts execution.
- PIP Loads the Peripheral Interchange Program for ubsequent disk file and peripheral transfer operations.
- ED Loads and executes the CP/M text editor program.
- SYSGEN Creates a new CP/M system disk.
- SUBMIT Submits a file of commands for batch processing.
- DUMP Dumps the contents of a file in hex.
- MOVCPM Regenerates the CP/M system for a particular memory size.

Physical devices

TTY: Teletype device (slow speed console)

CRT: Cathode ray tube device (high speed console)

BAT: Batch processing (console is current RDR:, output goes to current LST: device)

UC1: User-defined console

PTR: Paper tape reader (high speed reader)

UR1: User-defined reader #1

UR2: User-defined reader #2

PTP: Paper tape punch (high speed punch)

UP1: User-defined punch #1

UP2: User-defined punch #2

LPT: Line printer

UL1: User-defined list device #1

Logical devices

- CON: is the system console device, used by CCP for communication with the operator.
- RDR: is the paper tape reader device.
- PUN: is the paper tape punch device.
- LST: is the output list device.

Real programmer use:

```
copy con: setup.exe (MS-DOS)
pip setup.com=con: (CP/M)
```

File permissions

```
STAT d:filename.typ $R/O
STAT d:filename.typ $R/W
STAT d:filename.typ $SYS
STAT d:filename.typ $DIR
```

File operations

```
PIP d:=afn
PIP d1:=d2:afn
PIP ufn=d2:
PIP d1:ufn=d2:
```

CP/M implementation

on various 8-bit computers

Sinclair

- ZX81 - unknown status
- ZX Spectrum 48 - impossible to run CP/M natively because of Spectrum memory layout. Several memory paging enhancement available - in CS: Troller/Cisar & Lamac (Lec)
- ZX Spectrum 128 - memory extension not compatible with CP/M either
- Amstrad Spectrums +3/+2a - memory layout for CP/M ready. Several versions of CP/M are available
- QL - capable to run CP/M-68k (binaries incompatible with 8080/Z80 - need to recompile) or thru CPMulator, Success, Sandy CP/M emulator - support original binaries

CP/M on modified ZX Spectrum 48

Troller/Cisar - ST11/87 s.417

Lamac (AR9/88 s.337) - Spectrum (80-528k)
Pros:

- Giant RAM disk in 528k version

Cons:

- Initially for IF1 + Microdrive, later BetaDisk (D.Meca)

Available @ WoS - Thanks to Omikron

CP/M on +3

Version 2.2 (Beta) available for download @ WoS
Version 3 - Distribution denied! Still on-sale. Detailed manual available @ WoS

Terminal compatibility: Zenith Z19/Z29

Key bindings:
Ctrl = Extended Mode (Caps+Shift)
Del = Graph (Caps+9)
Backspace = Delete (Caps+0)
Tab = Inv Video (Caps+4)
Escape = Break (Caps+Space)

CP/M on PMD-85 = Mikros

Native system for PMD-32 disk drive
Mikros is CP/M v2.2

Original programs starting from Mikros environment (RUNNER)

CP/M on Amstrad CPC

Not tested yet

CP/M on C=128

Boot worked :)
The least used mode of C128 (according to Internet resources)

MCU: AVR CP/M

Hardware

- ATmega88 or ATmega8
- 44256 (4bit dynamic RAM = 128k x 8b available)
- MMC/SD Card
- Serial2USB or TTL2RS232 for communication

Software

- 8080 instructions only
- CP/M v2.2 tested

Modifications

- 2x 44256 = 8bit memory
- USB stick

MCU: PIC CP/M

Jaro...

Documentation and sources (1)

General
http://www.gaby.de/ecpm.htm
http://www.seasip.demon.co.uk/Cpm/
http://www.cpm.z80.de/
http://www.digitalresearch.biz/CPM.HTM
http://en.wikipedia.org/wiki/CP/M
http://cs.wikipedia.org/wiki/CP/M
http://www.retroarchive.org/cpm/
http://www.cpm8680.com/index.htm
http://www.seasip.demon.co.uk/Cpm/index.html
http://www.retrotechnology.com/dri/howto_cpm.html

Documentation and sources (2)

Documentation
http://www.cpm.z80.de/manuals/cpm22-m.pdf
http://gaby.de/cpm/manuals/archive/index.htm
http://www.shaels.net/index.php/cpm80-22-documents

Source code
http://www.cpm.z80.de/source.html

CPC
http://www.cpctech.org.uk/

Documentation and sources (3)

MCU world
http://code.google.com/p/cp-mega88/
http://www.mikrocontroller.net/topic/177481
http://spritesmods.com/?art=avrcpm
http://www.shaels.net/index.php/mic80