vocabulary of 64,000 words and a 260,000-word back-up dictionary.[160]

1971: Floppy disk
IBM introduces the floppy disk. Convenient and highly portable, the floppy becomes a personal computer industry standard for storing data.[161]

1973: Winchester storage technology
The IBM 3340 disk unit—known as "Winchester" after IBM's internal project name—is introduced, an advanced technology which more than doubled the information density on disk surfaces. It featured a smaller, lighter read/write head that was designed to ride on an air film only 18 millionths of an inch thick. Winchester technology was adopted by the industry and used for the next two decades.[162]

1973: Nobel Prize
Dr. Leo Esaki, an IBM Fellow who joined the company in 1960, shares the 1973 Nobel Prize in physics for his 1958 discovery of the phenomenon of electron tunneling. His discovery of the semiconductor junction called the Esaki diode finds wide use in electronics applications. More importantly, his work in the field of semiconductors lays a foundation for further exploration in the electronic transport of solids.[163]

1974: SNA
IBM announces Systems Network Architecture (SNA), a networking protocol for computing systems. SNA is a uniform set of rules and procedures for computer communications to free computer users from the technical complexities of communicating through local, national, and international computer networks. SNA becomes the most widely used system for data processing until more open architecture standards were approved in the 1990s.[164]


<table>
<thead>
<tr>
<th>Year</th>
<th>Gross income (in $m)</th>
<th>Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975</td>
<td>14,430</td>
<td>288,647</td>
</tr>
<tr>
<td>1980</td>
<td>26,210</td>
<td>341,279</td>
</tr>
<tr>
<td>1985</td>
<td>50,050</td>
<td>405,535</td>
</tr>
<tr>
<td>1990</td>
<td>69,010</td>
<td>373,816</td>
</tr>
<tr>
<td>1995</td>
<td>71,940</td>
<td>225,347</td>
</tr>
</tbody>
</table>

President of IBM John R. Opel became CEO in 1981.[165] His company was one of the world's largest and had a 62% share of the mainframe computer market that year.[154] Its share of the overall computer market, however, had declined from 60% in 1970 to 32% in 1980.[166] Perhaps distracted by the long-running antitrust lawsuit, the "Colossus of Armonk" completely missed the fast-growing minicomputer market during the 1970s.[167][168][169] and was behind rivals such as Wang, Hewlett-Packard (HP), and Control Data in other areas.[166]

In 1979 BusinessWeek asked, "Is IBM just another stodgy, mature company?" By 1981 its stock price had declined by 22%.[166] IBM's earnings for the first half the year grew by 5.3%—one third of the inflation rate—while those of minicomputer maker Digital Equipment Corporation (DEC) grew by more than 35%.[170] The company began selling minicomputers, but in January 1982 the Justice Department ended the antitrust suit because, The New York Times reported, the government "recognized what computer experts and securities analysts had long since concluded: I.B.M. no longer dominates the computer business".[154][171]

IBM wished to avoid the same outcome with the new personal computer industry.[169] The company opened its first retail store in November 1980,[172] and a team led by Don Estridge at the IBM Entry Systems Division in Boca Raton built the IBM PC, launched on August 12, 1981. IBM immediately became more of a presence in the consumer marketplace, thanks
to the memorable Little Tramp advertising campaign. Though not a spectacular machine by technological standards of the day, the IBM PC brought together all of the most desirable features of a computer into one small machine. It had 128 kilobytes of memory (expandable to 256 kilobytes), one or two floppy disks and an optional color monitor. And it had the prestige of the IBM brand. It was not cheap, but with a base price of US$1,565 it was affordable for businesses – and many businesses purchased PCs. Reassured by the IBM name, they began buying microcomputers on their own budgets aimed at numerous applications that corporate computer departments did not, and in many cases could not, accommodate. Typically, these purchases were not by corporate computer departments, as the PC was not seen as a "proper" computer. Purchases were often instigated by middle managers and senior staff who saw the potential – once the revolutionary VisiCalc spreadsheet, the killer app, had been surpassed by a far more powerful and stable product, Lotus 1-2-3.

IBM's dominance of the mainframe market in Europe and the US encouraged existing customers to buy the PC.[173] By 1985 the company was so successful that competitors and analysts speculated that IBM would again be sued for antitrust.[174][175] The company had helped others by defining technical standards and creating large new software markets. Customers feared becoming overdependent on IBM, however, and Datamation and others said that its continued growth might hurt the United States, by suppressing startups with new technology.[176]

Gartner Group estimated in 1985 that of the 100 largest data-processing companies, IBM had 41% of all revenue and 69% of profit. Its computer revenue was about nine times that of second-place DEC, and larger than that of IBM's six largest Japanese competitors combined. The 22% profit margin was three times the 6.7% average for the other 99 companies. Some competitors complained to Congress, ADAPSO discussed the company with the Justice Department, and European governments worried about IBM's influence but feared affecting its more than 100,000 employees there at 19 facilities.[176]

However, the company soon lost its lead in both PC hardware and software, thanks in part to its unprecedented (for IBM) decision to contract PC components to outside companies like Microsoft and Intel. Up to this point in its history, IBM relied on a vertically integrated strategy, building most key components of its systems itself, including processors, operating systems, peripherals, databases and the like. In an attempt to accelerate the time-to-market for the PC, IBM chose not to build a proprietary operating system and microprocessor. Instead, it sourced these vital components from Microsoft and Intel respectively. Ironically, in a decade which marked the end of IBM's monopoly, it was this fateful
decision by IBM that passed the sources of its monopolistic power (operating system and processor architecture) to Microsoft and Intel, paving the way for rise of PC compatibles and the creation of hundreds of billions of dollars of market value outside of IBM.

John Akers became IBM's CEO in 1985. During the 1980s, IBM's significant investment in building a world class research organization produced four Nobel Prize winners in physics, achieved breakthroughs in mathematics, memory storage and telecommunications, and made great strides in expanding computing capabilities. In 1980, IBM Research legend John Cocke introduced Reduced Instruction Set Technology (RISC). Cocke received both the National Medal of Technology and the National Medal of Science for his innovation, but IBM itself failed to recognize the importance of RISC, and lost the lead in RISC technology to Sun. In 1984 the company partnered with Sears to develop a pioneering online home banking and shopping service for home PCs that launched in 1988 as Prodigy. Despite a strong reputation and anticipating many of the features, functions, and technology that characterize the online experience of today, the venture was plagued by extremely conservative management decisions, and was eventually sold in the mid-1990s. The IBM token-ring local area network, introduced in 1985, permitted personal computer users to exchange information and share printers and files within a building or complex. In 1988, IBM partnered with the University of Michigan and MCI Communications to create the National Science Foundation Network (NSFNet), an important step in the creation of the Internet. But within five years the company backed away from this early lead in Internet protocols and router technologies in order to support its existing SNA cash cow, thereby missing a boom market of the 1990s. Still, IBM investments and advances in microprocessors, disk drives, network technologies, software applications, and online commerce in the 1980s set the stage for the emergence of the connected world in the 1990s.

But by the end of the decade, IBM was clearly in trouble. It was a bloated organization of some 400,000 employees that was heavily invested in low margin, transactional, commodity businesses. Technologies IBM invented and or commercialized – DRAM, hard disk drives, the PC, electric typewriters – were starting to erode. The company had a massive international organization characterized by redundant processes and functions – its cost structure couldn’t compete with smaller, less diversified competitors. And then the back-to-back revolutions – the PC and the client server – did the unthinkable. They combined to dramatically undermine IBM's core mainframe business. The PC revolution placed computers directly in the hands of millions of people. It was followed by the client/server revolution, which sought to link all of those PCs (the "clients") with larger computers that labored in the background (the "servers" that served data and applications to client machines). Both revolutions transformed the way customers viewed, used and bought technology. And both fundamentally rocked IBM. Businesses’ purchasing decisions were put in the hands of individuals and departments – not the places where IBM had long-standing customer relationships. Piece-part technologies took precedence over integrated solutions. The focus was on the desktop and personal productivity, not on business applications across the enterprise. As a result, earnings – which had been at or above US$5 billion since the early 1980s, dropped by more than a third to US$3 billion in 1989. A brief spike in earnings in 1990 proved illusory as corporate spending continued to shift from high profit margin mainframes to lower margin microprocessor-based systems. In addition, corporate downsizing was in full swing.

Akers tried to stop the bleeding – desperate moves and radical changes were considered and implemented. As IBM assessed the situation, it was clear that competition and innovation in the computer industry was now taking place along segmented, versus vertically integrated lines, where leaders emerged in their respective domains. Examples included Intel
in microprocessors, Microsoft in desktop software, Novell in networking, HP in printers, Seagate in disk drives and Oracle Corporation in database software. IBM’s dominance in personal computers was challenged by the likes of Compaq and later Dell. Recognizing this trend, management, with the support of the Board of Directors, began to implement a plan to split IBM into increasingly autonomous business units (e.g. processors, storage, software, services, printers, etc.) to compete more effectively with competitors that were more focused and nimble and had lower cost structures.

IBM also began shedding businesses that it felt were no longer core. It sold its typewriter, keyboard, and printer business – the organization that created the popular "Selectric" typewriter with its floating "golf ball" type element in the 1960s – to the investment firm of Clayton, Dubilier & Rice Inc. and became an independent company, Lexmark Inc..

These efforts failed to halt the slide. A decade of steady acceptance and widening corporate growth of local area networking technology, a trend headed by Novell Inc. and other vendors, and its logical counterpart, the ensuing decline of mainframe sales, brought about a wake-up call for IBM. After two consecutive years of reporting losses in excess of $1 billion, on January 19, 1993, IBM announced a US$8.10 billion loss for the 1992 financial year, which was then the largest single-year corporate loss in U.S. history.[177] All told, between 1991 and 1993, the company posted net losses of nearly $16 billion. IBM’s three-decade long Golden Age, triggered by Watson Jr. in the 1950s, was over. The computer industry now viewed IBM as no longer relevant, an organizational dinosaur. And hundreds of thousands of IBMers lost their jobs, including CEO John Akers.

Key events

**mid-1970s: IBM VNET**

VNET was an international computer networking system deployed in the mid-1970s, providing email and file-transfer for IBM. By September 1979, the network had grown to include 285 mainframe nodes in Europe, Asia and North America.

**1975: Fractals**

IBM researcher Benoit Mandelbrot conceives fractal geometry—the concept that seemingly irregular shapes can have identical structure at all scales. This new geometry makes it possible to describe mathematically the kinds of irregularities existing in nature. Fractals later make a great impact on engineering, economics, metallurgy, art and health sciences, and are also applied in the field of computer graphics and animation.[178]

**1975: IBM 5100 Portable computer**

IBM introduces the 5100 Portable Computer, a 50 lb. desktop machine that put computer capabilities at the fingertips of engineers, analysts, statisticians, and other problem-solvers. More "luggable" than portable, the 5100 can serve as a terminal for the System/370 and costs from $9000 to $20,000.[179]

**1976: Space Shuttle**

The Enterprise, the first vehicle in the U.S. Space Shuttle program, makes its debut at Palmdale, California, carrying IBM AP-101 flight computers and special hardware built by IBM.

**1976: Laser printer**

The first IBM 3800 printer is installed. The 3800 is the first commercial printer to combine laser technology and electrophotography. The technology speeds the printing of bank statements, premium notices, and other high-volume documents, and remains a workhorse...
1977: Data Encryption Standard
IBM-developed Data Encryption Standard (DES), a cryptographic algorithm, is adopted by the U.S. National Bureau of Standards as a national standard.[181]

1979: Retail checkout
IBM develops the Universal Product Code (UPC) in the 1970s as a method for embedding pricing and identification information on individual retail items. In 1979, IBM applies holographic scanner technology in IBM's supermarket checkout station to read the UPC stripes on merchandise, one of the first major commercial uses of holography. IBM's support of the UPC concept helps lead to its widespread acceptance by retail and other industries around the world.[182]

1979: Thin film recording heads
Instead of using hand-wound wire structures as coils for inductive elements, IBM researchers substitute thin film "wires" patterned by optical lithography. This leads to higher performance recording heads at reduced cost, and establishes IBM's leadership in "areal density": storing the most data in the least space. The result is higher-capacity and higher-performance disk drives.[183]

1979: Overcoming barriers to technology use
Since 1946, with its announcement of Chinese and Arabic ideographic character typewriters, IBM has worked to overcome cultural and physical barriers to the use of technology. As part of these ongoing efforts, IBM introduces the 3270 Kanji Display Terminal; the System/34 Kanji System with an ideographic feature, which processes more than 11,000 Japanese and Chinese characters; and the Audio Typing Unit for sight-impaired typists.

1979: First multi-function copier/printer
A communication-enabled laser printer and photocopier combination was introduced, the IBM 6670 Information Distributor. This was the first multi-function (copier/printer) device for the office market.

1980: Thermal conduction modules
IBM introduces the 3081 processor, the company's most powerful to date, which features Thermal Conduction Modules. In 1990, the Institute of Electrical and Electronics Engineers, Inc., awards its 1990 Corporate Innovation Recognition to IBM for the development of the Multilayer Ceramic Thermal Conduction Module for high performance computers.[184]

1980: Reduced instruction set computing (RISC) architecture
IBM successfully builds the first prototype computer employing IBM Fellow John Cocke's RISC architecture. RISC simplified the instructions given to computers, making them faster and more powerful. Today, RISC architecture is the basis of most workstations and widely viewed as the dominant computing architecture.[185]

1981: IBM PC
The IBM Personal Computer goes mass market and helps revolutionize the way the world does business. A year later, Time Magazine gives its "Person of the Year" award to the Personal Computer.[186]

1981: LASIK surgery
Three IBM scientists invent the Excimer laser surgical procedure that later forms the basis of LASIK and PRK corrective eye surgeries.[187]

1982: Antitrust suit
The United States antitrust suit against IBM, filed in 1969, is dismissed as being "without