Various subcontractors, including **Texas Instruments** and **Fairchild Semiconductor**, built components for the ILLIAC IV. The machine was assembled at a Burroughs plant in suburban Philadelphia. The original plan was to install the ILLIAC IV at the University of Illinois, but concern over campus antimilitary demonstrations, some of which had involved takeovers of computer centers by student radicals, led to a decision to install it at NASA's Ames Research Center in California. It was delivered in April 1972, but more than three years of painstaking checks were required before the computer went into operation in 1975.

During the construction phase, a Burroughs B6500 functioned as the front end to feed programs and data to the ILLIAC. Programmers at Ames later revised the ILLIAC IV's operating system so that a **Digital Equipment Corporation** PDP-10 could be used instead. Meanwhile, NASA employed a separate B6700 to compile programs written in the GLYPNIR language (a variation of ALGOL) for the ILLIAC IV.

Engineers at Burroughs applied the ILLIAC IV architecture on a more modest scale in their Burroughs Scientific Processor (BSP), which had 16 parallel arithmetic elements (AEs) controlled by one main instruction processor. Burroughs announced the BSP in 1977, and the prototype was operational at the factory in 1978, but none were sold. By that time, the **Cray 1**, which **Cray Research** began selling in 1976, had cornered the high-end scientific market. Although it was not a parallel processor, the Cray 1 would continue to control the market for several years. The Cray 1-S replaced the ILLIAC IV toward the end of 1981. It was another decade before parallel processing became fashionable.

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—George Gray

Information Appliance

Information appliances are easy-to-use devices geared for one or two simple information-processing applications. They lack the universality of a **personal computer** (PC) but are simpler and smaller. Like any good appliance, they have only "one button in the front" and are therefore user friendly. Examples of information appliances are a cellular telephone with a **browser**, a television set with integrated **electronic mail** service, and a gadget that determines the exact position of a car and leads the driver to his or her destination.

The history of computing has gone through several decade-long cycles: The 1960s were the age of **mainframes**, the 1970s of **minicomputers** and midrange machines, the 1980s the dawn of the **microcomputer** era, and the 1990s the age of networking. The first decade of the twenty-first century will witness the emergence and dominance of a new type of processing machine: embedded processors integrated in many other traditional appliances and capable of mobile computing. In the post-PC era, these new devices will lead the growth of the computer industry, not the PC, which, as a product, has already matured in the industrialized world. It has been predicted that the worldwide market for portable information appliances will reach 89 million units in 2004. The total market for all information appliances is projected to reach 830 million units in 2005.

PCs will not disappear, but in the future they will be only one more element in the total network. There are many persons who do not need a computer for writing or for retrieving information from the **Internet**. But they might want to have a cellular telephone and occasionally buy something with it online. They might want to take pictures using the same device and send them to friends. Some cellular telephones already offer this type of capability. At the beginning of 2000, there were 50 million cellular telephones in Japan, 10 million of them with an integrated browser.

The main aspect that has to be taken into account for an information appliance is ease of use. This is what defines an appliance such as a toaster: there is no need to install the system and no need to read a manual. The appliance is so intuitive and ergonomic that it can be used by anyone. This runs counter to many developments in the PC world: Any new release of an **operating system** is more complex than the one preceding, and the newest word processing package

includes many new options that are not needed by the majority of users. PCs are now easier to use due to the **graphical user interface**, but programs are not necessarily easier to understand.

Two examples of information appliances that will be offered in the coming years are Web pads and next-generation PDAs (**personal digital assistants**). *Web pads* are thin tablets with a convenient form factor that can be carried in a small suitcase. A Web pad provides an interface into the **World Wide Web** and could make the home PC obsolete. If communication costs continue falling at their current exponential rate, communication will be almost free in the future. There will be providers of computing power that can be tapped from a simple wireless tablet. All data will be stored at computer farms installed in large warehouses. Data backups will be done by these providers, and if the Web pad is lost, the data will still be secure with the provider. Meanwhile, *next-generation PDAs* should become easier to use because they will accept spoken commands. The PDA of the future will record voice, take digital pictures and video, and provide an interface to the Web.

The greatest challenge facing information appliances of the future is their seamless integration into a network. The home and the car of the future will have several dozen embedded processors and it is not at all clear how they will communicate. If a new TV set is bought, it should integrate itself into the home network. If a new intelligent refrigerator is installed, its presence should be announced in the network. It would then be possible to check the state of all one's home appliances remotely through the Web. One possible solution is the **Jini** protocol promoted by **Sun Microsystems** as a standard for communication in networks of processors. Using Jini, any new device announces its existence to the network and it is not necessary to do any other type of network management. The network grows and adjusts automatically to the new configuration.

One interesting sociological difference between the PC and the information appliances market is that the first has traditionally been driven by the *early adopters*, the sophisticated segment of the population willing to test a new technology. Appliances are for the rest of us, for the non-risk takers, for the common consumer. Information appliances will really take off when the **killer applications** of the post-PC era are identified and when they become simple enough to operate with a push of a single button.

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—*Raúl Rojas*

Information Infrastructure

The convergence of **digital** computing with communications technologies led in the 1990s to considering them together as information infrastructures. An information infrastructure can therefore be thought of as a **network** of networks, including the **Internet**, telephony (both land-line and mobile cellular phones), satellites, cable, digital interactive television, and other telecommunications systems. Information infrastructures are not only technical systems but also interlocking collections of institutions that might agree on interconnection standards, regulate how networks grow, decide what content the networks are allowed to carry, provide funding, or make policy.

Information infrastructures are a key factor in the growth of national and global economies, and for this reason, the actions of governments are very important in understanding differences between national information infrastructures of different states and how they might fit together in a global information infrastructure.

The term *information infrastructure*, which dates from at least 1976 in U.S. technology policy documents, was popularized by the 1993 announcement by Vice President Al Gore (1948–) of a *national information infrastructure*, often subsequently referred to as the *information superhighway*. The expectation, explicit in Gore's speech and common in other national plans, was that the national information infrastructure would