

**PEER-TO-PEER FILE SHARING**  
**CROSS-REFERENCE TO RELATED**  
**APPLICATIONS**

This application is a continuation-in-part and claims priority of U.S. patent application Ser. No. 10/115,448, filed Apr. 3, 2002, which is hereby incorporated by reference in its entirety.

**TECHNICAL FIELD**

The described technology relates generally to methods of and systems for peer-to-peer file sharing between computers.

**BACKGROUND**

There are a variety of known methods and systems of differing complexity for sharing files between two or more computers, both centralized and distributed. Conventional centralized client-server file sharing systems often require a massive server storage infrastructure. More basic file sharing systems that merely allow files to be uploaded to and then to be downloaded from a centralized site (e.g., an FTP site on the Internet) likewise may need to provide a substantial amount of centralized storage space. Distributed systems reduce the need for centralized file storage, but they may suffer from one or more disadvantages such as an unfamiliar user interface, a need for a substantial amount of user training, lack of up-to-date information on files currently available for retrieval, and so forth.

**BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 is a display page illustrating a file system folder structure with a shared folder in one embodiment.

FIGS. 2–4 are display pages illustrating the file system folder structure for members of various groups.

FIG. 5 is a block diagram illustrating components of the file sharing system in one embodiment.

FIGS. 6A–6E are diagrams illustrating the message flows between members of a group in one embodiment.

FIG. 7 is a flow diagram illustrating the processing of an invite component or peer component in one embodiment.

FIG. 8 is a flow diagram illustrating the processing of the peer component when it receives an invitation request message in one embodiment.

FIG. 9 is a flow diagram illustrating the processing of the peer component when it receives an invitation response message in one embodiment.

FIG. 10 is a flow diagram illustrating the processing of the peer component when it receives a synchronization response message in one embodiment.

FIG. 11 is a flow diagram illustrating the processing of discovering a computer system.

**DETAILED DESCRIPTION**

A method and system for sharing files between a group of computer systems is provided. In one embodiment, the file sharing system allows a group of computer systems to be defined. One computer system of the group may be designated as the “group owner.” The group owner may have the sole authority to invite other computer systems to join the group. Alternatively, other computer systems of the group (“members of the group”) may have the authority to also invite other computer systems to join the group. In one

embodiment, the files shared by a group are associated with a group folder. A group folder is represented by a folder created by the file system of each member. The folder at each member contains a file for each file that is shared by the group. The files in the folder of a member may be actual files stored at that member, which contains the content of the shared file, or virtual files identifying the actual file that is stored at another member. A shared file is identified by metadata stored in association with the virtual file (e.g., as properties of the virtual file). A member who shares a file that is stored at that member is referred to as the “file owner.” When a file is shared, the folder of the file owner contains the actual file and the folders of the other members of the group contain a virtual file corresponding to the shared file. When a member accesses a virtual file, the file sharing system detects the access and requests that the file owner provide a copy of the file to the accessing member on a peer-to-peer basis. Whenever a shared file is modified, the file owner sends updated metadata for that file to the other members of the group. In this way, the members use their local file systems to represent each shared file of the group and defer downloading a shared file until it is accessed by a member who is not the file owner.

In one embodiment of the file sharing system, the members receive from another member a notification that a file is to be shared with the members of the group. The notification includes metadata describing the file to be shared. For example, the metadata may identify the file name, the file owner, the create date of the file, the last modified date of the file, the size of the file, and so on. Upon receiving the notification, the member creates a virtual file in their folder for the group using the file system of that member. A virtual file may be a file that has the same name as the file being shared except for an identifying extension, may have no actual content (e.g., a file size of 0), and may have the metadata represented as attributes of the virtual file. Whenever the actual file is changed at the file owner, the file owner sends the updated metadata for the file to the other members, who update the metadata associated with their corresponding virtual file as appropriate. The members, who are not the file owner, use the metadata when accessing the shared file.

In one embodiment, the group owner maintains a list of the group members. All messages related to metadata updates are routed through the group owner. For example, when a shared file is updated, the file owner sends a message to the group owner containing new metadata for the shared file. The group owner identifies the other members of the group and sends the updated metadata to each member. A member may be either online or offline. (More generally, a computer system, regardless of whether it is currently a member of a group, can be online or offline.) If a member is online, then the member can receive messages from other members, can access the files whose file owners are also online, and can notify other members of changes that it makes to the shared files that it owns. If a member is offline, the member can neither receive nor send any messages. In one embodiment, the file sharing system may have a server (e.g., an authorization server) that controls whether a member is currently online or offline. A member goes online by providing authentication information to the authentication server. When the information can be authenticated, the member is online. The authentication server, when requested by a member, provides access information for another online member. When a member goes online, it contacts the group owner (assuming that the group owner is currently online) to synchronize its copy of the group folder with the group owner. For example, files of the group folder may have been