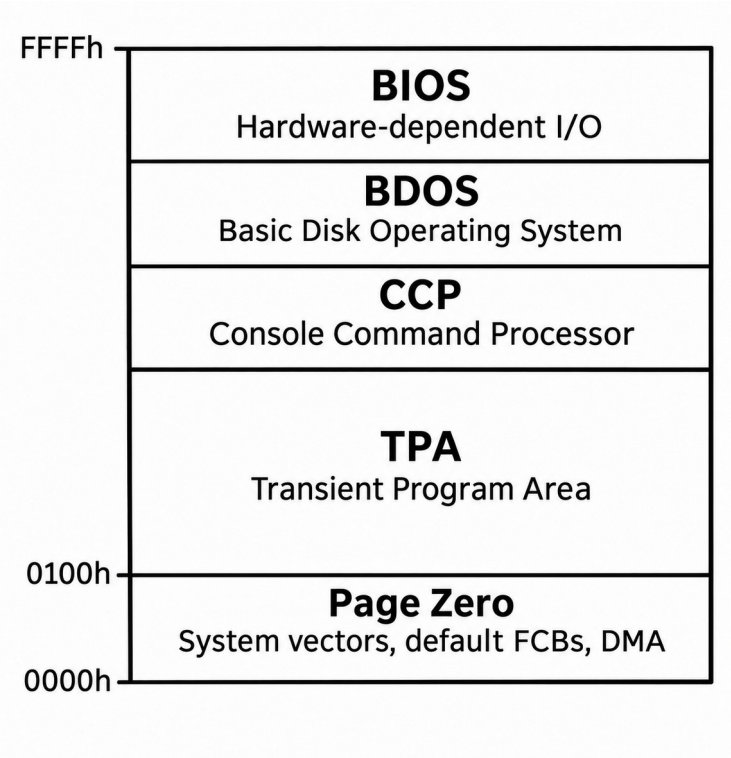
The CP/M Operating System: Part 2

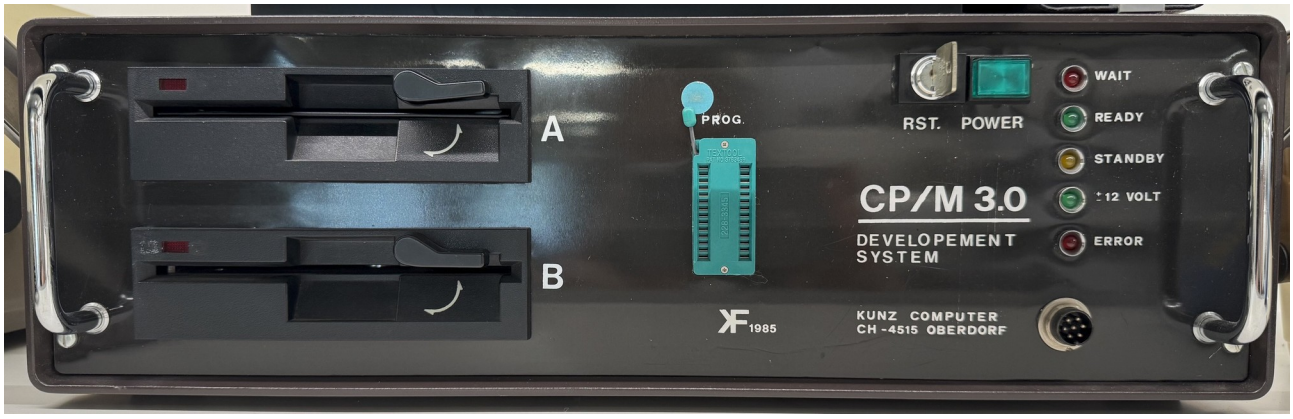
Prof. Dr. Bruce Nikkel, Bern University of Applied Sciences

The CP/M operating system was designed with three separate architectural components or modules. The BIOS (Basic Input/Output System) provides a hardware dependent interface of low level I/O routines for the BDOS to access. The BDOS (Basic Disk Operating System) provides a higher level interface for user commands and programs to perform I/O functions. The CCP (Console Command Processor) provides a command line interface for users to interact with the filesystem system, use I/O devices, and execute programs. The original Digital Research source code for the BIOS, BDOS, and CCP, has been publicly released (see reference below). A fourth part of CP/M is the TPA (Transient Program Area), the area of memory reserved for storing the running user programs.



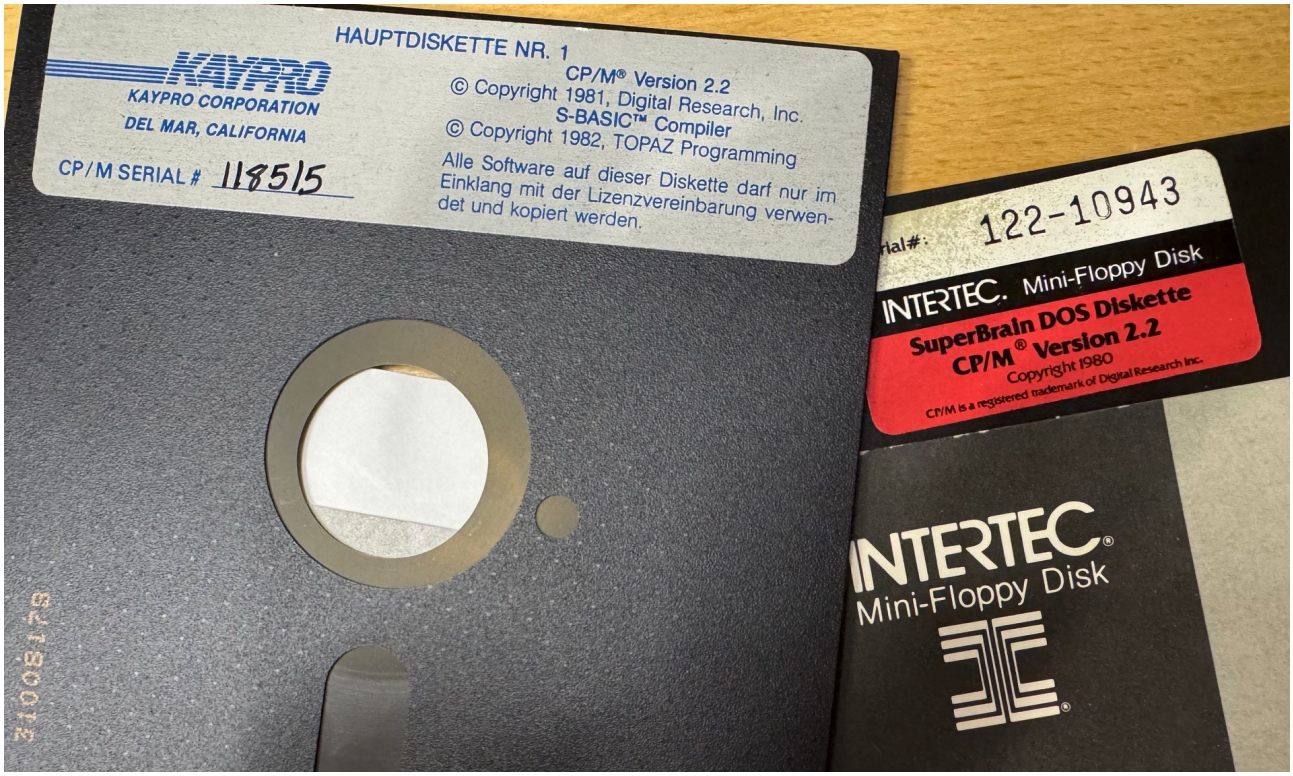
CP/M 2.2 Memory Map

The BIOS module is the hardware dependent layer of the CP/M operating system. It interfaces with peripherals such as floppy/hard disk drives, paper tape devices, terminals, printers, and other peripherals. CP/M documentation includes an 'Alteration Guide' which described how to alter (or modify) the BIOS for operation on particular hardware. These modifications were called a 'patch' to the BIOS module of CP/M. Patching the BIOS for new hardware could be performed by writing a memory loader program (GETSYS) to load CP/M into memory for modification, and a similar program to write the modified BIOS back to disk (PUTSYS). Alternatively, the vendor or manufacturer may provide various utility and system-generation programs.



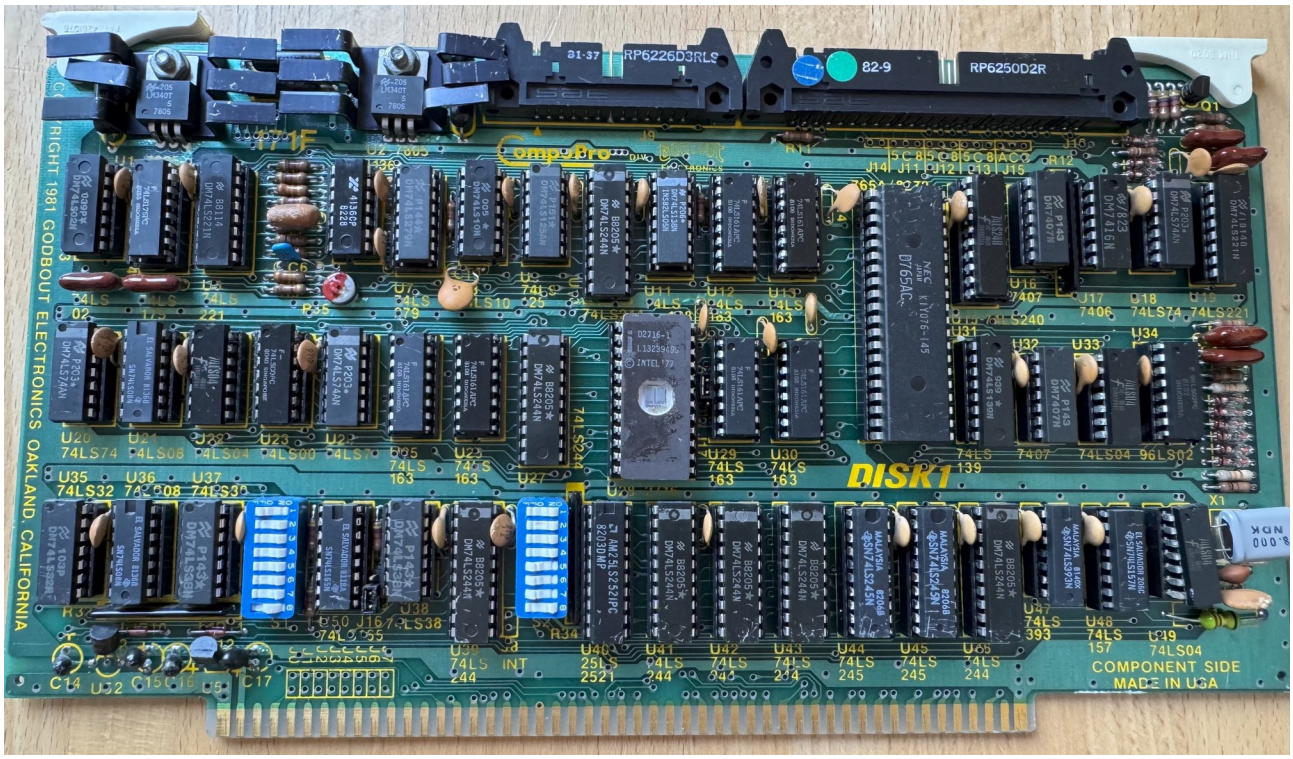
A Swiss CP/M Development System from Felix Kunz

The BDOS module provides a higher level interface for the CCP and for running programs, allowing them to use the functionality of the BIOS. A list of function call numbers can be requested by programs or the CCP, passing parameters and results using CPU registers. These functions provide logical I/O operations like managing files, printing, and console activity. It is possible for programs to bypass the BDOS and call the BIOS directly (using jump tables/vectors), but this is not recommended unless needed for hardware specific low level utilities.



Computer Manufacturer Supplied CP/M Diskettes

The CCP module is the human user command interface (like the shell in Unix/Linux) and provides the "A>" prompt. Here A is the drive letter, and can be switched to other drive letters representing additional floppy and disk drives. Commands are either built-in to the CCP module or run as separate (transient) executable programs with the filename extension *.COM. Commands can be scripted using *.sub batch files run with SUBMIT.COM. After a user program is started, it is allowed to overwrite the CCP in memory if needed. If a program overwrites the CCP, it must perform a warm reboot on exit (jumping to address 0x0000) to reload the CCP and setup the current default disk drive.



S-100 Bus Floppy Controller with EPROM used to Boot CP/M

The TPA is an area of ram allocated for running user programs. On single user, single memory bank, and single tasking CP/M systems, this is simply a block of memory starting at 0x100H and ending before the CCP (unless more memory is needed and the CCP is overwritten). CP/M version 3 uses more complex memory bank switching for RAM greater than 64k, and the BIOS and BDOS have separate resident parts in each bank to maintain usability when memory banks switch.

```
LXI     H,CPMB              ;BASE OF CP/M (INITIAL LOAD
;LOAD ONE MORE SECTOR
PUSH    B           ;SAVE SECTOR COUNT, CURRENT TRACK
PUSH    D           ;SAVE NEXT SECTOR TO READ
PUSH    H           ;SAVE DMA ADDRESS
MOV     C,D         ;GET SECTOR ADDRESS TO REGISTER C
CALL    SETSEC      ;SET SECTOR ADDRESS FROM REGISTER C
```
CP/M Assembly Language Fragment to from a Disk Boot Loader

The boot process is typically started by the disk controller hardware at power up, which reads the first sector (often 128 bytes) of track 0 into memory for execution. This 'cold boot' loader code loads the rest of the sectors in tracks 0 and 1. In CP/M versions 1 and 2, these two tracks contain the CCP, BDOS, and BIOS module code to load into memory. CP/M version 3 stores the BIOS+DBOS and CCP as files on the filesystem as CPM3.SYS and CCP.COM. CP/M has no concept of proper shutdown, if no unsaved data is in memory, a CP/M computer can simply be powered off.

This was a high level overview of CP/M’s technical architecture and boot process. In followup articles I will cover the CP/M filesystem, user commands, and modern tools and emulators for using and accessing CP/M disks.

References

Original CP/M source code
http://www.cpm.z80.de/source.html

Digital Research documentation
https://bitsavers.org/pdf/digitalResearch/

CP/M Handbooks and Manuals
http://gaby.de/cpm/drilib.html

My original English version can be found here:
https://digitalforensics.ch/enter