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—Tania Rojas-Esponda

Digital Equipment Corporation

Digital Equipment Corporation (DEC) was more than a company; it was an icon of the computer industry until 1998, when it was bought by **Compaq Computer Corporation**, a manufacturer of **microcomputers**. Digital Equipment is credited with having “invented” the **minicomputer** market in the 1960s. The list of machines that made DEC a brand name in the computing arena includes the PDP-1, PDP-8, PDP-10, and PDP-11, up through **VAX** computers and Alpha processors. The rise and fall of DEC illustrates dramatically the forces at work in the dynamic computing industry.

The 1960s were the heyday of the **mainframe**, large computer systems that cost millions of dollars and were owned mainly by large companies. **Kenneth Olsen** (1926–), an engineer from MIT, founded DEC with Harlan Anderson in 1957. They saw a business opportunity in the manufacture and sale of small electronic modules. But in 1959 DEC had already started the design of Programmed Data Processor 1 (PDP-1). In 1960, the first PDP-1 was delivered to **Bolt, Beranek and Newman**. It was the world’s first small interactive computer. Gordon Bell (1934–), an engineer at DEC, developed several other small computers during the 1960s. In 1965 the PDP-8 was announced. It was the first mass-produced minicomputer; it had a word length of 12 bits and “only” 4 kilobytes of core memory. The instruction set was extremely simple.

With the PDP-8 and later with the PDP-11, a 16-bit machine introduced in 1970, DEC became the main manufacturer of minicomputers. Ken Olsen had succeeded where **IBM** had failed, because he had anticipated a large market for small machines. IBM, producer of large mainframes, did not want to cannibalize its own business and so entered the new market much later than DEC. The minicomputer revolution started by DEC, which peaked during the 1970s, is a classical example of

technology push, in which a company brings to market a product whose advantages are only later recognized by the general public and by other competitors.

DEC was also a pioneer in the field of **time-sharing**. The PDP-10 (successor to the PDP-6) was fully interactive. Users sat at terminals and worked with the computer in much the same way as we do today. This was a big change from IBM installations, in which programs were first punched in a batch of cards before being processed. Parts of the “look and feel” of TOPS-10 (the operating system of the PDP-10) was later copied in other operating systems, such as CP/M and MS-DOS.

In the 1980s the main computer line offered by DEC was the **VAX**, a complex machine in between a mainframe and a minicomputer. However, DEC’s decline started around this time, with the ascent of the **microcomputer**. Ken Olsen, the former revolutionary, failed to see a market for machines even smaller than the minicomputer. He is often quoted as having said that he could not imagine why someone would want to have a computer at home.

Where DEC could not see a business opportunity, others did. Microcomputers ate steadily into DEC’s business until it became not the second-largest computer company in the world, but only one among many, behind even some startups. To rejuvenate its aging family of computers, DEC announced the Alpha processor in 1992. The Alpha was, at its introduction, the fastest microprocessor available. However, it was not compatible with the software written for Intel/Microsoft machines and was not used for home computers. DEC’s strategy was to occupy the high end of the market, where the Alpha could be used for file and compute servers. It was even used to build **supercomputers**, such as those offered by **Cray**.

Although DEC diversified its business during the 1990s, offering small and large computers, microprocessors, networking equipment, and even Internet services (such as the search engine Altavista), the company fell prey to the consolidation of the computer industry into a handful of workable computer architectures. Ken Olsen, who was to DEC what **Bill Gates** (1955–) is to **Microsoft**, was removed as CEO in 1992. The new board could not turn the company around and in a U.S.\$9.6 billion deal, DEC became a subsidiary of Compaq in 1998. This deal positioned Compaq as the second-largest computer com-

pany in the world, the position occupied by DEC during the 1980s. The combined annual revenues of the merged companies reached U.S.\$37 billion in 1998.

FURTHER READING

Olsen, Kenneth H. *Digital Equipment Corporation: The First Twenty-Five Years*. New York: Newcomen Society, 1983.

Rifkin, Glenn, and George Harrar. *The Ultimate Entrepreneur: The Story of Ken Olsen and Digital Equipment Corporation*. Roseville, Calif.: Prima Publishing, 1988.

—Raúl Rojas

Digital Millennium Copyright Act

Passed into law in 1998, the Digital Millennium Copyright Act (DMCA) extends and expands traditional U.S. copyright protection to global data networks. Copyright infringement is, of course, already illegal. The controversial step taken by the DMCA is to ban not only illegal copying but also the circumvention of existing copyright protections and any tools that might enable such circumvention.

Written to comply with the Digital Copyright Treaty passed by the **World Intellectual Property Organization** in 1996, the DMCA represents an attempt on the part of U.S. lawmakers to protect intellectual property and copyright in an era when digital copies (of text, music, films, and other works) are becoming increasingly easy to make and share. The entertainment industry celebrated the passage of the DMCA, declaring that it would help make cyberspace safe for intellectual property. Opponents of the DMCA, such as the **Electronic Frontier Foundation** (EFF), have argued that the law's language is overly broad. Some are concerned that despite a fair use exception, the access to information—which they view as a public good—will be restricted unnecessarily. Others think that the act provides inappropriate commercial benefits; they argue that copyright law was not intended to secure revenue for corporations. Critics also protest that in making tools illegal (rather than making *misuse* of tools illegal), the DMCA conflicts with rights guaranteed by the U.S. Constitution.

In the short time since the DMCA took effect, a variety of cases have been brought before U.S. courts.

The legislation has been used by the Church of Scientology, for example, to attack Web sites that are critical of the church. Scientologists complain that these sites, which commonly publish “secret” scientology documents in an attempt to expose the church to criticism, are copyright violations. The owners of the sites generally argue that their use of the documents falls under the doctrine of fair use, which permits the use of copyrighted documents for educational, critical, or satirical purposes.

Under the DMCA, all that is required is for a copyright owner to complain to the **Internet service provider** (ISP) that he or she is being infringed and the ISP is obliged to contact the infringer with a cease-and-desist notification. The ISP is itself protected under a provision of the DMCA nicknamed *safe harbor*, which means that the ISP is not liable for the actions of its users, provided that it responds immediately to any infringement complaints.

The safe harbor defense made news in 2000 when Napster, a company that provided software to enable the sharing of music files, was sued by the Recording Industry Association of America (RIAA). The RIAA initiated the suit on the grounds that Napster enabled copyright infringement on a massive scale. Initially, Napster's attorneys argued that the company was protected under the DMCA's safe harbor defense. In other words, Napster was a mere service provider—it was users who controlled whether the service was used in an illegal way. The judge rejected this claim, pointing out that almost *all* files traded on Napster were illegal files. Napster had to find other grounds on which to base its (ultimately unsuccessful) defense.

Perhaps the most significant exercise of the DMCA so far has been by the film industry. In recent years, the DVD format for home viewing of films has been steadily gaining in popularity (*DVD* stands for either *digital video disk* or *digital versatile disk*). To prevent users from copying the digitized films, an **encryption** system called CSS (Content Scrambling System) is installed on the disks. In October 1999 a teenage programmer in Norway named Jon Johansen (1984–) released software called *DeCSS* (for *decrypts CSS*) over the Internet. DeCSS enables a **personal computer** to “brute force” decrypt DVDs—in other words, to keep