

MS-DOS Contrasted to CP/M and Linux

*Note: This essay was given a final grade of A+. The instructor said it was the best work he had seen in years - but he was a computer systems instructor at Northwestern, which isn't exactly known for its high academic standards.*

## MS-DOS Contrasted to CP/M and Linux

*- The Present, Past and Future of Microcomputer Operating Systems -*

Kristopher T. Marks

*Northwestern Technical Institute*

### Abstract:

As the microcomputer industry was born in the seventies, boomed in the eighties, and became a part of life in the nineties, three operating systems were created that significantly impacted the way people use those machines in their daily lives. As one operating system gains success, another one improving on its technology is created and eventually surpasses the one before it. This constant shifting, while often harmful for companies and individuals that create the operating systems themselves, is advantageous for computer users as a whole.

## MS-DOS Contrasted to CP/M and Linux:

After being given this assignment, the hardest part of writing was to decide what two operating systems to compare with MS-DOS. I first considered Novell NetWare because it is a system I already know a good bit about (having already taken the school's NetWare specific classes), but it was disqualified after weighing what a true operating system is. An operating system is, by definition, code that loads into a computer's main memory during boot and can directly control the basic hardware aspects of a computer system. NetWare does not qualify as a true operating system because it runs over DOS; not as an actual DOS shell, but still using components of DOS to control the computer. Since NetWare is disqualified due to that reliance, Windows 3.x, Windows 95 and Windows 98 were also eliminated since they also use DOS or DOS components.

To further narrow the field of possible choices I chose not to include any operating systems using a graphical interface instead of the text-based command line systems familiar to DOS users. Since I have some limited experience with Linux, my attention naturally focused on that system. That led to considering Unix for this report, but while searching the Internet for information on the genealogy of MS-DOS I stumbled on a fairly substantial collection of documentation about CP/M. So after several weeks of deliberation I decided to compare MS-DOS to a much older system and a much newer operating system - CP/M and Linux, respectively.

## General History of the Systems:

It would be preferable not to make this into a history lesson, but the strengths and weaknesses of these systems are related to the history of their development, so a bit of history is necessary to put the rest of the report in context.

The Control Program for Microcomputers, CP/M, was created in 1974 by

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Digital Research founder Gary Kildall for microcomputers built around Intel's 8-bit 8080 processor. Intel refused to purchase the system from Kildall, so it was marketed as a standalone operating system for the many varieties of microcomputers used by hobbyists at that time. To appeal to people using different types of systems, CP/M's basic input/output system, or BIOS, was ported to a wide selection of computer processors, allowing the system to work on those as well. Versions of CP/M were made available for the 8-bit Intel 8080, Zenith Z80, Motorola's 6800, and eventually for the Intel 8086 chip - but only after DOS became the dominant operating system for that processor. CP/M proved so popular on microcomputers in the 1970's that unauthorized clones were produced by several smaller companies like Seattle Computer Products.

In February 1981 when IBM needed an operating system for its Intel 8086-based Personal Computer, the company first contacted Digital Research about CP/M but was unable to reach an agreement to license the system. IBM then contacted Microsoft, a business known at the time only for its work on the BASIC command language. Microsoft promised IBM an operating system for the PC, then quickly contacted Seattle Computer Products and bought 86-DOS, its CP/M clone for the 16-bit Intel 8086 chip, for \$50,000. Microsoft made a few minor modifications to 86-DOS, then licensed it to IBM as the Microsoft Disk Operating System, MS-DOS.

After its release in August 1981 the IBM Personal Computer became so popular that it too was cloned by other companies. Since Microsoft's licensing agreement with IBM allowed it to sell MS-DOS to other computer manufacturers, nearly all of the PC clones used MS-DOS as well. Their overwhelming popularity eventually made MS-DOS the most widely installed system in history.

Over a decade later the Linux operating system was created from an entirely different family of software. But its origins stretched back to 1969 before CP/M or MS-DOS

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even the microcomputer, to when Ken Thompson at Bell Labs wrote the first version of what was to be called Unix for a Digital Equipment PDP-7 mainframe. Bell Labs' parent company AT&T was, at the time, prevented from copyrighting the system because of government trade restrictions, so it was distributed freely to universities around the country, many of which still use it for computer training courses. But due to its complexity and limited demand, Unix was only produced by a handful of companies at a high cost until the late 1980's.

In 1991 a computer student from Finland purchased a copy of the Minix variety of Unix, but he found the system to be inflexible and insufficient for the tasks he had bought it for. So he created a clean-room (that is, compatible but not based on) version of Unix later dubbed Linux, and in 1994 released the program's source code to the public to speed up its development. Under the Linux license, anyone can view the operating system's source code and modify it, as long as the modifications are available free of charge. That unique feature has been Linux's most valuable feature; over a dozen companies and organizations now produce their own 'distributions' of Linux. Those distributions run on a large selection of processors, ranging from the Compaq Alpha and IBM PowerPC to Intel's 486 and Pentium III.

### Security, File Systems and Data Sharing:

CP/M, from its creation in 1973, was intended to be used by one person dealing with insensitive information on a single computer. CP/M's primitive file system, managed by the BDOS I/O module, supported multiple disk drives but without a hierarchical directory

structure. At that time microcomputers were only used by hobbyists who spent more time programming than actually computing, so of course security was never a concern. Similarly, networks for micros were still years away, so there was no need for file sharing of any kind. CP/M did, however, set a

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standard that plagued computer users for more than two decades: the file name limitation of eight characters followed by a period and a three-letter extension.

MS-DOS, being derived from a CP/M clone, originally used the same type of file system. Just like CP/M it supported multiple floppy drives and used the eight-plus-three naming scheme, but offered no directories or security. By version 2.0 Microsoft had added support for fixed disks and a Unix-like hierarchical file system to DOS' file system and I/O controller, MSDOS.SYS. However DOS has always stuck close to its single-user roots, never offering integrated security or file sharing of any kind. At one time there was a raft of third-party network file sharing software for DOS, but most of that is no longer available because of Windows's dominance in the software market.

In contrast to those older systems, Linux was designed from the start with a directory-based file system built into the kernel itself. In addition to directories and unlimited drives, the Linux system also features integrated security and file sharing. Linux's security is similar to the type used on network operating systems like Windows NT or NetWare; during boot every user is required to enter a login name and password determining the files and directories they have permission to access. Those file access privileges and other rights are set by an administrator, known as the root user on Linux and Unix machines. While the system does provide a high level of security and protection for sensitive information, logging in after each reboot adds more complication to an already complex operating system, not to mention effort used to administrate privileges and

remember passwords.

## User Interface and Common Commands:

All three of the systems featured in this report use a utilitarian but extremely useful text-only interface, in the form of colored text on a dark screen. CP/M and

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MS-DOS both sport a flashing command line consisting of the current drive letter followed by a colon. Improvements made later to DOS allowed the prompt to be changed to display different bits of information, including the date, time, current active directory and the greater-than symbol to mark the end of the prompt. Commands entered into CP/M are handled by its console command processor, or CCP. The same functions in DOS are handled by the COMMAND.COM shell, a file completely separate from the operating system's kernel.

Linux varies from distribution to distribution, but the majority of Linux systems use the bash shell. Any Linux user can change or modify the shell, but since bash is the most popular one we'll use it for the purposes of this comparison.

At the first glance the bash command line appears similar to DOS' classic interface, but after closer inspection several differences become clear. Most obviously, the line displays a user's login name first, followed by the current drive and directory (depending on user configuration). In addition to that, Linux's bash uses a feature familiar to mainframe users that recalls the last commands used with the press of up and down cursor keys. The bash shell also expands incomplete commands or file names when a user presses the tab key after entering a few characters. If there are several commands with the same beginning characters, bash will only expand the command to the point where they begin to differentiate.

## MS-DOS, CP/M and Linux Today:

CP/M, while a decent, successful system for the era it was created, has been out of production for over a decade. After failing to make a dent in MS-DOS' market share with CP/M for the 8086 and 8286, Digital Research created its own version of DOS based on the original CP/M. But that also failed to make an impact on the market, so Novell purchased Digital Research in 1991 - shortly before Digital founder

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and CP/M creator Gary Kildall died while mountain climbing. In 1996 after several unsuccessful attempts to revive DR DOS or combine it with NetWare, Novell sold off its Digital Research products to the Caldera company. Caldera, a business most known for its Linux distribution and related software, has now made DR DOS and CP/M available for free on its Web site.

After six major releases and eleven years of still unmatched success, MS-DOS was retired as a standalone product in 1995 when Microsoft introduced Windows 95. But while MS-DOS is no longer available as an independent product, a modified version 7 continues to be a key part of Windows 95 and its successor, Windows 98. Unfortunately MS-DOS' days are numbered; with the release of Millennium Windows and Windows 2000 sometime early next year MS-DOS will finally be tossed into the dustbin of history alongside CP/M.

While CP/M and MS-DOS are dead and dying, Linux has only recently started to gain notoriety among the same groups that first popularized its predecessors - hobbyists. While the complexity of Linux intimidates the average home user, Linux has slowly been accepted by more and more companies and individuals as a dependable, inexpensive operating system to supplement or (in some cases) replace expensive Windows and

outdated DOS machines. As the number of available applications increases and the level of complexity decreases, Linux will become accepted by more groups, from companies running an assembly line to grandmothers checking their e-mail.

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