

## Fidonet

Fidonet was one of the earliest **wide area networks** open to the public. Run by amateurs, it provided low-cost **electronic mail** and **Usenet** services at a time when network connections were expensive and difficult to obtain. Because the Fidonet software ran on commonly available **personal computers** running MS-DOS, it helped train a generation of computer users in network organization and management.

Fidonet grew out of the electronic bulletin board community, which was active in the early 1980s. These electronic boards were small servers that offered services similar to those found on computer networks. Users could dial into these servers and send messages to other users, download files that others had posted on the server, or post files themselves. Unlike networks, these bulletin boards were isolated and supported only a limited community of users.

The origins of Fidonet can be traced to 1984, when a programmer named Tom Jennings wrote new code to allow his **bulletin board system** (BBS) to exchange information over the telephone with similar systems. He modified a popular system called Fido BBS, so-named because it was developed on a reliable but slow computer that reminded users of an old faithful dog named Fido. Over the next year, Fidonet grew to 200 nodes. It was a *store-and-forward network*; rather than being connected round the clock, Fidonet computers would call each other at selected hours of the day to exchange mail and files. Initially, the network set a specific time, called *zone mail hour*, at which to transfer mail from computer to computer.

The network operators, called *sysops* for systems operators, were volunteers who bore the entire cost of running the network, including the telephone charges. During the first two years of operation, the Fidonet sysops developed both a topology for the network and a social structure to coordinate network operations. By 1986, they had defined a tree structuring for Fidonet, which divided the network into zones and nets. There were six zones, which were the continents of North America, South American, Europe, Asia, Africa, and Oceania (Australia and New Zealand). Nets covered smaller geographic areas, usually about the size of a

city. Within the nets were power users or points, which handled concentrated flows of data. Each node had a unique address, written zone:region/node.point.

The Fidonet sysops established a network technical committee to write standards for the new network. This committee operated in a manner similar to its Internet counterpart. It drafted proposed standards and circulated them over Fidonet for comment. Also like the **Internet**, the Fidonet environment tended to be a free-wheeling one. Jennings and the Fidonet sysops were determined to avoid censoring the contents of the network, adopting the slogan "Thou shalt not offend, nor be easily offended."

The size of Fidonet peaked in 1993, when the network had 20,000 nodes. The Internet undermined Fidonet by providing more services. However, Fidonet continued operating through the 1990s, although on a much reduced scale.

### FURTHER READING

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Rheingold, Howard. *The Virtual Community: Homesteading on the Virtual Frontier*. Reading, Mass.: Addison-Wesley, 1995.

—David Alan Grier

## File Server

A file server is a computer in a **local area network** (LAN) whose main purpose is to manage large arrays of hard disks containing the data files and programs for all users in the network. With a file server, instead of having copies of a program or a database in the local hard disks of each computer in the network, a single copy is kept. This guarantees that databases remain consistent and it simplifies program upgrades, since only the copy in the file server has to be reloaded. A file server usually has a large main memory that is used as a cache for the file system.

The name server is attached to machines reserved for a single task. A *compute server*, for example, is a machine set aside for number crunching in which users can log in to let computationally intensive programs run. A *mail server* is a computer that receives all incom-

ing and outgoing **electronic mail** and distributes it to the local machines. A *Web server* is a computer in which special software runs that manages all hits to the local **World Wide Web** pages. A *printer server* takes care of all printers connected to a network, and so on.

A *file server* needs some kind of protocol so that computers in the network can view the server hard disks as if they were local units. The computers in the network “mount” the server file system in order to access the files stored there. **NetWare**, for example, is proprietary software from **Novell** that distributes the operating system functions across the networked machines. Access to the server files is transparent for the user. The network filing and printing protocol is called NetWare Core Protocol.

NFS, the Network File System protocol, is a popular alternative for LANs. NFS was defined by **Sun Microsystems** and has an open architecture (i.e., one whose definition has been put in the public domain). Any other vendor of computer hardware or software can write an implementation of the protocol. NFS runs on top of **TCP/IP**, the **Internet** protocol, making it possible for computers of different types to access the same file server. Different **personal computers** (PCs) and workstations can thus share files.

NFS was defined by Sun in March 1989 in RFC 1094, an Internet request for comments, and became a standard component of Sun networks shortly thereafter. The file system operates using the client-server abstraction. Any computer willing to access a file in another computer is a client; the computer on which the file is locally stored is a server. NFS defines a *virtual file system* (VFS), which abstracts characteristics and specific file systems of each machine from the underlying hardware.

The file server under the NFS protocol adopts a stateless strategy; the server does not record the history of transactions with any client. This can be a problem if several users want to access the same file simultaneously, since *file locking* (closing the file so that other machines cannot access it until the operation is complete) cannot be used directly. Also, with NFS, a server can be a client of another server, and this server a client of yet another server. A request for a file is then sent through the chain of machines

to the correct server. The client receives a *handle*, an identification for the file, and can subsequently refer to it through this handle.

There are other alternatives to NFS for **Windows**-based machines. SAMBA is a freely available standard (under the GNU scheme) that implements the SMB (server message block) protocol and allows **Unix** machines and PCs to use the same file servers. SMB is the protocol by which **IBM PC** and compatible machines share files and other devices. In terms of performance, SAMBA is as fast as NFS.

**Microsoft** never adopted the NFS standard and designed SMB, adopting a previous IBM proposal, for use with its LAN manager. It was extended to be used with Windows and Windows NT but is no longer a proprietary protocol, since several companies have proposed to make it an open Internet protocol. SMB can also use Internet Protocol (IP) as its underlying messaging protocol, or another lower-level alternative, such as NETBIOS.

Microsoft, **Intel**, and other companies announced that they are working together to develop a Common Internet File System Specification (CIFS), which has already been submitted as an Internet draft. The draft includes some security capabilities absent in NFS, such as anonymous access and encrypted passwords.

#### FURTHER READING

- Eckstein, Robert, David Collier-Brown, and Peter Kelly. *Using SAMBA*. Sebastopol, Calif.: O'Reilly, 1999.
- Kabir, Mohammed J. *Apache Server Administrator's Handbook*. Foster City, Calif.: IDG Books Worldwide, 1999.
- Stern, Hal. *Managing NFS and NIS*. Sebastopol, Calif.: O'Reilly, 1991.

—Raúl Rojas

## File Transfer Protocol See FTP.

## Firewall

A firewall is any device that monitors and controls the flow of traffic between two networks (such as an internal corporate **local area network** and the **Internet**). The firewall ensures that all network traffic