but it emerged immediately as one of the largest computer companies in the world.

AT&T tried to enter the growing personal computer market and started selling micro- and minicomputers under its own brand name. It was not very successful, but in 1991 AT&T and the computer company NCR joined in a U.S.$7.3 billion deal that would supposedly complement the product range of each company. Later, in 1993, AT&T acquired McCaw Cellular, a wireless telephone company that in the end transformed AT&T into a long-distance service, wireless telephony, computer company.

Sensing in 1995 that the corporation had become too large and inflexible, the board of AT&T decided to split the company. In September 1995 three companies emerged from the old corporation: AT&T, a U.S.$51 billion company, that would keep the name of the corporation and concentrate on telephone services, Lucent Technologies, a U.S.$20 billion company, that would produce technology and equipment for voice and data networks, and NCR, an U.S.$8 billion company, which would again concentrate on producing computers. The telephone service customer base of AT&T reached 90 million in 1996 and was poised to grow further, since the new company filed immediately to provide local service in all 50 U.S. states.

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—*Tania Rojas-Esponda*

AT&T Breakup

AT&T, the former American Telephone and Telegraph company, whose roots go back to 1875 and the invention of the telephone, has gone through two major breakups in its long history. The first took place in 1984 when an antitrust suit against the company was settled by divesting the local service telephone companies. The second was voluntary, and led to the creation of three major companies from the mother company: the new AT&T, Lucent Technologies, and NCR. The first breakup, the result of a long legal battle, is seen by many as the model under which a breakup of **Microsoft** might take place in the future.

The origin of the 1974 antitrust suit has much to do with the concept of a *natural monopoly*. When the telephone system, the power grid, and the railroads were first being installed in the United States, there were no agreed-upon standards among the operating companies. In many cases the systems could not be interconnected, leading to inefficiency and losses. A natural monopoly develops in areas in which interoperability is needed and leads to the exploitation of network economies. In the case of the telephone system, the dilemma was solved by tolerating the strongest company, AT&T, as a de facto legally regulated natural monopoly.

The later evolution of the telephone system and the emergence of new telephone companies led the U.S. government to look again at this philosophy. The first antitrust suit was filed against AT&T in 1949, and it resulted in a consent decree issued in 1956 that restricted AT&T to the telephone business and government work. At a time in which the first computer companies were developing, this was an important limitation imposed on AT&T, which would become one of the largest users and even producers of computerized telephone equipment.

In 1974, the U.S. government filed a new antitrust suit against AT&T. The main issue was separating the long-distance business, manufacturing, and research and development from the operation of the local telephone system. It was felt that competition between local companies would lead to lower prices, benefiting the consumer, and that the natural monopoly argument no longer applied to this section of the telephone market, for which international standards were in place. The suit was settled by Judge Harold Greene (1923–2000) and AT&T in 1982, when AT&T agreed to

leave the local telephone business. In exchange, AT&T could participate in new business areas, such as the computer market. AT&T was hailed immediately as one of the major new players in the computer industry.

On 1 January 1984, the new companies started operating the telephone system, which continued working without interruption. Twenty-two operating companies were severed from AT&T and were reorganized into seven regional operating companies, called Baby Bells: Ameritech, Bell Atlantic, Bellsouth, Nynex, Pacific Telesis Group, Southwestern Bell, and U.S. West. AT&T retained U.S.$34 billion in assets, from the U.S.$150 billion it had the day before. Its work force fell from around 1 million employees to one-third of that figure.

The breakup of AT&T eventually led to fierce competition in the long-distance telephone business because AT&T competitors could now sign agreements with local companies. The rates for long-distance calls have been falling at almost an exponential rate ever since, and new factors, such as Internet telephony, are leading to a situation in which the cost of communication is becoming negligible (at least for the data rates needed in telephony). Nevertheless, AT&T did not become the formidable computer company that had been anticipated in the 1980s, although it acquired National Cash Register (NCR) in 1991. NCR was again made an independent company in 1995, after the new voluntary breakup of the mother company.

The arguments used by the AT&T lawyers at the time of the antitrust suit of 1974 are similar to the ones voiced now by Microsoft lawyers. It is argued that the software of the PC is an integrated system, which can best work when cast from one mold. Also, as in the case of AT&T, the high quality of the end product is offered as proof that the virtual monopoly has not been against the best interests of the customer.

The breakup of Microsoft is not a universally popular solution, and in some quarters feelings were similarly mixed about AT&T. There are accounts that in 1984 President Ronald Reagan (1911–) and his Secretaries of Commerce and Defense believed that the monopoly of AT&T was for the national benefit and should be preserved. But the Justice Department insisted that only by divesting the regional telephone monopolies from AT&T's long-distance monopoly would long-distance competitors to AT&T have a fair chance to hook up to local telephone networks. However, eleven months after the breakup, telephone users remained ill informed of the benefits, and a *Business Week* poll showed that the American public disapproved by a margin of 65 percent to 25 percent.

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— *Raúl Rojas*

Atanasoff–Berry Computer

The Atanasoff–Berry computer (ABC) is considered by many to have been the first electronic digital computer. It was conceived by **John Atanasoff** (1903–95) in 1937 at Iowa State College (now Iowa State University), prototyped in 1939, and made functional in 1940. Improvements to it were made until June 1942, when World War II drew its inventors away. Although the patent application was never completed, the revelation of the ABC to **John Mauchly** (1907–80) in 1940 led to the development of the **ENIAC** and **EDVAC** as larger-scale computers based on its principles. It thus played a pivotal role in the history of the invention of the computer.

The ABC was the first computer to combine electronic circuits and binary logic. Prior computing devices had used electronics in analog devices, or had used mechanical methods to calculate with digital representation. The synthesis of these two ideas was as significant an invention as the combination of the glider and the internal combustion engine was for the Wright Brothers airplane. It laid the foundation for the follow-on computers of the 1940s. The term *first-generation computer* is applied to computers based on **vacuum-tube** technology, and the ABC was the original computer of that generation.

Unlike computers built soon after World War II, the ABC was almost as portable as a modern single-cabinet system. It measured 0.9 meter (m) deep by 0.9 m high by