Digital Equipment Corporation

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Digital Equipment Corporation, also known as **DEC**[1] and using the trademark **Digital**, was a major American company in the computer industry from the 1960s to the 1990s. It was a leading vendor of computer systems, including computers, software, and peripherals, and its PDP and successor VAX products were the most successful of all minicomputers in terms of sales.

From 1957 until 1992 its headquarters were located in a former wool mill in Maynard, Massachusetts, since renamed Clock Tower Place and now home to multiple companies. DEC was acquired in June 1998 by Compaq, which subsequently merged with Hewlett-Packard in May 2002. Some parts of DEC, notably the compiler business and the Hudson, Massachusetts facility, were sold to Intel.

Digital Equipment Corporation should not be confused with the unrelated companies Digital Research, Inc or Western Digital, although the latter manufactured the LSI-11 chipsets used in DEC's low end PDP-11/03 computers.

Contents

Digital Equipment Corporation

Honesty and respect for customers and employees.

Industry	Computer manufacturing
Fate	Acquired by Compaq, after divestiture of major assets.
Successor(s)	Hewlett-Packard (2002 – present) Compaq (1998–2002)
Founded	1957
Defunct	1998
Headquarters	Maynard, Massachusetts, United States
Key people	Ken Olsen (founder, president, and chairman) Harlan Anderson (co-founder) C. Gordon Bell (VP Engineering, 1972-1983)
Products	PDP minicomputers VAX minicomputers Alpha servers and workstations DECnet VT100 terminal StrongARM microprocessors Digital Linear Tape
Employees	over 140,000 (1987)

Overview

Initially focusing on the small-end of the computer market allowed DEC to grow without its potential competitors making serious efforts to compete with them. Their PDP series of machines became popular in the 1960s, especially the PDP-8, widely considered to be the first successful minicomputer. Looking to simplify and update their line, DEC replaced most of their smaller machines with the PDP-11 in 1970, eventually selling over 600,000 units and cementing DECs position in the industry. Originally designed as a follow-on to the PDP-11, DEC's VAX-11 series was the first widely used 32-bit minicomputer, sometimes referred to as "superminis". These were able to compete in many roles with larger mainframe computers, such as the IBM System/370. The VAX was a best-seller, with over 400,000 sold, and its sales through the 1980s propelled the company into the second largest in the industry. At its peak, DEC was the second largest employer in Massachusetts, second only to the state government.

The rapid rise of the business microcomputer in the late 1980s, and especially the introduction of powerful 32-bit systems in the 1990s, quickly eroded the value of DEC's systems. DEC's last major attempt to find a space in the rapidly changing market was the DEC Alpha 64-bit RISC processor architecture. DEC initially started work on Alpha as a way to re-implement their VAX series, but also employed it in a range of high-performance workstations. Although the Alpha processor family met both of these goals, and, for most of its lifetime, was the fastest processor family on the market, extremely high asking prices[2] were outsold by lower priced x86 chips from Intel and clones such as AMD.

The company was acquired in June 1998 by Compaq, in what was at that time the largest merger in the history of the computer industry. At the time, Compaq was focused on the enterprise market and had recently purchased several other large vendors. DEC was a major player overseas where Compaq had less presence. However, Compaq had little idea what to do with its acquisitions, and soon found itself in financial difficulty of its own. The company subsequently merged with Hewlett-Packard in May 2002. As of 2007 some of DEC's product lines were still produced under the HP name.

History

Origins

Ken Olsen and Harlan Anderson were two engineers who had been working at MIT Lincoln Laboratory on the lab's various computer projects. The Lab is best known for their work on what would today be known as "interactivity", and their machines were among the first where operators had direct control over programs running in real-time. These had started in 1944 with the famed Whirlwind which was originally developed to make a flight

simulator for the US Navy, although this was never completed.[3] Instead, this effort evolved into the SAGE system for the US Air Force, which used large screens and light guns to allow operators to interact with radar data stored in the computer.[4]

When the Air Force project wound down, the Lab turned their attention to an effort to build a version of the Whirlwind using transistors in place of vacuum tubes. In order to test their new circuitry, they first built a small 18-bit machine known as TX-0 which first ran in 1956.[5] When the TX-0 successfully proved the basic concepts, attention turned to a much larger system, the 36-bit TX-2 with a then-enormous 64 kWords of core memory. Core was so expensive that parts of TX-0's memory were stripped for the TX-2, and what remained of the TX-0 was then given to MIT on permanent loan.[6]

DEC was headquartered at a former wool mill at Clock Tower Place, Maynard MA from 1957 until 1992

At MIT, Olsen and Anderson noticed something odd: students would line up for hours to get a turn to use the stripped-down TX-0, while largely ignoring a faster IBM machine that was also available. The two decided that the draw of interactive computing was so strong that they felt there was a market for a small machine dedicated to this role, essentially a commercialized TX-0. They could sell this to users where graphical output or realtime operation would be more important than outright performance. Additionally, as the machine would cost much less than the larger systems then available, it would also be able to serve users that needed a lower-cost solution dedicated to a specific task, where a larger 36-bit machine wouldn't be needed.[7]

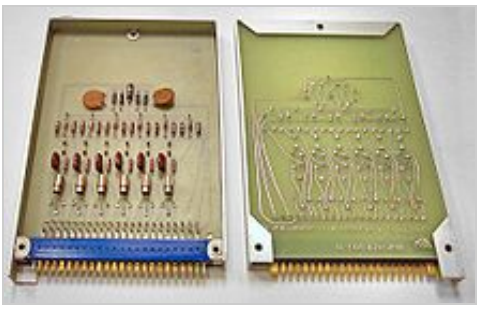
In 1957 when the pair and Ken's brother Stan went looking for capital, they found that the American business community was hostile to investing in computer companies. Many smaller computer companies had come and gone in the 1950s, wiped out when new technical developments rendered their platforms obsolete, and even large companies like RCA and General Electric were failing to make a profit in the market. The only serious expression of interest came from Georges Doriot and his American Research and Development Corporation (AR&D). Worried that a new computer company would find it difficult to arrange further financing, Doriot suggested the fledgling company change its business plan to focus less on computers, and even change their name from "Digital Computer Corporation".[7]

The pair returned with an updated business plan that outlined two-phases for the company's development. They would start by selling computer modules as stand-alone devices that could be purchased separately and wired together to produce a number of different digital systems for lab use. Then, if these "digital modules" were able to build a self-sustaining business, the company would be free to use them to develop a complete computer in their Phase II.[8] The newly christened "Digital *Equipment* Corporation" received $70,000 from AR&D for a 70% share of the company,[7] and began operations in a Civil War era textile mill in Maynard, Massachusetts, where plenty of inexpensive manufacturing space was available.

Digital modules

In early 1958 DEC shipped its first products, the "Digital Laboratory Module" line. The Modules consisted of a number of individual electronic components and germanium transistors mounted to a circuit board, the actual circuits being based on those from the TX-2.[9]

The Laboratory Modules were packaged in an extruded aluminum housing,[10] intended to sit on an engineer's workbench, although a rack-mount bay was sold that held 9 laboratory modules.[11] They were then connected together using banana plug patch cords inserted at the front of the modules. Three versions were offered, running at 5 MHz (1957), 500 kHz (1959), or 10 MHz (1960).[12] The Modules proved to be in high demand in other computer companies, who used them to build equipment to test their own systems. Despite the recession of the late 1950s, the company sold $94,000 worth of these modules during 1958 alone, turning a profit at the end of its first year.[7]



System Building Blocks (System Module) 1103 hex-inverter card (both sides)

The original Laboratory Modules were soon supplemented with the "Digital Systems Module" line, which were identical internally but packaged differently. The Systems Modules were designed with all of the connections at the back of the module using 22-pin Amphenol connectors, and were attached to each other by plugging them into a backplane that could be mounted in a 19-inch rack. The backplanes allowed 25 modules in a single 5-1/4 inch section of rack, and allowed the high densities needed to build a computer.[9]

The original laboratory and system module lines were offered in 500 kilocycle, 5 megacycle and 10 megacycle versions. In all cases, the supply voltages were -15 and +10 volts, with logic levels of -3 volts (passive pull-down) and 0 volts (active pull-up).[11]

DEC used the Systems Modules to build their "Memory Test" machine for testing core memory systems, selling about 50 of these pre-packaged units over the next eight years.[13] The PDP-1 and LINC computers were also built using Systems Modules (see below).

Modules were part of DEC's product line into the 1970s, although they went through several evolutions during this time as technology changed. The same circuits were then packaged as the first "R" (red) series "Flip-Chip" modules. Later, other module series provided additional speed, much higher logic density, and industrial I/O capabilities.[14] Digital published extensive data about the modules in free catalogs that became very popular.

PDP-1 family

Main article: PDP-1

With the company established and a successful product on the market, DEC turned its attention to the computer market once again as part of its planned "Phase II".[8] In August 1959, Ben Gurley started design of the company's first computer, the PDP-1. In keeping with Doriot's instructions, the name was an initialism for "Programmable Data Processor", leaving off the term "computer". As Gurley put it, "We aren't building computers, we're building 'Programmable Data Processors'." The prototype was first shown publicly at the Joint Computer Conference in Boston in December 1959.[15] The first PDP-1 was delivered to Bolt, Beranek and Newman in November 1960,[16] and formally accepted the next April.[17] The PDP-1 sold in basic form for $120,000, or about $900,000 in 2011 US dollars.[18] By the time production ended in 1969, 53 PDP-1s had been delivered.[13][19]

The PDP-1 was supplied standard with 4096 words of core memory, 18-bits per word, and ran at a basic speed of 100,000 operations per second. It was constructed using many System Building Blocks that were packaged into several 19-inch racks. The racks were themselves packaged into a single large mainframe case, with a hexagonal control panel containing switches and lights mounted to lay at table-top height at one end of the mainframe. Above the control panel was the system's standard input/output solution, a punch tape reader and writer. Most systems were purchased with two peripherals, the Type 30 vector graphics display, and a Soroban Engineering modified IBM Model B Electric typewriter that was used as a printer. The Soroban system was notoriously unreliable, and often replaced with a modified Friden Flexowriter, which also contained its own punch tape system. A variety of more-expensive add-ons followed, including magnetic tape systems, punched card readers and punches, and faster punch tape and printer systems.

A PDP-1 system, with Steve Russell, developer of Spacewar! at the console. This is a canonical example of the PDP-1, with the console typewriter on the left, CPU and main control panel in the center, the Type 30 display on the right.

When DEC introduced the PDP-1, they also mentioned larger machines at 24, 30 and 36-bits, based on the same design.[20] During construction of the prototype PDP-1, some design work was carried out on a 24-bit PDP-2, and the 36-bit PDP-3. Although the PDP-2 never proceeded beyond the initial design, the PDP-3 found some interest and was designed in full.[21] Only one PDP-3 appears to have been built, in 1960, by the CIA's Scientific Engineering Institute (SEI) in Waltham, Massachusetts. According to the limited information available, they used it to process radar cross section data for the Lockheed A-12 reconnaissance aircraft. Gordon Bell remembered that it was being used in Oregon some time later, but could not recall who was using it.[22]

In November 1962 DEC introduced the $65,000 PDP-4. The PDP-4 was similar to the PDP-1 and used a similar instruction set, but used slower memory and different packaging to lower the price. Like the PDP-1, about 54 PDP-4's were eventually sold, most to a customer base similar to the original PDP-1.[23]

In 1964 DEC introduced its new Flip Chip module design, and used it to re-implement the PDP-4 as the PDP-7. The PDP-7 was introduced in December 1964, and about 120 were eventually produced.[24] An upgrade to the Flip Chip led to the R series, which in turn led to the PDP-7A in 1965.[25] The PDP-7 is most famous as the original machine for the Unix operating system.[26]

A more dramatic upgrade to the PDP-1 series was introduced in August 1966, the PDP-9.[27] The PDP-9 was instruction compatible with the PDP-4 and −7, but ran about twice as fast as the −7 and was intended to be used in larger deployments. At only $19,900 in 1968,[28] the PDP-9 was a big seller, eventually selling 445 machines, more than all of the earlier models combined.[29]

Even while the PDP-9 was being introduced, its replacement was being designed, and was introduced as 1969's PDP-15, which re-implemented the PDP-9 using integrated circuits in place of modules. Much faster than the PDP-9 even in basic form, the PDP-15 also included a floating point unit and a separate input/output processor for further performance gains. Over 400 PDP-15's were ordered in the first eight months of production, and production eventually amounted to 790 examples in 12 basic models.[29] However, by this time other machines in DEC's lineup could fill the same niche at even lower price points, and the PDP-15 would be the last of the 18-bit

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