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**UTILITY
PATENT APPLICATION
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(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	012861-13
First Inventor	ABOULHOSN, Amir L.
Title	Peer-to-Peer File Sharing On ...
Express Mail Label No.	EV 071359423 US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. ☐ Fee Transmittal Form (e.g., PTO/SB/17)
(Submit an original and a duplicate for fee processing)
2. ☐ Applicant claims small entity status.
See 37 CFR 1.27.
3. ☒ Specification (Total Pages 20)
(preferred arrangement set forth below)
 - Descriptive title of the invention
 - Cross Reference to Related Applications
 - Statement Regarding Fed sponsored R & D
 - Reference to sequence listing, a table, or a computer program listing appendix
 - Background of the Invention
 - Brief Summary of the Invention
 - Brief Description of the Drawings (if filed)
 - Detailed Description
 - Claim(s)
 - Abstract of the Disclosure
4. ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets 15]
5. Oath or Declaration [Total Pages 1]
 - a. ☐ Newly executed (original or copy)
Copy from a prior application (37 CFR 1.63 (d))
 - b. ☐ (for continuation/divisional with Box 18 completed)
 - i. ☐ **DELETION OF INVENTOR(S)**
Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
6. ☐ Application Data Sheet. See 37 CFR 1.76

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7. ☐ CD-ROM or CD-R in duplicate, large table or Computer Program (Appendix)
8. Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary)
 - a. ☐ Computer Readable Form (CRF)
 - b. Specification Sequence Listing on:
 - i. ☐ CD-ROM or CD-R (2 copies); or
 - ii. ☐ paper
 - c. ☐ Statements verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

9. ☐ Assignment Papers (cover sheet & document(s))
10. ☐ 37 CFR 3.73(b) Statement (when there is an assignee) ☐ Power of Attorney
11. ☐ English Translation Document (if applicable)
12. ☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations
13. ☐ Preliminary Amendment
14. ☒ Return Receipt Postcard (MPEP 503) (Should be specifically itemized)
15. ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed)
16. ☐ Nonpublication Request under 35 U.S.C. 122 (b)(2)(B)(i). Applicant must attach form PTO/SB/35 or its equivalent.
17. ☐ Other: _____

18. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in a preliminary amendment, or in an Application Data Sheet under 37 CFR 1.76:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No. _____ / _____
 Prior application information. Examiner _____ Group Art Unit. _____

For CONTINUATION OR DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 5b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

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First Named Inventor: Amir L. Aboulhosn et al.

For: Peer-to-Peer File Sharing On A Computer Network, Each Computer Using a Native File Manager

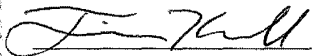
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1. Non-Provisional Utility Patent Application Transmittal Form (PTO/SB/05),
2. 20 Pages of Specification, including 22 claims, Abstract, 15 sheets of drawings (Figs. 1-10)
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**PEER-TO-PEER FILE SHARING ON A COMPUTER NETWORK, EACH COMPUTER
USING A NATIVE FILE MANAGER**

BACKGROUND OF THE INVENTION

The present invention relates generally to methods of and systems for peer-to-peer file
5 sharing between computers that are connectable to a network for communication with each other.
It is considered particularly suitable for but is not limited to implementation on the Internet.

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
10 basic file sharing systems which merely allow files to be uploaded to then 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
15 currently available for retrieval, and so forth.

BRIEF SUMMARY OF THE INVENTION

A primary object of the present invention is to provide a new method of and system for
peer-to-peer file sharing which does not depend upon centralized file storage and which allows
computer users to share files with other users directly from within a variety of native file
20 managers.

A further object of the present invention is to provide a new method of and system for
maintaining synchronization between such shared files so that all users can see which files are
currently available for retrieval, and for enabling the retrieval of files that are of interest.

Generally, the method of the present invention is implemented within the environment of
25 a communication system comprising a plurality of computers connectable to a network for
communication with each other. Each of the computers includes a memory and a user interface
for displaying and interacting with files stored in the memory. As well, each of the computers is
programmed with a native operating system, the operating system including a native file
manager for organizing files in directories (also known as folders) and subdirectories (or folders
30 within folders).

The network may be a local area network (LAN), a wide area network (WAN) or another type of network. In a preferred embodiment the network is the Internet.

Suitable operating systems and their associated file managers include Microsoft Windows Operating Systems (e.g. Windows 2000) with Microsoft Windows Explorer, and
5 Macintosh Operating Systems (e.g. MAC OS X) with Macintosh Finder. But, the invention may be implemented with other systems and their associated file managers including Unix, Linux and so forth. It is to be noted that the present invention does not require computers on the network to be programmed with the same type of operating system or the same type of file manager.

In a broad aspect of the method of the present invention, there is provided a method of
10 file sharing comprising the following steps in any appropriate order:

- (a) storing a local file in the memory of a first computer;
- (b) managing the local file within a first directory defined in the first computer with the file manager of the first computer;
- (c) storing a location reference in the memory of a second computer, the location reference
15 being a reference to the local file in the first computer;
- (d) managing the location reference as a virtual file within a second directory defined in the second computer with the file manager of the second computer; and,
- (e) repeatedly transmitting metadata associated with the local file from the first computer to
20 the second computer to create the location reference and, in the event that the local file is updated, to correspondingly update the location reference.

This process can be applied to sharing groups of users where many users in a defined group each have one or more (or in some cases perhaps no) local files that they wish to share. Within the defined group, there may be many possible combinations of first and second
25 computers. Any given local file stored in one computer within the group becomes a virtual file stored in the memory of those other ones of computers in the group that have received the metadata. The repeated transmission of the metadata provides synchronization by serving to ensure that users who are connected online to the network are kept substantially up-to-date on files that are currently available for retrieval. Users who comes online following a period offline are brought up-to-date on the next transmission cycle.

A further object of the present invention is to provide a new method of and system for maintaining synchronization between such shared files so that all users can see what files are currently available for retrieval, and for enabling retrieval of those files that are of interest.

Herein, a “virtual file” is an actual file and is managed with a computer’s native file manager like any other file. But, its content is basically limited to metadata. In the context of the present invention, the metadata associated with a particular virtual file stored on one computer will comprise but is not limited to metadata associated with a local file stored on another computer. But, for example, while the file size of a file locally stored on one computer might show as 100KB, the same file stored as a virtual file on another computer would show as having a file size of 0KB.

The “metadata” associated with a file comprises data about the file or, more particularly, about properties of the file. For example, the metadata may include but is not limited to file name, owner name, file size, creation date, last modified date, etc. Metadata is to be distinguished from substantive file content such as graphics data, word processing text data, multimedia data, software application data, etc.

Preferably, virtual files in a given directory are visually presented by the user interface in a manner visibly distinct from any local file or local files within the same directory. This may be done, for example, by associating a unique icon with virtual files. As well, since virtual files necessarily are a unique file type, this may be done by showing the file type with the display of the file’s name. Further, this may be done by placing virtual files in a uniquely named subdirectory within the given directory and which is reserved for holding virtual files.

When a given computer has a location reference for a file locally stored in another computer, then the location reference may be utilized to transmit a transfer request via the network from the given computer to the other computer. The other computer then transmits the locally stored file to the given computer in response to reception of the transfer request. A transfer request may be prompted by an instruction to open the virtual file associated with the location reference. Typically, such an instruction may be given in various ways (e.g. by double clicking with a mouse on the virtual file, by selecting the virtual and then an Open command from a menu, etc.) In any case, a suitable instruction will depend upon characteristics of the file manager in the given computer.

It is to be noted that the foregoing does not require the operating systems and file managers on differing computers to be the same. Further, by using an operating system’s

familiar native file manager as the user interface for file sharing, minimal user training is required.

In a preferred embodiment, the communication system further comprises an authentication server connected to the network for controlling communication between computers. Execution of the method by the computers is made subject to the preliminary step of providing prescribed authentication information (e.g. a user name and password) from the computers to the authentication server. The authentication server may then compare the information provided with information previously provided and deny a connection in the event of disconformity or if other prescribed conditions are not satisfied.

The authentication server can be easily scaled to handle large numbers of users because while it maintains information about users it is not required to provide storage space for user files.

In another aspect of the present invention, there is provided a first computer connectable to a network for receiving communications from and sending communications to a second computer; the first computer including a memory and a user interface for displaying and for interacting with files stored in the memory, the first computer being programmed with a native operating system which includes a native file manager for organizing files in directories and subdirectories, and a file sharing software application. The file sharing software application comprises:

- (1) means for repeatably receiving from the second computer via the network a set of metadata comprising data corresponding to properties of a file locally stored in a memory of the second computer, the set of metadata including data providing a location reference to the locally stored file;
- (2) means interactive with the file manager for processing the received set of metadata to create a virtual file within a directory defined in the first computer, the virtual file including file properties corresponding to selected file properties of the file locally stored in the second computer;
- (3) means for comparing the set of metadata received on one cycle of reception with the set of metadata received on a preceding cycle of reception and, if the set of metadata has been updated between cycles, then updating the file properties of the virtual file; and,

- (4) means interactive with the location reference for transmitting to the second computer a request to transmit the file locally stored in the second computer from the second computer to the first computer.

The foregoing and other features and advantages of the present invention will now be described with reference to the drawings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

FIG. 1 is a system block diagram showing a number of computers connected to a network for file sharing communication with each other under the control of an authentication server.

FIG. 2 illustrates an example of how a user's file system may be organized in computer memory to provide space for file sharing activities in accordance with the present invention.

FIG. 3 consisting of FIGS. 3A and 3B assembled as shown in FIG. 3C illustrates an example of how a group directory as shown in FIG. 2 may visually appear when opened in a typical computer screen display.

FIG. 4 consisting of FIGS. 4A and 4B assembled as shown in FIG. 4C illustrates an example of how the Remote folder or directory shown FIG. 3 may visually appear when opened in a typical screen display.

FIG. 5 is a flowchart of a typical file transfer session.

FIG. 5A illustrates an example of a screen display where a local file has been selected for uploading to a user sharing the file.

FIG. 5B illustrates an example of screen display for monitoring progress as a shared file is being downloaded.

FIG. 5C illustrates an example of a screen display for monitoring progress as a shared file is being uploaded, and also for monitoring progress of a confirming message that the file has been uploaded.

FIG. 6 is a flowchart of a process for synchronizing metadata.

FIG. 7 is a flowchart of a process for shared file management.

FIG. 8 is a flowchart of a process for granting access permissions to shared files.

FIG. 9 is a flowchart of a process for sending file availability notifications.

FIG. 9A illustrates an example of a screen display for a file availability notification sent by email.

FIG. 10 is a flowchart of a voting process for deletion of a file sharing group.

5 DETAILED DESCRIPTION OF THE INVENTION

10 The system shown in FIG. 1 comprises a plurality of terminals or computers 100A, 100B ... 100N connected in a conventional manner to a network 120 (in this case the Internet) via conventional network interfaces 105A, 105B ... 105N for file sharing communication with each other. Each computer includes a memory (representationally shown as memory 109A for the case of computer 100A) and a user interface for displaying and for interacting with files stored in its memory. Typically, the user interface may include a screen display 101A, 101B ... 101N and a keyboard or the like (not shown).

As a group, computers 100A, 100B ... 100N are collectively designated 110 and their users are collectively referred to herein as users 110.

15 Each computer 100A, 100B ... 100N is programmed with a native operating system, and each operating system includes a native file manager for organizing files in directories and subdirectories. In FIG. 1, the operating system for computer 100A is representationally shown within memory 109A as local operating system 102A and the file manager is representationally shown as local file manager 103A. Although not depicted, computers 100B ... 100N likewise
20 each include a local operating system and a local file manager. However, as indicated above, it is to be understood that the operating systems/file managers installed on the respective computers may differ. For example, computer 100A may have a Windows Operating System with Microsoft Windows Explorer as the file manager, whereas computer 100B may have a Macintosh Operating System with Macintosh Finder as the file manager.

25 As well, each computer 100A, 100B ... 100N is programmed with an application program (herein referred to as the File Share Enabling Software) that enables file sharing communication in accordance with the present invention in the manner described below. In FIG. 1, the File Share Enabling Software for computer 100A is representationally shown within memory 109A as Local File Share Enabling Software 104A. Although not depicted, computers 100B ... 100N
30 likewise each include Local File Share Enabling Software. For each computer, the Local File

Share Enabling Software is necessarily adapted to the operating system and file manager of the computer.

The system shown in FIG. 1 also includes an authentication server 150 connected in a conventional manner to network 120 via a network interface, the latter of which includes a firewall 156. The purpose of server 150 is to control communication between computers 100A, 100B ... 100N. Generally, it does so by storing information about each individual user 110 in a database 158 in its memory 159, and by impairing attempted communication by any given user 110 unless the given user is first properly identified.

Authentication server 150 has an associated administrator 160 who, for example, may be an independent third party who supplies the File Share Enabling Software to users 110. In such a case, the requirement for identification may be implemented by administrator 160 in a manner that impairs use of unauthorized copies of the File Share Enabling Software. For example, the File Share Enabling Software may be structured such that each user 110 is first required to provide a user name and a password before communication with other users will be enabled. The particular user name and the particular password may be associated in a record in database 158 with a particular location on network 120.

In the case of computer 100A, connection 105A to network 120 is shown to include a conventional firewall 106A. However, the use of firewall 106A as part of the connection is merely illustrative. No such firewall is used in the case of computer 100B or 100N. More generally, it will be understood that some computers in group 110 may connect to network 120 in a direct manner while others may connect through a firewall, Network Address Translator (NAT), or some other device. Depending upon the circumstances, differing strategies may be invoked to traverse such devices.

Strategy 1: If two computers are both behind NAT with local Internet Protocols (IPs), then an intermediate or tunnelling server is needed to allow the transmission of data between the two.

Strategy 2: If a first computer is behind NAT with local IP and a second is not (i.e. it is a unidirectional communication), then regardless of who initiates a communication, it has to be that the first computer connects to the second, and that a reverted connection is needed if the second want to initiate a communication with the first.

Strategy 3: If a firewall is involved at either end of a connection between two computers, then a fixed port has to open or an open port can be used. If a firewall allows only inside-out connection, then the solution will be similar to strategy 2 and 3.

Referring now to FIG. 2, there is representationally shown in the memory 109 of a
5 computer an architecture or hierarchy 201 of directories and subdirectories 202-208, 211, 212 and files 209-210. The computer per se is not depicted, but is programmed with a local operating system 102, a local file manager 103, and local File Share Enabling Software 104, and may be considered as any one of computers 100A, 100B ... 100N in FIG. 1.

Directory 202 is a top (root) directory associated with the particular file manager 103.
10 Directories 203-205 are top directories defined in the computer within root directory 202 to hold various files in an organized manner for various purposes. In this case, directory 203 has been user defined with file manager 103 and reserved to be used for file sharing activities in accordance with the present invention. Directories 204, 205 are used for unrelated purposes.

Within directory 203, subdirectories 206-208 have been created to define and segregate
15 different sharing groups with whom the user is prepared to share files. For example, one set of files may be managed with file manager 103 in one of subdirectories 206-208 for one sharing group, and another set of files may be managed with file manager 103 in another one of subdirectories 206-208 for another sharing group. By way of example, two local files 209, 210 are shown as being managed within subdirectory 207 to be shared with users in the associated
20 group.

In the manner described below, each shared subdirectory or folder 206-208 is
administered by a folder administrator who controls who has access to the folder. Once an administrator grants another user access to a folder, the other user will be able to see a list off all files that are being shared from the same folder by all authorized users. For example, if 8 users
25 had access to folder 207, and each user placed a file in that folder, then all 8 users would see all 8 files regardless of whose computer they were located on. Each user would see the file that they placed in their folder as a local file, and the remaining 7 files would be seen as virtual files.

Subdirectory 207 contains a further subdirectory 211 entitled "Remote". Subdirectory
211 is reserved to hold virtual files (not depicted in FIG. 2) which provide links to local files in
30 other computers that other users in the group are prepared to share (hence the title "Remote"). As well, subdirectory 207 contains a subdirectory 212 entitled "Archive". An Archive directory

may be considered as a convenient adjunct to provide file backup and/or a directory for holding earlier versions of files that were subsequently updated.

5 A clearer appreciation of the possible contents of a directories such as subdirectories 207 and 211 will be seen with reference to FIGS. 3 and 4. FIG. 3 illustrates a screen display example typical of that which would be presented under the management of the Windows Operating System with Microsoft Windows Explorer as file manager 103. Subdirectory 207 is entitled "SynerDrive" and contains a number of local files 301 as well as Remote file subdirectory 211 and Archive file subdirectory 212. Subdirectories 211, 212 are both visually presented in a conventional manner by file folder icons and are identified as File Folders. Local files 301 includes local files 209, 210 identified in FIG. 2, and which by way of example happen to be a video clip (avi extension) and an executable application (exe extension). Other local files include text documents (txt extension), image documents (gif and jpg extensions), and a media file (mp3 extension). Of course, any of the local files may be opened (or launched in the case of the executable application) in a conventional manner with a mouse click or other appropriate action on the file icon or name in the screen display.

FIG. 4 illustrates a screen display example of the contents of Remote file subdirectory 211. This directory may be opened for display in a conventional manner with a mouse click or other appropriate action on file name or folder icon in FIG. 3. In FIG. 4, Subdirectory 211 is entitled "Remote" and includes a number of virtual files 401. All the virtual files have a visually unique icon 402 to signify that they are virtual files, and a unique file Type "SDF" which also signifies that they are virtual files. Further, the fact that all files are all shown as having a file size of 0KB is suggestive though not conclusive that they are virtual files.

Herein, it will be understood that the terms "directory" and "subdirectory" are relative terms. In a hierarchy of directories and subdirectories, a directory which contains one or more subdirectories may itself be considered as a subdirectory within another directory. Further, it will be understood that the particular hierarchy shown in FIG. 2 and discussed with reference to FIG. 3 and 4 while indicative of a preferred structure is merely an example. For example, while it is considered desirable to maintain virtual files 401 in subdirectory 211 to more clearly segregate them from local files 301 in subdirectory 207, they could be maintained with local files 301 directly within subdirectory 207. The virtual files would remain distinguishable from the local files by virtue of their visually unique icons 402 and their SDF file type designation. As a further example, it will be recognized that in situations where there never will be more than one

file sharing group, then subdirectory 207 can be omitted and its contents managed within directory 203.

FIG. 5 describes the steps which occur when a user ostensibly with access to files in a sharing group connects online with network 120 for a file transfer session. At step 501, the user is required to connect with and to provide authentication information such as a user name and password to authentication server 150. If required information is provided, then the user is authenticated at step 502 and the session continues. If not, the session ends.

If the session continues, the user next at step 503 may receive a file availability notification as discussed below in relation to FIG. 9. Then, at step 504, the user is in a position to select with his local file manager one or more files to download from other users in the group or to upload or push to other users in the group.

Appropriate selection depends upon whether the user wishes to download or upload a file. To download a file, the user selects and opens a virtual file in the same manner that he would select and open a local file (e.g. by double clicking with a mouse). To select a file for upload, the user first highlights the file (e.g. by single clicking with a mouse) as shown by the example of local file 540 (named "328i") in FIG. 5A, then initiates transfer of the highlighted file with the selection of "Send with SynerDrive ..." in pop-up menu 545 also shown in FIG. 5A.

When a file is selected, then at step 506 the system looks for a peer-to-peer link over network 120 to the user from whom the file is to be downloaded or to whom the file is to be uploaded. If there is a failure to achieve a link (e.g. if the other user is not online), then steps 503 and 504 repeat. If a link is achieved, then file transfer (download or upload) begins. As indicated by step 507, the file may be encrypted or compressed before it is sent - but this step is optional. Likewise, step 508 which provides a screen display window to monitor and track file transfer progress is optional.

FIG. 5B shows an example of a suitable monitoring window 550 for a case where the user is downloading a shared file. FIG. 5C shows an example of a suitable monitoring window 560 for a case where the user is uploading a shared file. In this case, the file transfer is complete and the user has been alerted accordingly by the confirming message "File has been uploaded successfully" in window 560 (optional step 509).

Next, at optional step 509 which applies in cases where a file has been uploaded, a file availability notice is sent to target users. This step is described below more completely with reference to FIG. 9.

As indicated, all of steps 507 through 510. In any given system one or more or all of them may be omitted. In case, and until such time as the user disconnects at step 511, the system cycles back to step 503 after file transfer is complete.

During the time that the user is online, a metadata synchronization process 505 runs periodically in parallel with file transfer steps 503-510. This process is more completely described in FIG. 6 where the first steps 601, 602 are to identify and locate other online users (viz. other users in the sharing group that connected with authentication server 150) and to establish communication links with those users. At step 604, metadata is sent by a given user describing groups (created or deleted) and the local files that the given user has available for other users, including assigned access permissions. At step 603, a given user receives metadata that describes groups (created or deleted) and the local files that other users have available for the given user, including assigned access permissions.

When metadata is received, then at step 605 it is interpreted and sorted so that the user has access to the most current list of local files available from other users through their local file managers and to specific information on individual files (e.g. name, size, owner's notes, file type, creation date, etc.) all of which is part of the metadata.

When metadata on a particular local file is first received, then a location reference to the locally stored file in the sending computer is created from the metadata and stored in the memory of the receiving computer. Using the local file manager in the receiving computer, the location reference is managed as a virtual file in a designated directory (e.g. as in the example of virtual files 401 shown in FIG. 4).

Following step 605, the system then awaits the next cycle of synchronization at step 606. A key aspect of the up-to-date integrity of the system is the repeated transmission of the metadata which pertains to each local file. Preferably, the intervals between transmissions from each user can be configured, but they are also preferably relatively frequent (e.g. 1 minute). If a local file is updated, then the metadata relating to that file is updated to reflect the most current version of the file. The information that all online users have then remains substantially synchronized.

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The process of shared file management shown generally in FIG. 7 and begins at step 701 when a user opens a top sharing directory (e.g. directory 203) using his local file manager. Within the top sharing directory the user is free at step 702 to create or delete subdirectories (e.g. subdirectory 207) for differing projects, interests, etc. which are based on the user's choice. A process for such creation or deletion is described in more detail in FIG. 11. If the effect of any changes made is to alter metadata, then the changes will be reflected at step 703 on the next cycle of metadata synchronization (FIG. 6).

As indicated in step 704, the user is free to grant any other users permission to access files in a defined group by the file access permission process described in FIG. 8. Any changes in access permission will be reflected at step 704 on the next cycle of metadata synchronization (FIG. 6).

When a user opens up one of the sharing groups, then as indicated in step 706 and as described above in the example of FIG. 3 the user sees local files which could have been created by the user or downloaded from others users in the group. As well the user sees a remote directory (e.g. subdirectory 211) which contains virtual files.

FIG. 7 also notes that a user within a sharing group is free to create as many subdirectories for subgroups as may be needed (step 707); that the user is free to separate access permission to each local file or to inherit permission from a parent directory (step 708); and that a user may select one or more files in the remote directory for download as described in relation to FIG. 5 (step 709).

Referring now to the process of sending file availability notifications, it will be seen in FIG. 9, steps 901, 902, that when a file to be shared is made available by a given user for retrieval by sharing users or has been pushed or uploaded to sharing users, then the given user may select the file with his local file manager, and may choose to give sharing users separate notice that the particular file is available for sharing. A separate notification may be considered desirable in various circumstances where a sharing user may otherwise not realize in a timely manner that the file is available or that it has been uploaded. In the absence of separate notification, the availability of a particular file may not become apparent to the sharing users unless and until he makes a point of examining the contents of the sharing directory in which the file has been placed. As indicated in step 903, and depending upon a sharing user's choice of how to be notified about file availability, an email, pop-up window message, SMS (Short Message Service), or other suitable message may be sent.

An example of an email file availability notification is shown in FIG. 9A. Here, a sharing user “Rui” at rui.chen@mindtrend.com is being notified by “David Koo” that file “cthd.avi” is available for retrieval.

If a file sharing group is to be deleted, a process for doing so is described in FIG. 10.

- 5 More particularly, if a user wishes to be delete a group, then at step 1001 the group is deleted if it is not shared with any other users. If it is shared with other users, then the group is marked for deletion and other users sharing the group are notified. Then, at step 1002, other users who are notified can vote on whether they want to delete the group. If it is determined at step 1003 that all sharing users have not voted to delete the group, then the group is not deleted. But, at step 10 1004, the group then will be hidden from those who voted to delete. If it is determined at step 1003 that all sharing users have voted to delete the group, then the group is permanently deleted at step 1005.

- 15 A variety of modifications, changes and variations to the invention are possible within the spirit and scope of the following claims, and will undoubtedly occur to those skilled in the art. The invention should not be considered as restricted to the specific embodiment that has been described and illustrated with reference to the drawings.

WE CLAIM:

1. In a communication system comprising first and second computers connectable to a network for communication with each other, each of said computers including a memory and a user interface for displaying and for interacting with files stored in said memory, each of said computers being programmed with a native operating system, said operating system including a native file manager for organizing files in directories and subdirectories, a method of file sharing comprising the following steps in any appropriate order:
- (a) managing within a first directory defined in said first computer with said file manager a first file locally stored in the memory of said first computer;
 - (b) creating with said first computer a first set of metadata stored in the memory of said first computer, said first set of metadata comprising data relating to said first file;
 - (c) if said first file is updated, then updating said first set of metadata;
 - (d) repeatedly transmitting said first set of metadata via said network from said first computer to said second computer; and,
 - (e) in response to reception by said second computer of said first set of metadata:
 - (i) if not already created, then creating from said first set of metadata a first location reference in the memory of said second computer, said first location reference being a reference to said first file locally stored in the memory of said first computer;
 - (ii) managing said first location reference as a virtual file within a second directory defined in said second computer with said file manager; and,
 - (iii) if said first set of metadata is updated, then updating said first location reference.
2. A method as defined in claim 1, further comprising:
- (a) utilizing said first location reference for transmitting a transfer request via said network from said second computer to said first computer; and;

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- (b) in response to reception of said transfer request by said first computer,
transmitting said first file from said first computer to said second computer.
3. A method as defined in claim 1, further comprising the step of pushing said first file via
said network from said first computer to said second computer.
- 5 4. A method as defined in claim 1, 2 or 3, wherein said virtual file is visually presented by
the user interface of said second computer within said second directory in a manner visibly
distinct from any local file or local files also within said second directory.
5. A method as defined in claim 1, 2 or 3, wherein said virtual file is managed within a file
subdirectory within said second directory.
- 10 6. A method as defined in claim 1, 2 or 3, wherein said first set of metadata is repeatedly
transmitted from said first computer to said second computer at configurable intervals.
7. A method as defined in claim 1, further including the following steps in any appropriate
order:
- 15 (a) managing within said second directory a second file locally stored in the memory
of said second computer;
- (b) creating with said second computer a second set of metadata stored in the memory
of said second computer, said second set of metadata comprising data relating to
said second file;
- (c) if said second file is updated, then updating said second set of metadata;
- 20 (d) repeatedly transmitting said second set of metadata via said network from said
second computer to said first computer; and,
- (d) in response to reception by said first computer of said second set of metadata:
- 25 (i) if not already created, creating from said second set of metadata a second
location reference in the memory of said first computer, said second
location reference being a reference to said second file locally stored in the
memory of said second computer;
- (ii) managing said second location reference as a virtual file within said first
directory; and,

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- (iii) if said second set of metadata is updated, then updating said second location reference.
- 8. A method as defined in claim 7, further comprising:
 - (a) utilizing said second location reference for transmitting a transfer request via said network from said first computer to said second computer; and;
 - (b) in response to reception of said transfer request by said second computer, transmitting said second file from said second computer to said first computer.
- 9. A method as defined in claim 7, further comprising the step of pushing said second file via said network from said second computer to said first computer.
- 10. A method as defined in claim 7, 8 or 9, wherein:
 - (a) said virtual file with said second directory is visually presented by the user interface of said second computer within said second directory in a manner visibly distinct from any local file or local files also within said second directory; and,
 - (b) said virtual file in said first directory is presented is visually presented by the user interface of said first computer within said first directory in a manner visibly distinct from any local file or local files also within said first directory.
- 11. A method as defined in claim 7, 8 or 9, wherein:
 - (a) said virtual file within said second directory is managed within a file subdirectory within said second directory; and,
 - (b) said virtual file within said first directory is managed within a file subdirectory within said first directory.
- 12. A method as defined in claim 7, 8 or 9, wherein:
 - (a) said first set of metadata is repeatedly transmitted from said first computer to said second computer at configurable intervals; and,
 - (b) said second set of metadata is repeatedly transmitted from said second computer to said first computer at configurable intervals.

13. In a communication system comprising first and second computers connectable to a network for communication with each other, each of said computers including a memory and a user interface for displaying and for interacting with files stored in said memory, each of said computers being programmed with a native operating system, said operating system including a native file manager for organizing files in directories and subdirectories, a method of file sharing comprising the following steps in any appropriate order:

- (a) storing a local file in the memory of said first computer;
- (b) managing said local file within a first directory defined in said first computer with said file manager;
- 10 (c) storing a location reference in the memory of said second computer, said location reference being a reference to said local file in said first computer;
- (d) managing said location reference as a virtual file within a second directory defined in said second computer with said file manager; and,
- 15 (e) repeatedly transmitting metadata associated with said local file from said first computer to said second computer to create said location reference and, in the event that said local file is updated, to correspondingly update said location reference.

14. A method as defined in claim 13, wherein said virtual file is visually presented by the user interface of said second computer within said second directory in a manner visibly distinct from any local file or local files also within said second directory.

20 15. A method as defined in claim 14, further comprising the steps of:

- (a) selecting said virtual file using the user interface of said second computer;
- (b) in response to said selection, utilizing said location reference for transmitting a transfer request via said network from said second computer to said first computer; and,
- 25 (c) in response to reception of said request by said first computer, transmitting said local file via said network from said first computer to said second computer.

16. A method as defined in claim 13 wherein said virtual file is managed within a file subdirectory within said second directory.

17. A method as defined in any one or more of the preceding claims, wherein said communication system further comprises an authentication server connected to said network for controlling communication between said computers, and wherein execution of said method by said computers is subject to the preliminary step of providing prescribed authentication information from said computers to said authentication server.

18. A method as defined in any one or more of the preceding claims, wherein said network is a wide area network.

19. A method as defined in any one or more of the preceding claims, wherein said network is the Internet.

20. A method as defined in any one or more of the preceding claims, wherein said network is a local area network.

21. A first computer connectable to a network for receiving communications from and sending communications to a second computer,

- (a) said first computer including a memory and a user interface for displaying and for interacting with files stored in said memory;
- (b) said first computer being programmed with a native operating system, said operating system including a native file manager for organizing files in directories and subdirectories; and,
- (c) said first computer including a file sharing software application stored in said memory, said application comprising:
 - (i) means for repeatably receiving from said second computer via said network a set of metadata comprising data corresponding to properties of a file locally stored in a memory of said second computer, said set of metadata including data providing a location reference to said locally stored file;
 - (ii) means interactive with said file manager for processing said received set of metadata to create a virtual file within a directory defined in said first computer, said virtual file including file properties corresponding to selected file properties of said file locally stored in said second computer;

- (iii) means for comparing the set of metadata received on one cycle of reception with the set of metadata received on a preceding cycle of reception and, if said set of metadata has been updated between said cycles, then updating the file properties of said virtual file; and,
- 5 (iv) means interactive with said location reference for transmitting to said second computer a request to transmit said file locally stored in said second computer from said second computer to said first computer.
20. A first computer as defined in claim 19, wherein said network is a wide area network.
21. A first computer as defined in claim 19, wherein said network is the Internet.
- 10 22. A first computer as defined in claim 19, wherein said network is a local area network.

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**PEER-TO-PEER FILE SHARING ON A COMPUTER NETWORK, EACH COMPUTER
USING ITS NATIVE FILE MANAGER**

ABSTRACT OF THE DISCLOSURE

Peer-to-peer file sharing is implemented within the environment of a communication
5 system comprising a plurality of computers connectable to a network for communication with
each other. Each of the computers includes a memory and a user interface for displaying and
interacting with files stored in the memory. As well, each of the computers is programmed with
a native operating system, the operating system including a native file manager. A file stored
locally within a conventional directory in a first computer is recognized on a second computer by
10 a location reference which is managed by the native file manager of the second computer as a
virtual file within a conventional directory in the second computer. To create and to maintain the
location reference up-to-date, metadata associated with the locally stored file is repeatedly
transmitted from the first computer to the second computer. The procedure extends to third,
fourth or any other number of computers.

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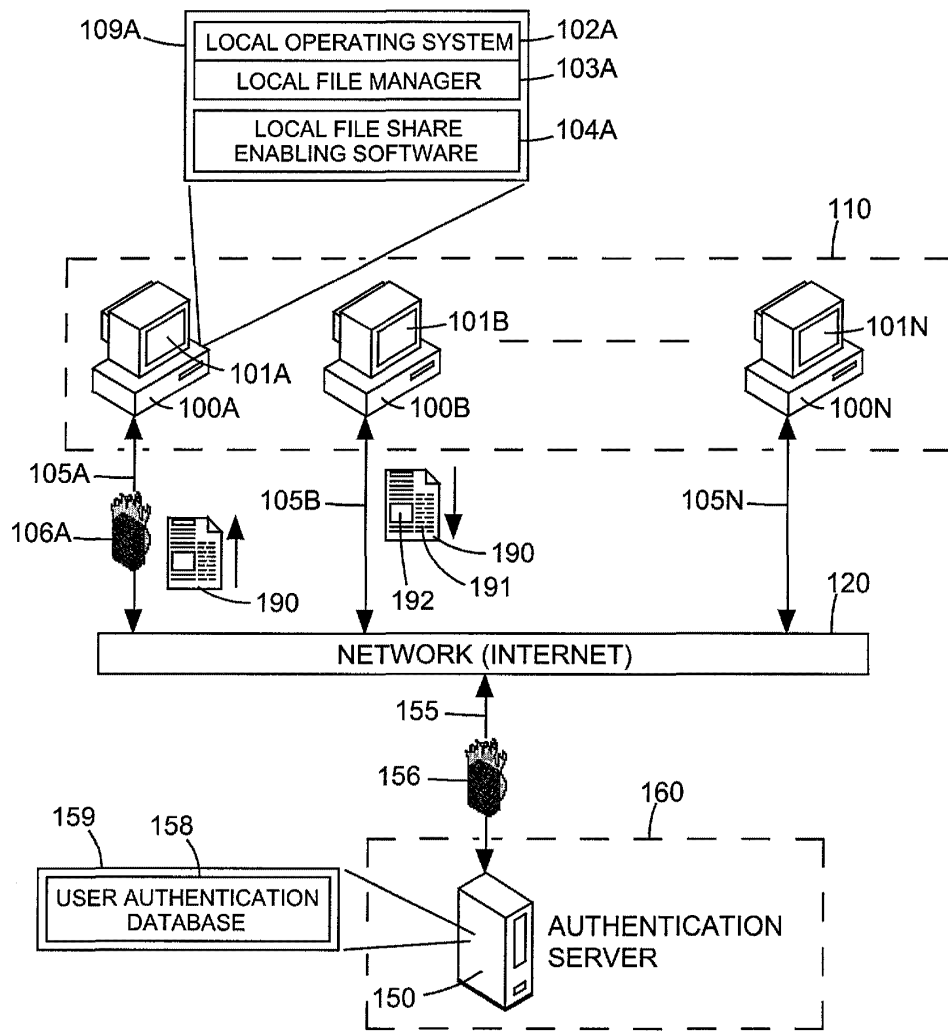


FIG. 1

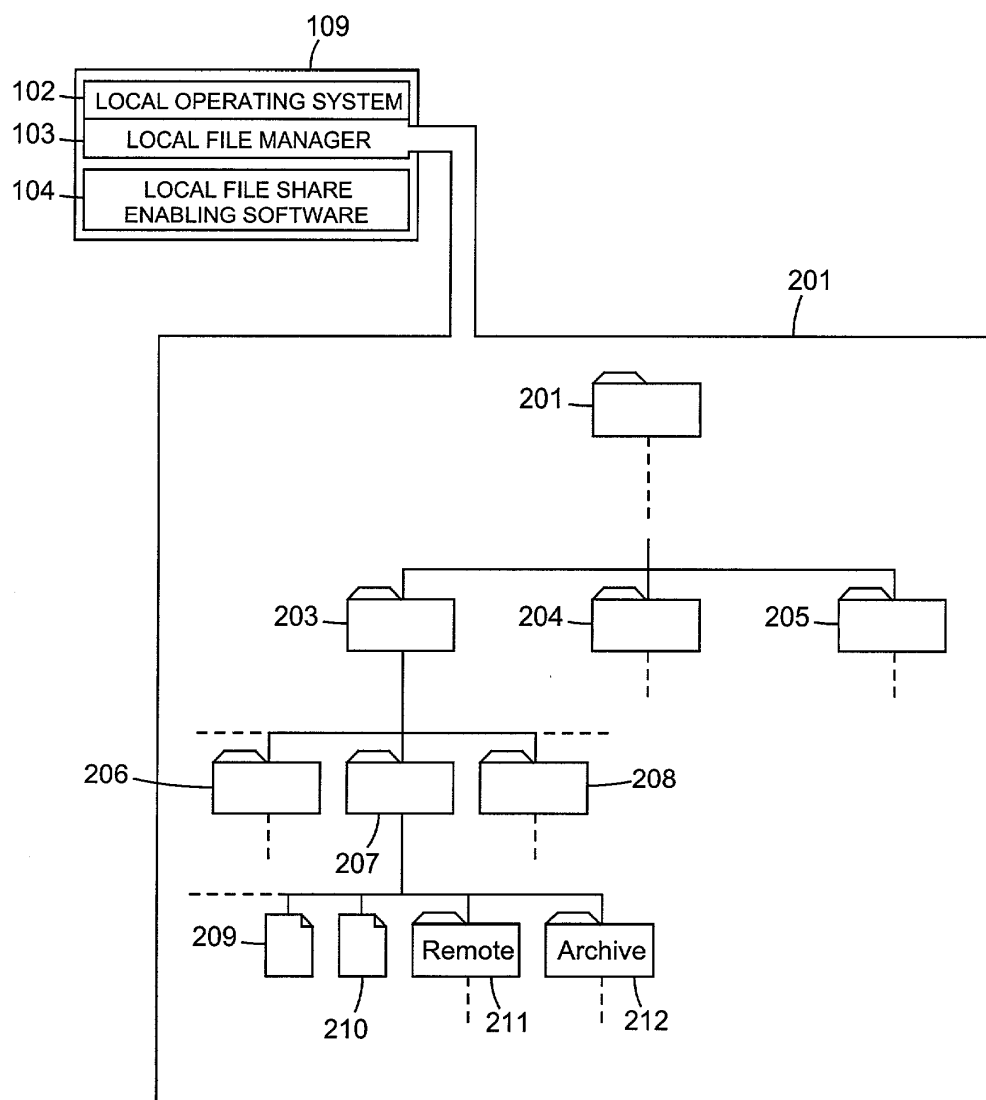


FIG. 2

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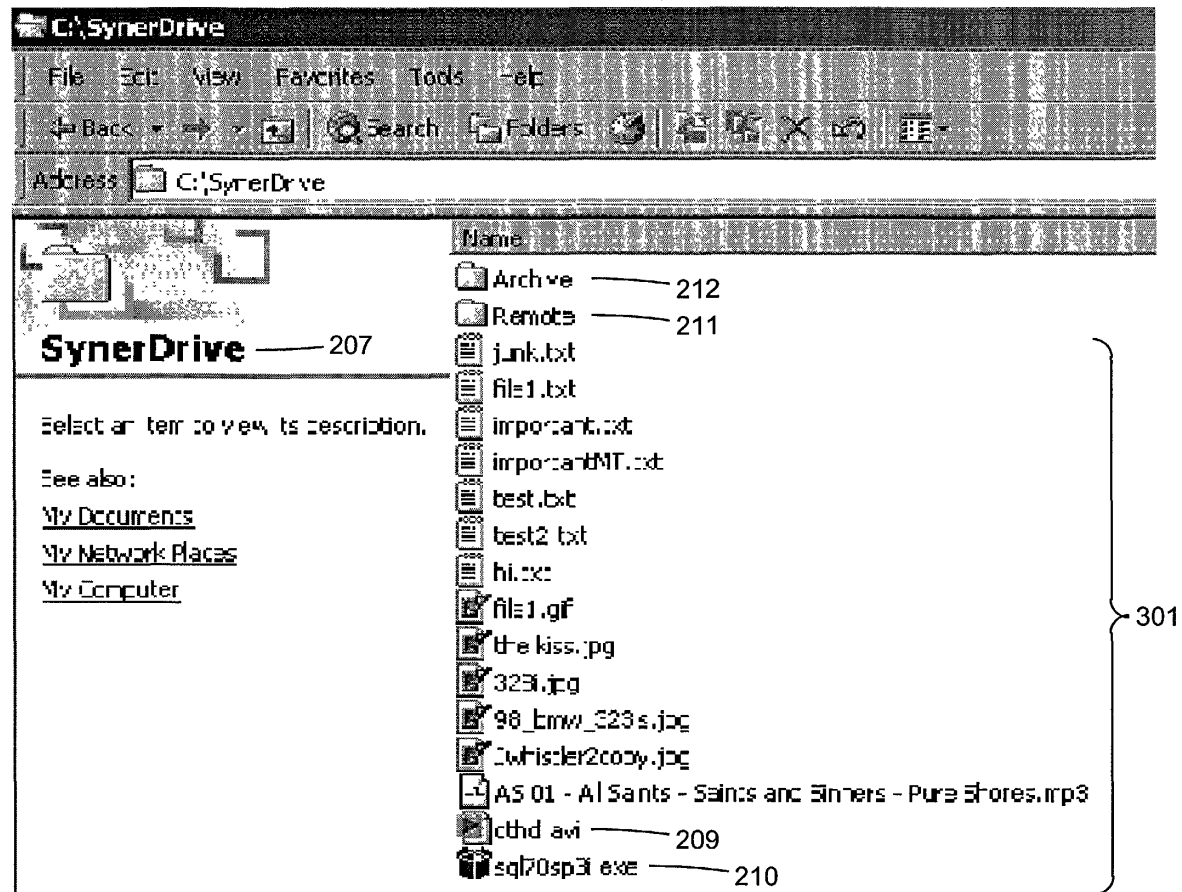
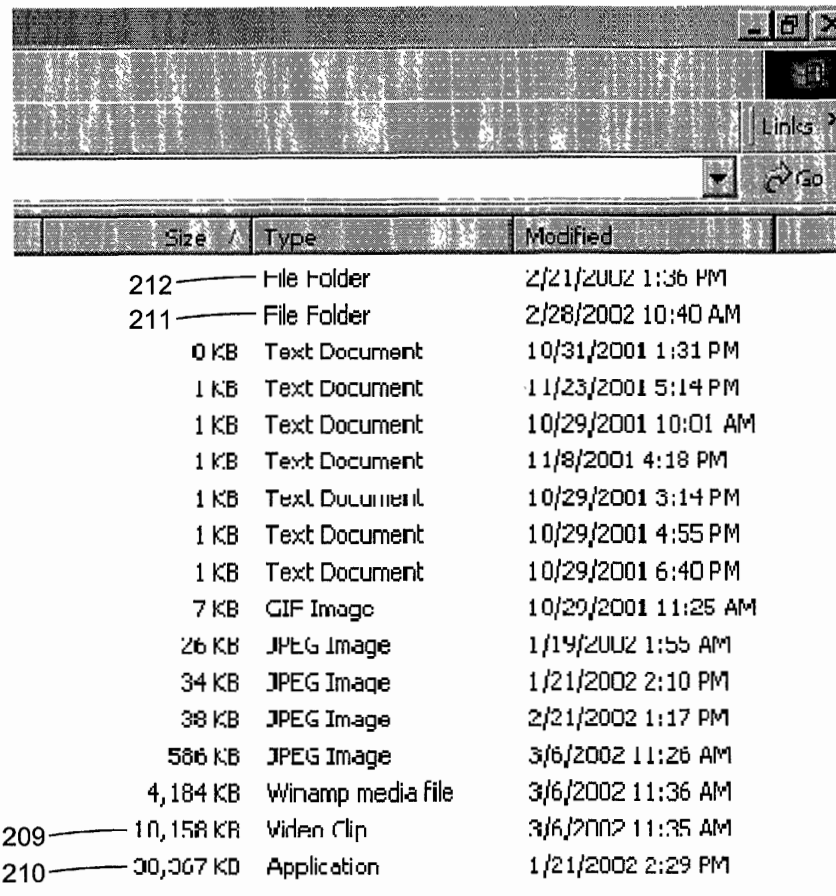


FIG. 3A

202040" 84457707



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	1 KB	Text Document	11/23/2001 5:14 PM
	1 KB	Text Document	10/29/2001 10:01 AM
	1 KB	Text Document	11/8/2001 4:18 PM
	1 KB	Text Document	10/29/2001 3:14 PM
	1 KB	Text Document	10/29/2001 4:55 PM
	1 KB	Text Document	10/29/2001 6:40 PM
	7 KB	GIF Image	10/29/2001 11:25 AM
	26 KB	JPEG Image	1/19/2002 1:55 AM
	34 KB	JPEG Image	1/21/2002 2:10 PM
	38 KB	JPEG Image	2/21/2002 1:17 PM
	586 KB	JPEG Image	3/6/2002 11:26 AM
	4,184 KB	Winamp media file	3/6/2002 11:36 AM
209	10,158 KB	Video Clip	3/6/2002 11:35 AM
210	30,367 KB	Application	1/21/2002 2:29 PM

FIG. 3A FIG. 3B

FIG. 3C

FIG. 3B

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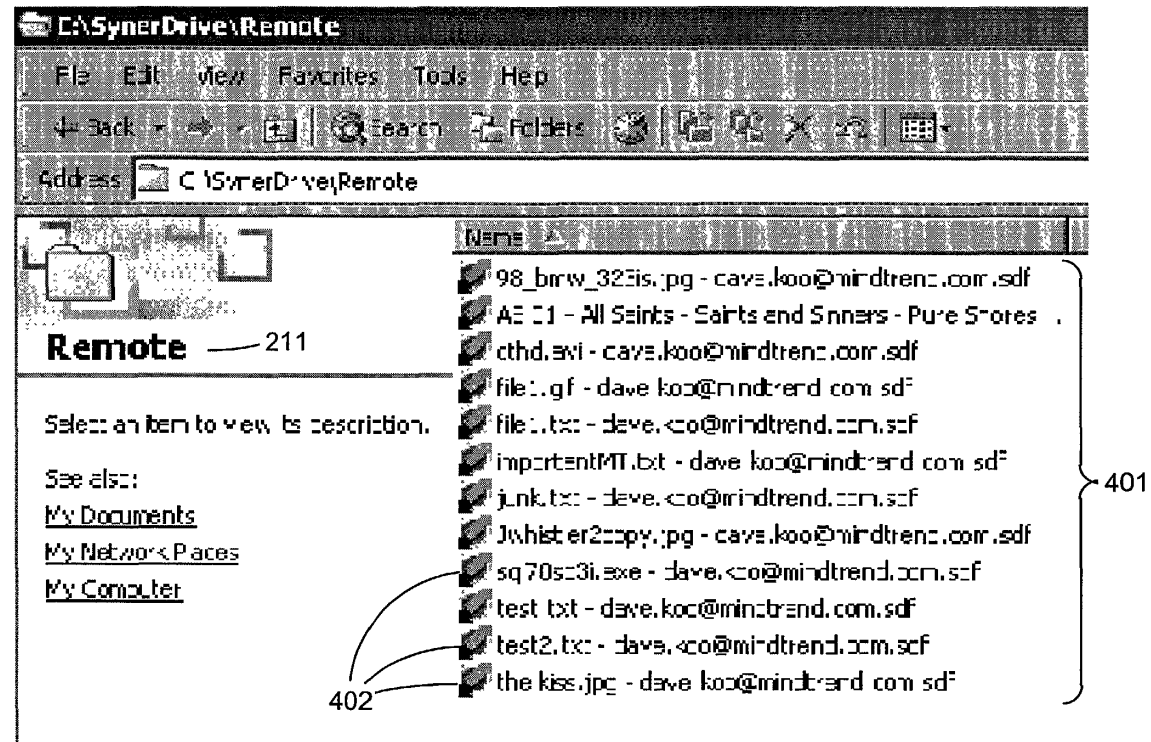
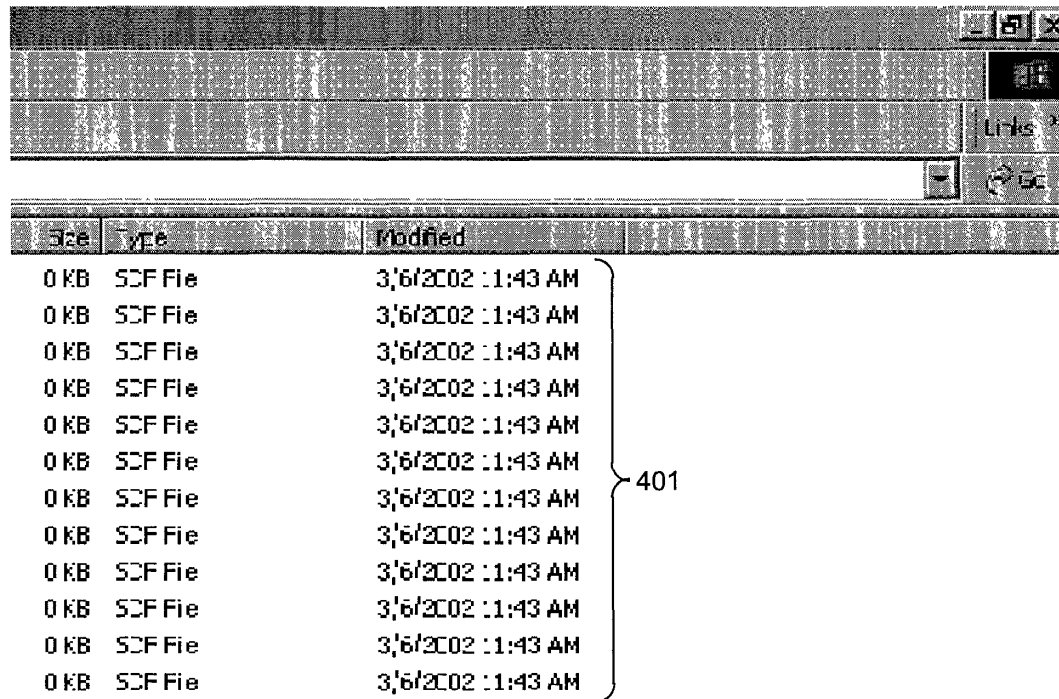


FIG. 4A

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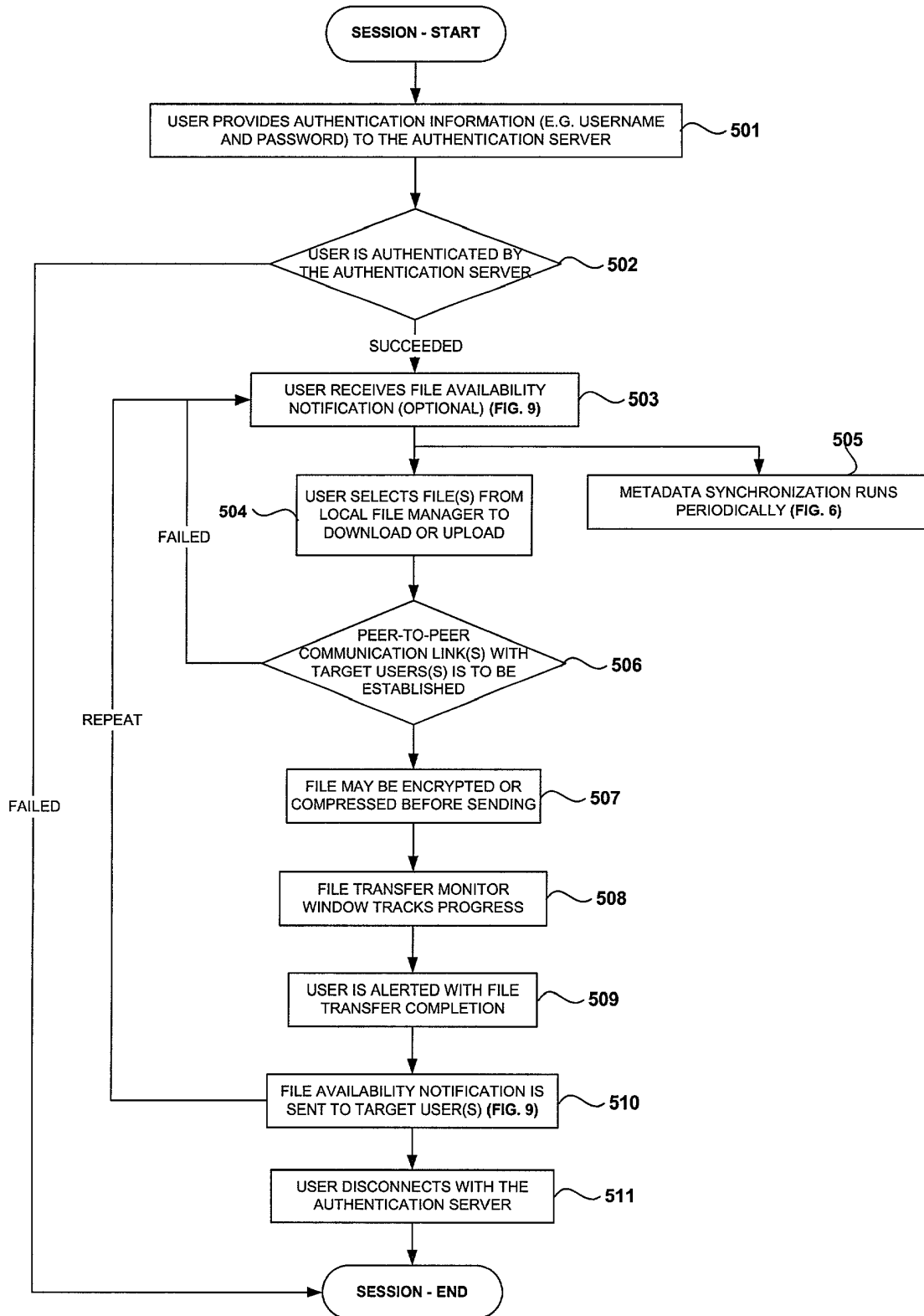
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FIG. 4A FIG. 4B

FIG. 4C

FIG. 4B

FIG. 5



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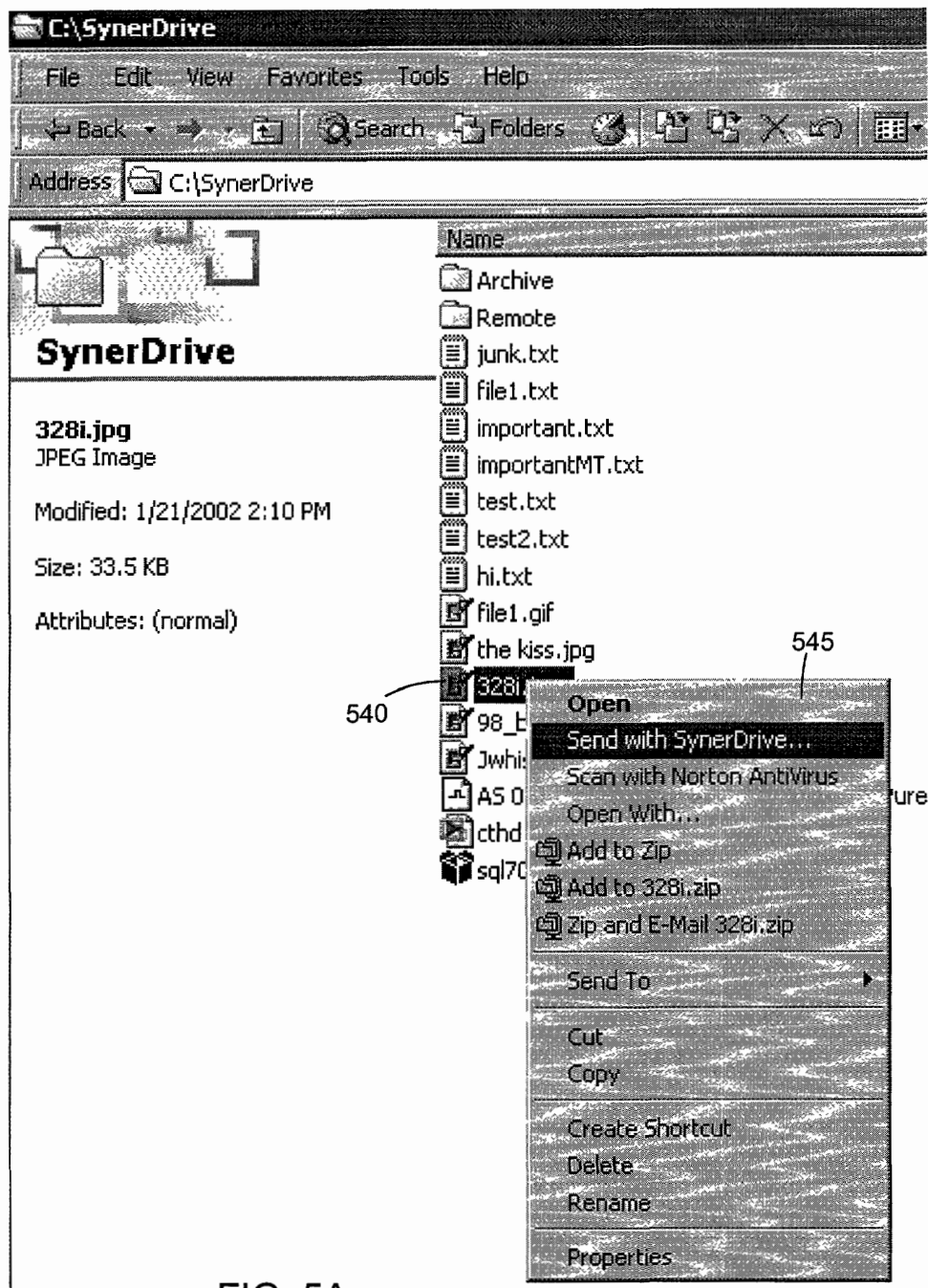
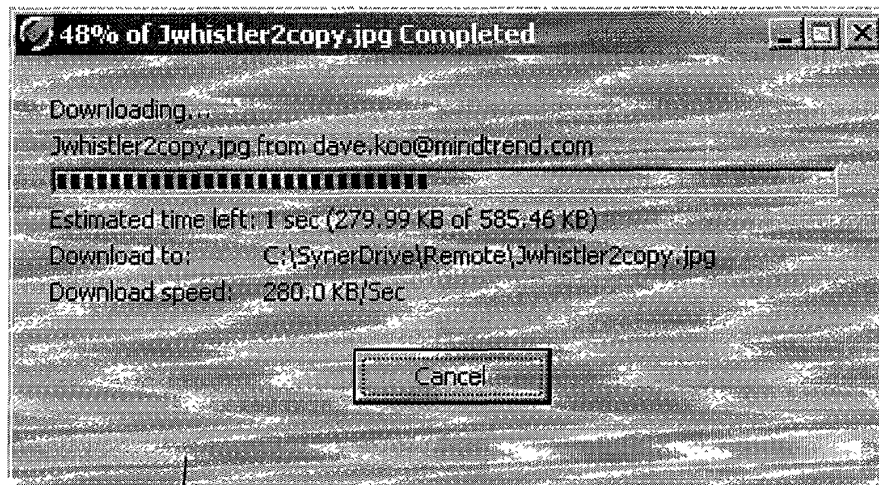


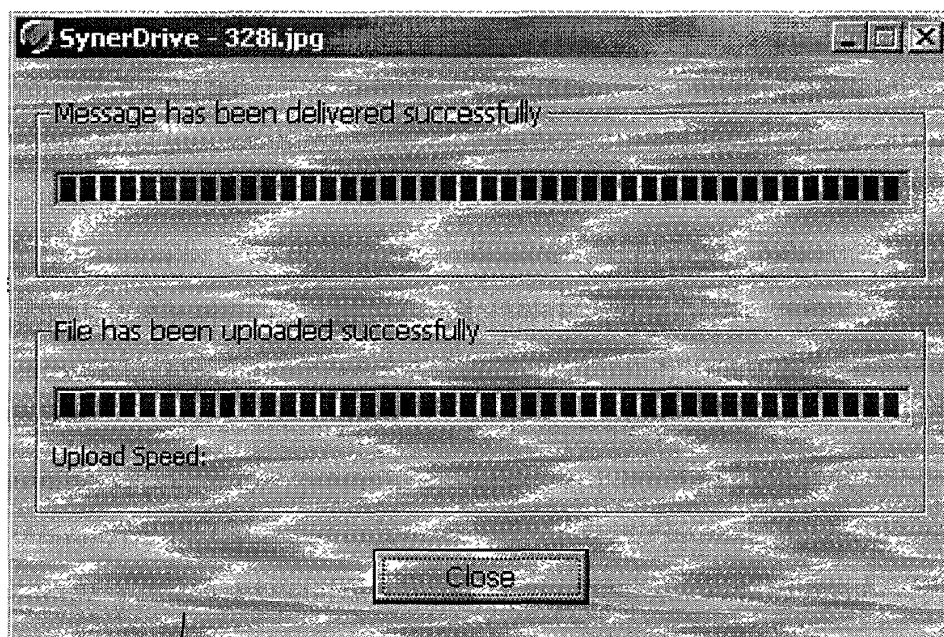
FIG. 5A

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FIG. 5B



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FIG. 5C

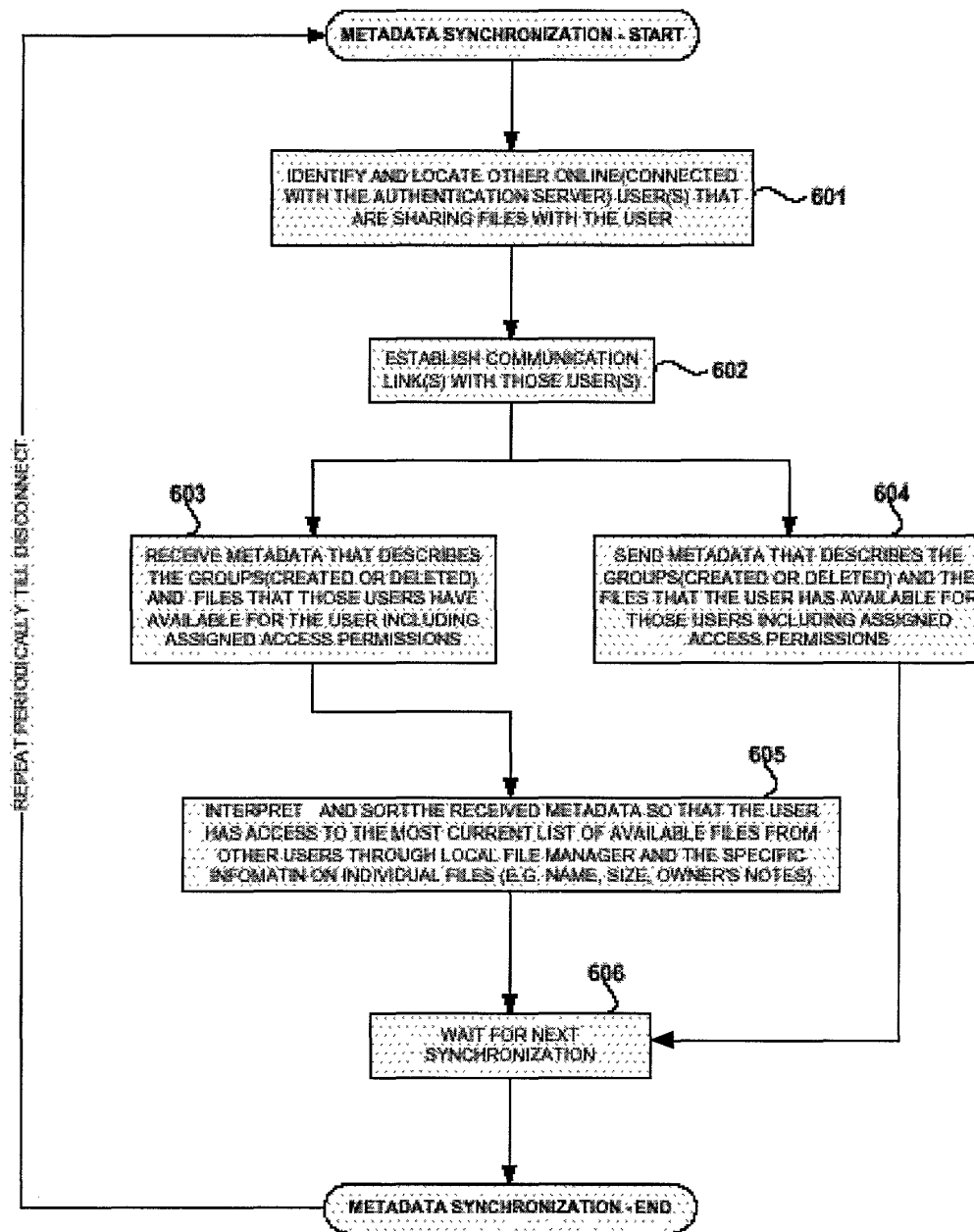


FIG. 6

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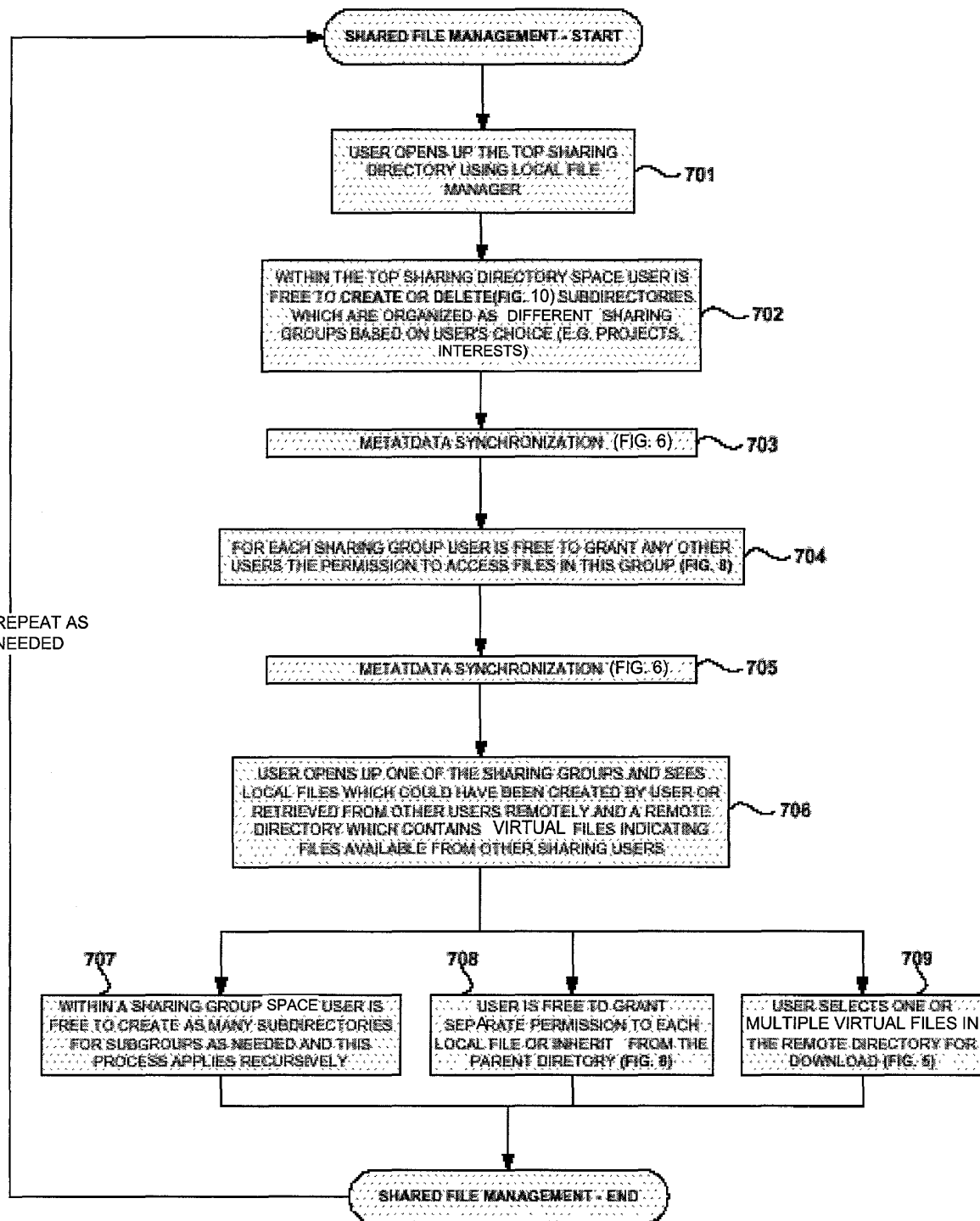


FIG. 7

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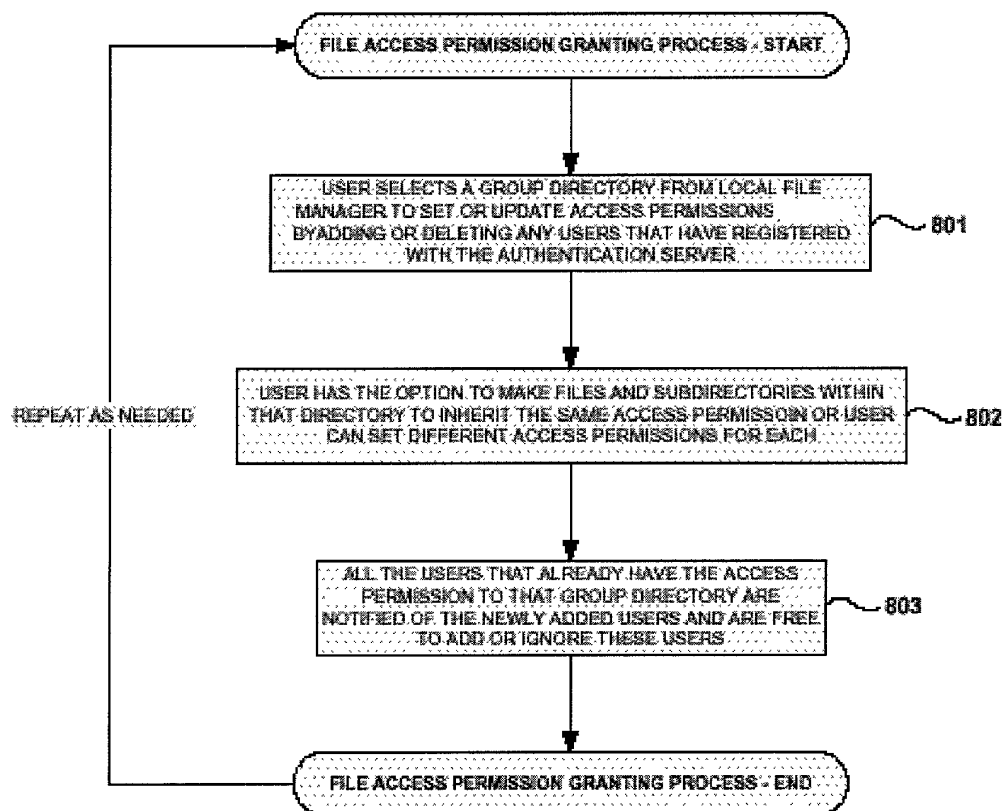


FIG. 8

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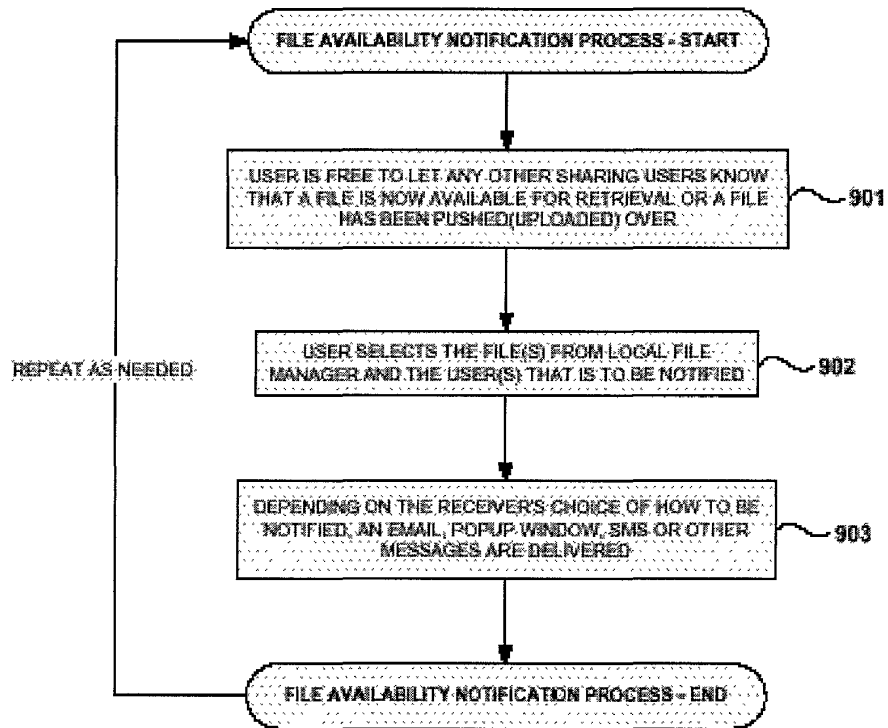


FIG. 9

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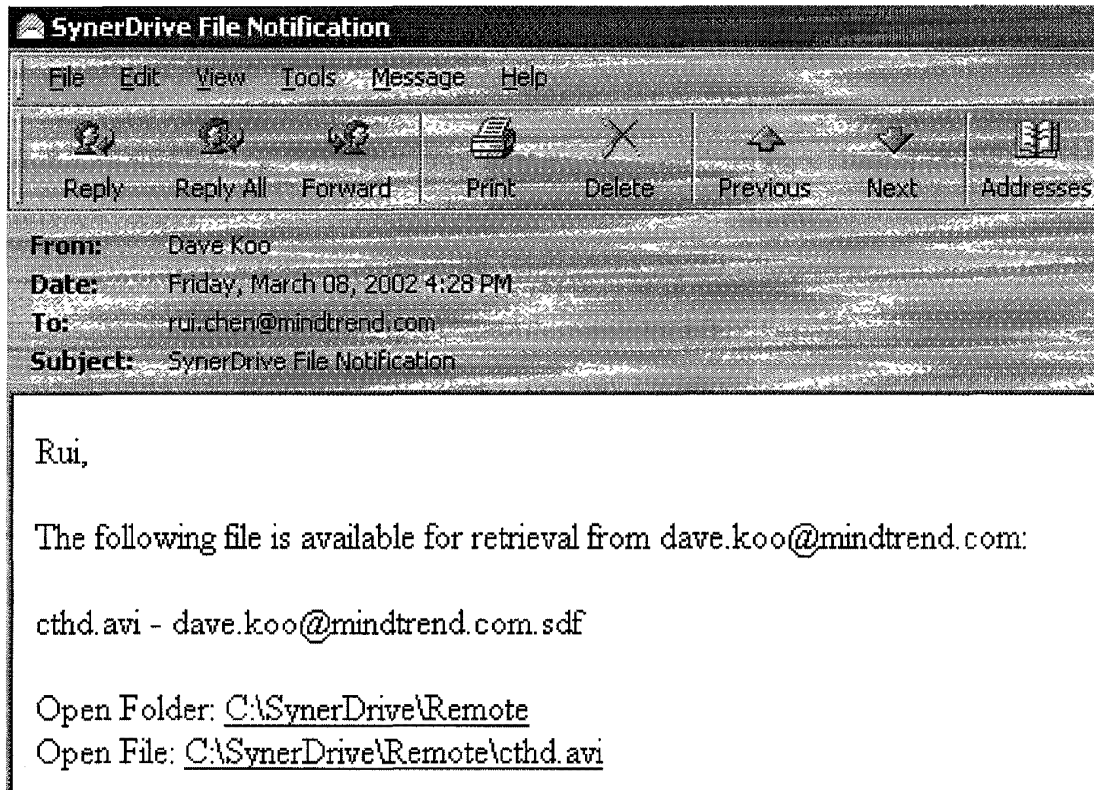


FIG. 9A

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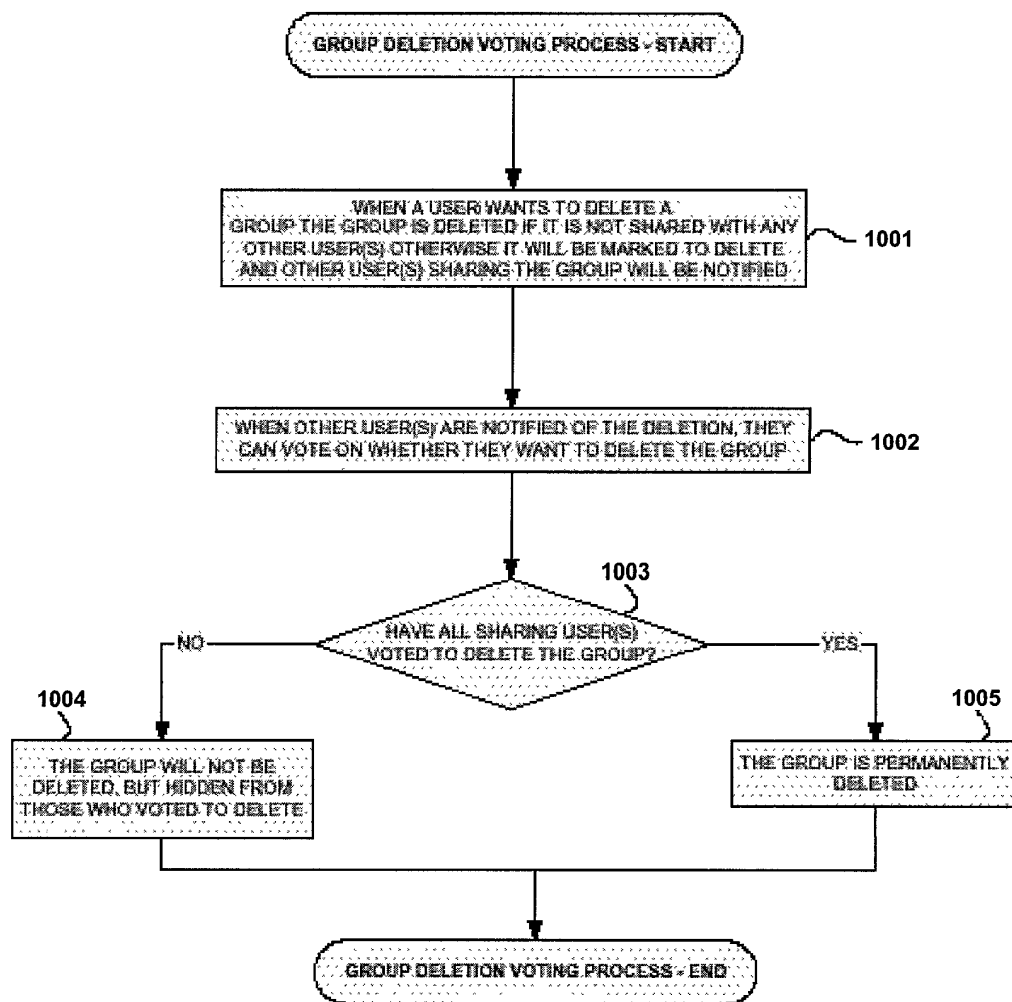
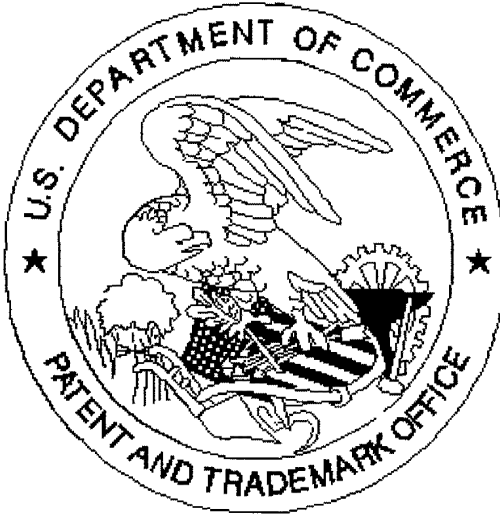


FIG. 10

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