

Where other organizations often stress the purely pragmatic advantages of free software (often calling it **open source** instead of *free*), the foundation's emphasis has always been on ethical and moral issues. The Free Software foundation argues that the rights to use, modify, and redistribute software are valuable because they are essential for a culture of sharing, not just because they result in better quality software.

The foundation is the umbrella organization under which the **GNU Project** operates; the GNU Project supports the development of new free software. As well as accepting donations, the foundation raises money by selling copies manuals and **CD-ROM** copies of GNU software. Both the Free Software foundation and the GNU Project are led by **Richard Stallman** (1953–).

In addition to supporting the GNU Project, the foundation defends the freedoms and rights necessary for free software to exist. For example, it opposes software patents, user interface copyrights, censorship, and controls on encryption technology. It also protects free software by enforcing the GNU General Public License (a license designed to protect rather than restrict the user's freedoms), although this is usually done through behind-the-scenes negotiation rather than by public confrontation. The Free Software Foundation also supports information use and access rights outside software, for example by opposing the extension of copyright powers in other areas.

Although based in the United States, the Free Software foundation leads a genuinely international movement, with volunteers and supporters worldwide. It provides a beacon to those concerned with the rights and freedoms of software users and programmers. Many disagree with Stallman's uncompromising moral position, but it cannot be ignored and helps to set the context of debate. The Free Software Foundation is a major force in shaping modern computing.

#### FURTHER READING

*GNU's Bulletin*, Vol. 1, No. 24, Mar. 1998.

<http://www.gnu.org/bulletins/bull24.html>

Wayner, Peter. *Free for All: How Linux and the Free Software Movement Undercut the High-Tech Titans*. New York: Harper Business, 2000.

—Danny Yee

## Frequently Asked Questions See FAQ.

### FTP

**F**TP stands for *file transfer protocol* and, as the name implies, is a protocol used on the **Internet** to retrieve files from a remote computer or to copy files to it. The user initiates a program, also called FTP, giving the name and domain of the remote computer. For example, a user wanting to retrieve files from the computer "foo" at the Massachusetts Institute of Technology would type "ftp foo.mit.edu." The remote host (in this case, "foo") answers by asking for user identification (ID) and a password. After the user answers, he or she can navigate in the subdirectories of the remote system. Files can be retrieved using the *get* command and can be copied to the remote system using the *put* command. FTP operations are performed by typing the commands at the FTP prompt. FTP transfers can also be initiated from a **World Wide Web** browser by entering "ftp://".

Many companies and most universities allow *anonymous* FTP to their Internet servers. This means that no user ID is required and the password can be one's own e-mail address. The purpose is to permit any user to download software or any other file from a public zone.

The first Request for Comments (RFC)—a series of documents that established the protocols of the Internet—dealing with FTP is RFC 172 from June 1971. The **ARPANET** was just two years old when the authors of the RFC wrote: "The primary function of FTP is to facilitate transfer of files between hosts, and to allow convenient use of storage and file handling capabilities of other hosts."

*Ftp-mail* was developed for sites without interactive connection to the Internet. Users can send **electronic mail** to a server, which interprets the text of the message as FTP commands and sends the desired file by e-mail. With the explosion of interactive Internet connections, this kind of server has become less used.

Web browsers can hide the FTP commands from the user, so that simple point-and-click can be used to download files from another site. This means that FTP will eventually become "invisible" for the end user,

who will not have to use its commands directly. New security options, which would hinder an intruder from interfering with an FTP communication link and tampering with the data, have been proposed in some recent Internet RFCs.

#### FURTHER READING

- Bhushan, A., B. Braden, W. Crowther, et al. *The File Transfer Protocol*. RFC 172. June 1971.
- Horowitz, M., and S. Lunt. *FTP Security Extensions*. RFC 2228, Oct. 1997.
- Stevens, W. Richard, and W. Richard Stevens. *TCP/IP Illustrated: The Implementation*. Reading, Mass.: Addison-Wesley, 1994–96.

—Raúl Rojas

## Fujitsu

Fujitsu Limited, headquartered in Kawasaki, Kanagawa, Japan, specializes in the manufacture and sales of software and services, computers and information processing platforms, telecommunications systems, semiconductors, and electronic devices. Fujitsu originally focused on the Japanese market, but over the past decade has invested in sales, marketing, and customer support programs by starting direct sales subsidiaries in many other countries. This suggests a long-term strategy of competing in the emerging global markets of networked business systems.

Fujitsu Limited was established in June 1935 by the Communications Division of Fuji Electric Co. Ltd. Much of Fujitsu's initial focus was on the telecommunications industry; it began production of computer-related technology in 1951. In 1954, Fujitsu introduced Japan's first commercial computer, FACOM 100. Eventually, this technology became the basis for modern numerical control and factory automation. The FACOM 100 evolved into the FANUC and FACOM 270 series computers, which were popular in manufacturing environments.

In the 1960s, Fujitsu became a major producer of transistors and integrated this technology into its computers. In 1968, Fujitsu California Inc. (FCI) was established and Fujitsu Limited merged with Kobe Industry Inc. During the 1970s, Fujitsu continued global expansion.

Fujitsu FANUC Ltd. and Fujitsu TEN Ltd. were established to incorporate the Numerical Control Division and Auto Radio and Car Stereo Division of Fujitsu Ltd.

Fujitsu's first Japanese word processor, OASYS 100, was introduced in 1980, and Fujitsu's first **personal computer**, FM-8, was launched the following year. Throughout the 1980s and 1990s Fujitsu continued to expand operations in the computer and communications arenas, making important contributions in the areas of ISDN, PBX, and fiber optic communications. At the same time, Fujitsu purchased Ross Technologies and the Amdahl Corporation and strengthened its computer lines.

In the late 1990s, Fujitsu's focus remained on networked computing systems. Advances in server technology and WebTV were at the forefront of its activities. Technological partnerships with many organizations enabled it to contribute significantly in the networking and communication arenas.

In the fiscal year ending on 31 March 1999, the Fujitsu Group reported revenues of U.S.\$43.3 billion, with hardware and software technology in computers, telecommunications, and electronic devices providing the largest proportion. As of this writing, the Fujitsu Group included ICL, Amdahl, and DMR Consulting Group and more than 500 other companies, 188,000 employees, and operations in more than 100 countries.

#### FURTHER READING

- Moad, Jeff. "Next Stop, World Markets (Fujitsu Ltd.)." *Datamation*, Vol. 35, No. 15, 1 Aug. 1989, p. 28, sec. 5.

—Roger McHaney

## Functional Programming

Functional programming describes the process of expressing all operations to be executed by a computer as *function* applications. A function is simply a rule defining how to produce an output from a given input. In functional programming, the emphasis is on the evaluation of complete expressions, as opposed to the execution of low-level commands.

Functional programming is merely what we learned in school: how to find the value of an expression, for