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(54) SYSTEM AND METHOD FOR EXCHANGING IMAGES

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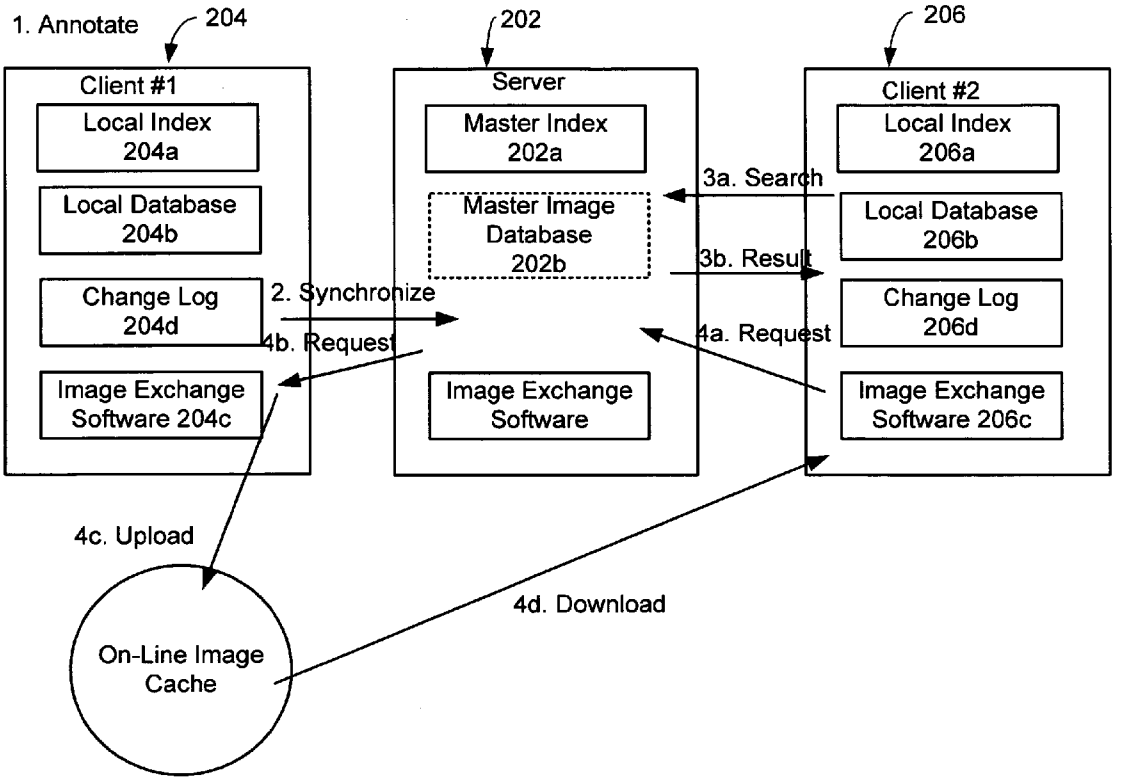
(57) **ABSTRACT**

A system and method for providing a peer-to-peer photo-sharing environment. The system includes: manual and automatic photo annotation at the client; periodic client-server synchronization; an index of client photos on a central server or a photo database that is resident on the central server, which is updated by the client-server synchronization function; end-user search functionality to search the centralized index or photo database; and transmission of the relevant photos to the client via an on-line image cache. In one embodiment, one client's new photos are automatically displayed on another client's computer (e.g., via screen saver or another mechanism).



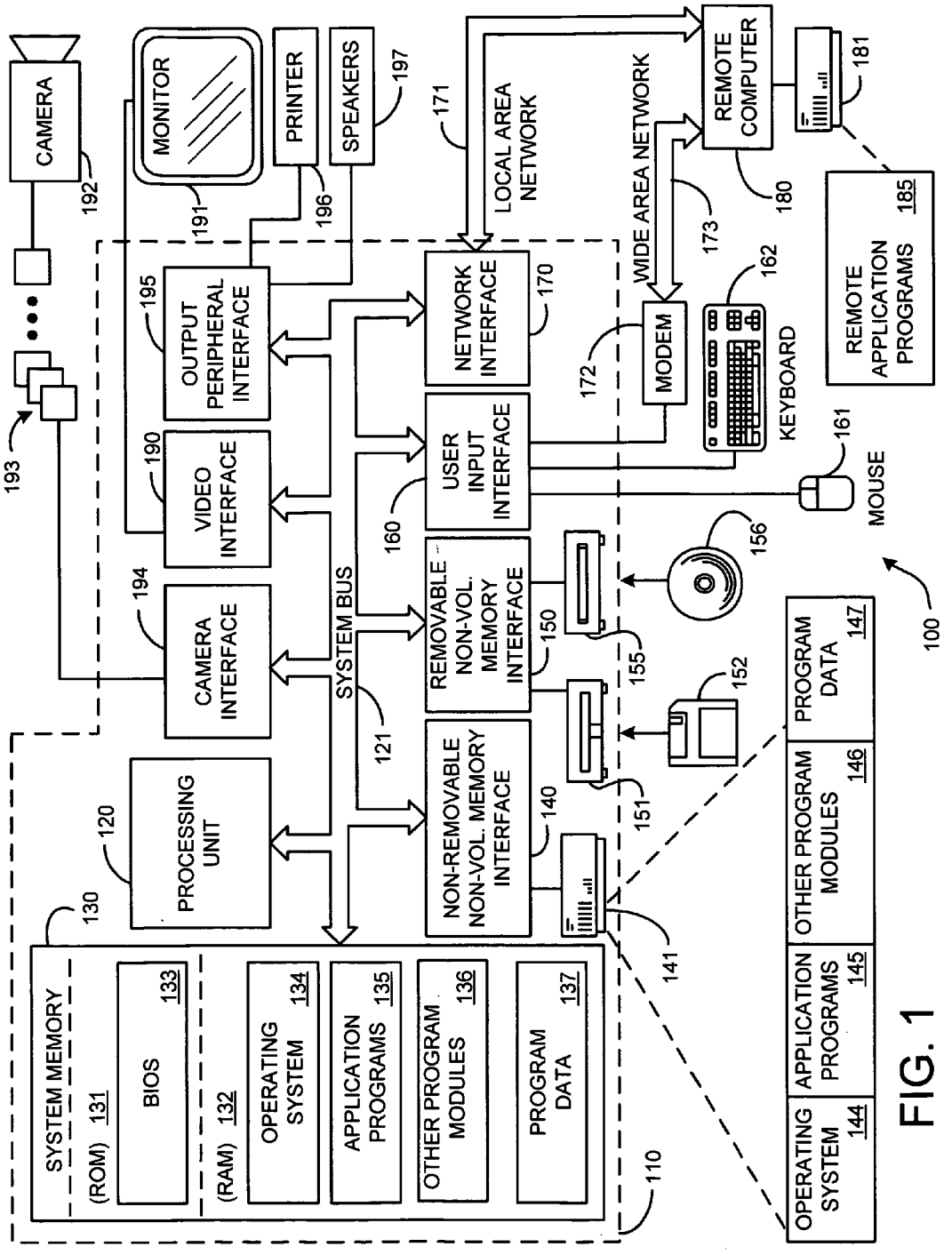

CAMERA
192
193
MONITOR
191
PRINTER
196
SPEAKERS
197
171
LOCAL AREA NETWORK
WIDE AREA NETWORK
REMOTE COMPUTER
180
181
173
REMOTE APPLICATION PROGRAMS
185
OUTPUT PERIPHERAL INTERFACE
195
NETWORK INTERFACE
170
MODEM
172
162
KEYBOARD
VIDEO INTERFACE
190
USER INPUT INTERFACE
160
161
MOUSE
CAMERA INTERFACE
194
SYSTEM BUS
121
REMOVABLE NON-VOL. MEMORY INTERFACE
150
155
156
152
151
NON-REMOVABLE NON-VOL. MEMORY INTERFACE
140
141
PROCESSING UNIT
120
130
SYSTEM MEMORY
(ROM) 131
BIOS 133
(RAM) 132
OPERATING SYSTEM 134
APPLICATION PROGRAMS 135
OTHER PROGRAM MODULES 136
PROGRAM DATA 137
110
OPERATING SYSTEM 144
APPLICATION PROGRAMS 145
OTHER PROGRAM MODULES 146
PROGRAM DATA 147
100

FIG. 1

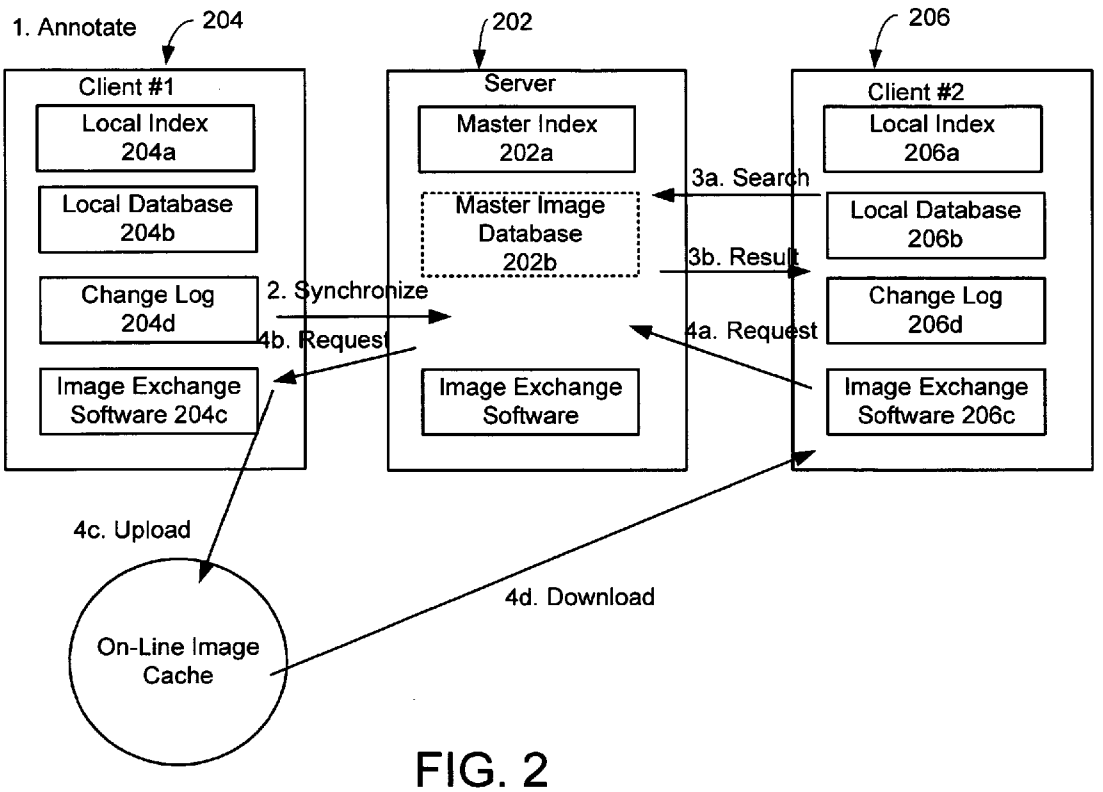

1. Annotate
204
202
206
Client #1
Local Index 204a
Local Database 204b
Change Log 204d
Image Exchange Software 204c
Server
Master Index 202a
Master Image Database 202b
Image Exchange Software
Client #2
Local Index 206a
Local Database 206b
Change Log 206d
Image Exchange Software 206c
2. Synchronize
3a. Search
3b. Result
4a. Request
4b. Request
4c. Upload
4d. Download
On-Line Image Cache

FIG. 2

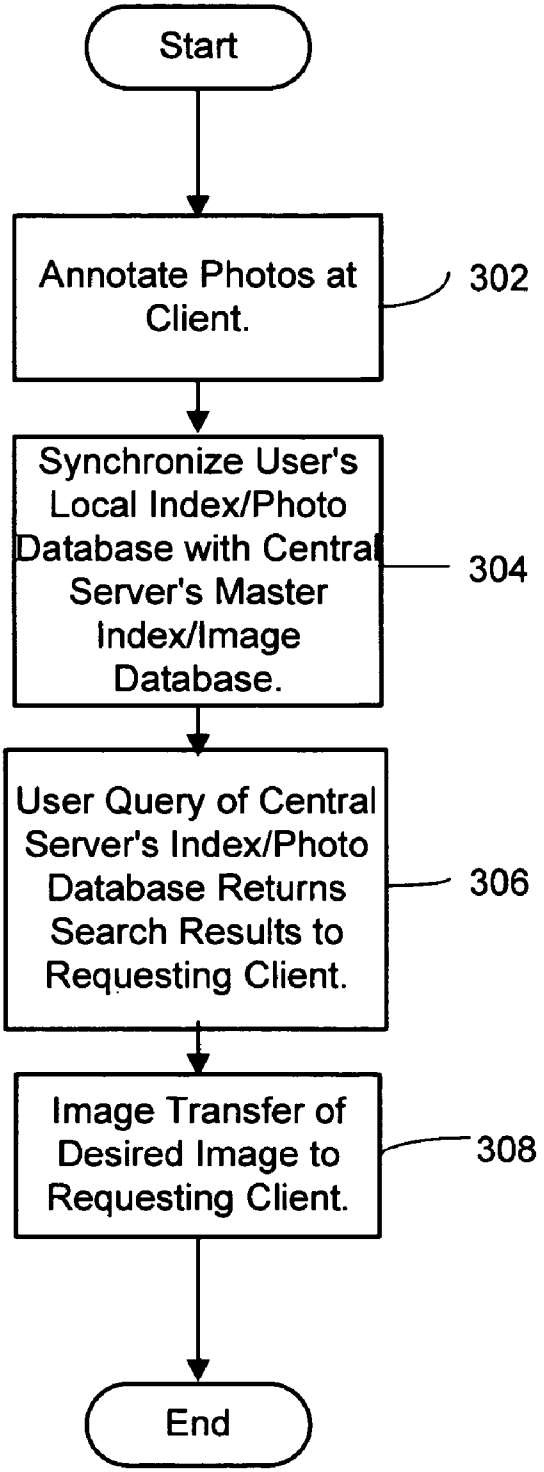

Start
Annotate Photos at Client.
302
Synchronize User's Local Index/Photo Database with Central Server's Master Index/Image Database.
304
User Query of Central Server's Index/Photo Database Returns Search Results to Requesting Client.
306
Image Transfer of Desired Image to Requesting Client.
308
End

FIG. 3

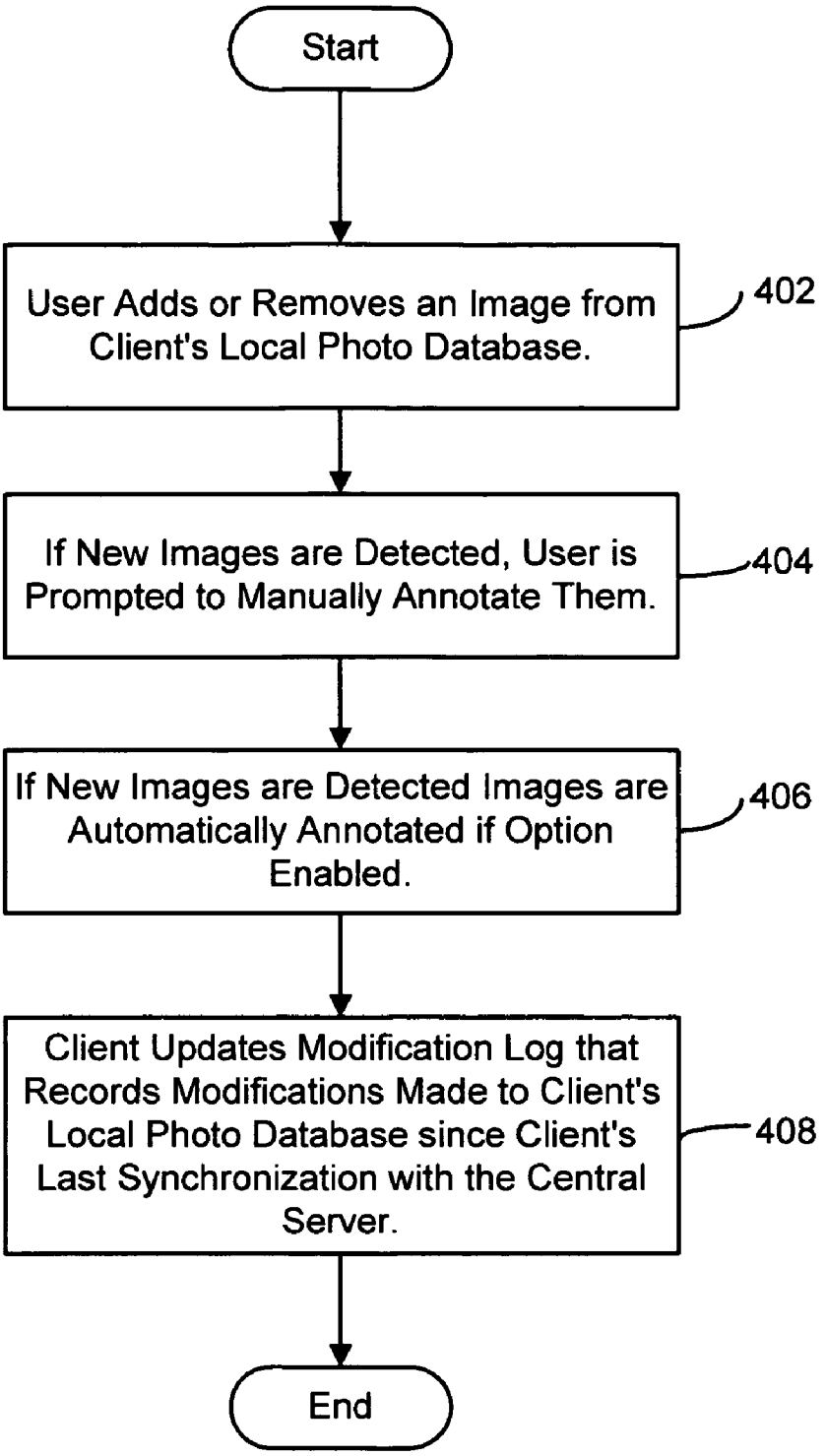

Start
User Adds or Removes an Image from Client's Local Photo Database.
402
If New Images are Detected, User is Prompted to Manually Annotate Them.
404
If New Images are Detected Images are Automatically Annotated if Option Enabled.
406
Client Updates Modification Log that Records Modifications Made to Client's Local Photo Database since Client's Last Synchronization with the Central Server.
408
End

FIG. 4

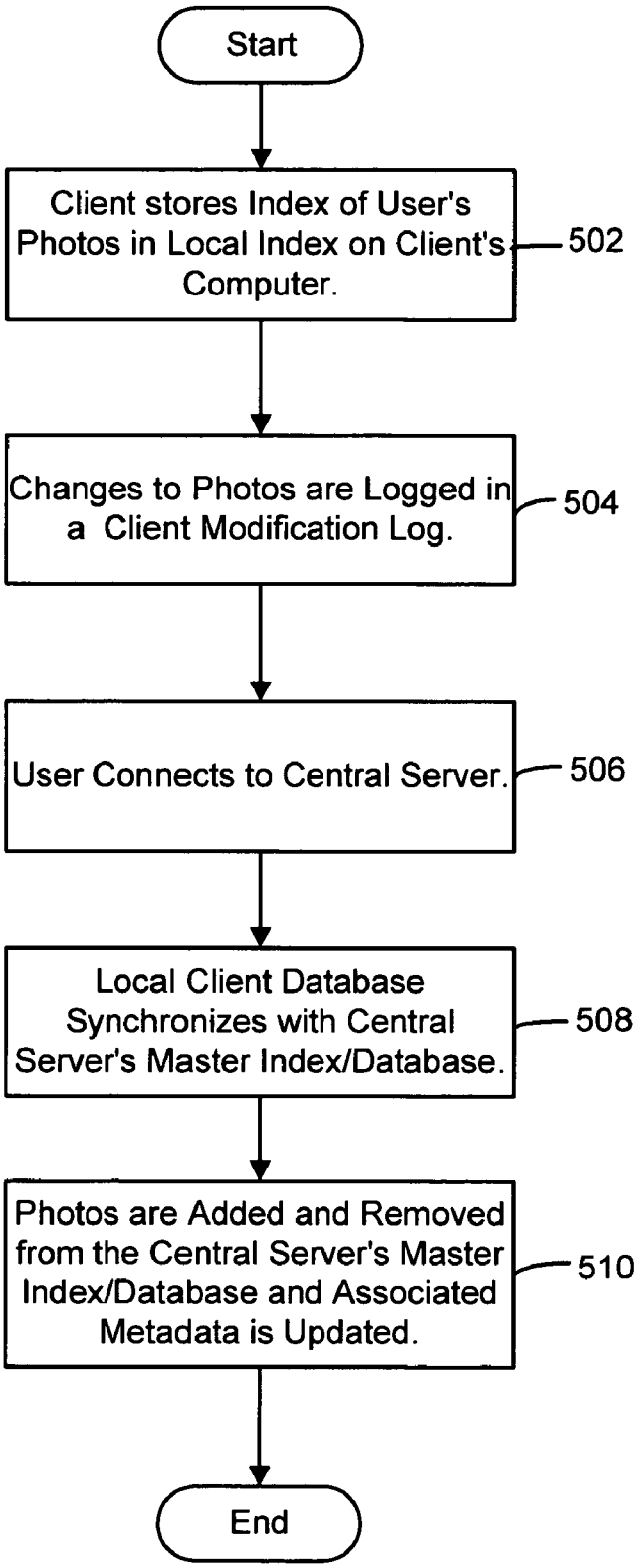

Start
Client stores Index of User's Photos in Local Index on Client's Computer.
502
Changes to Photos are Logged in a Client Modification Log.
504
User Connects to Central Server.
506
Local Client Database Synchronizes with Central Server's Master Index/Database.
508
Photos are Added and Removed from the Central Server's Master Index/Database and Associated Metadata is Updated.
510
End

FIG. 5

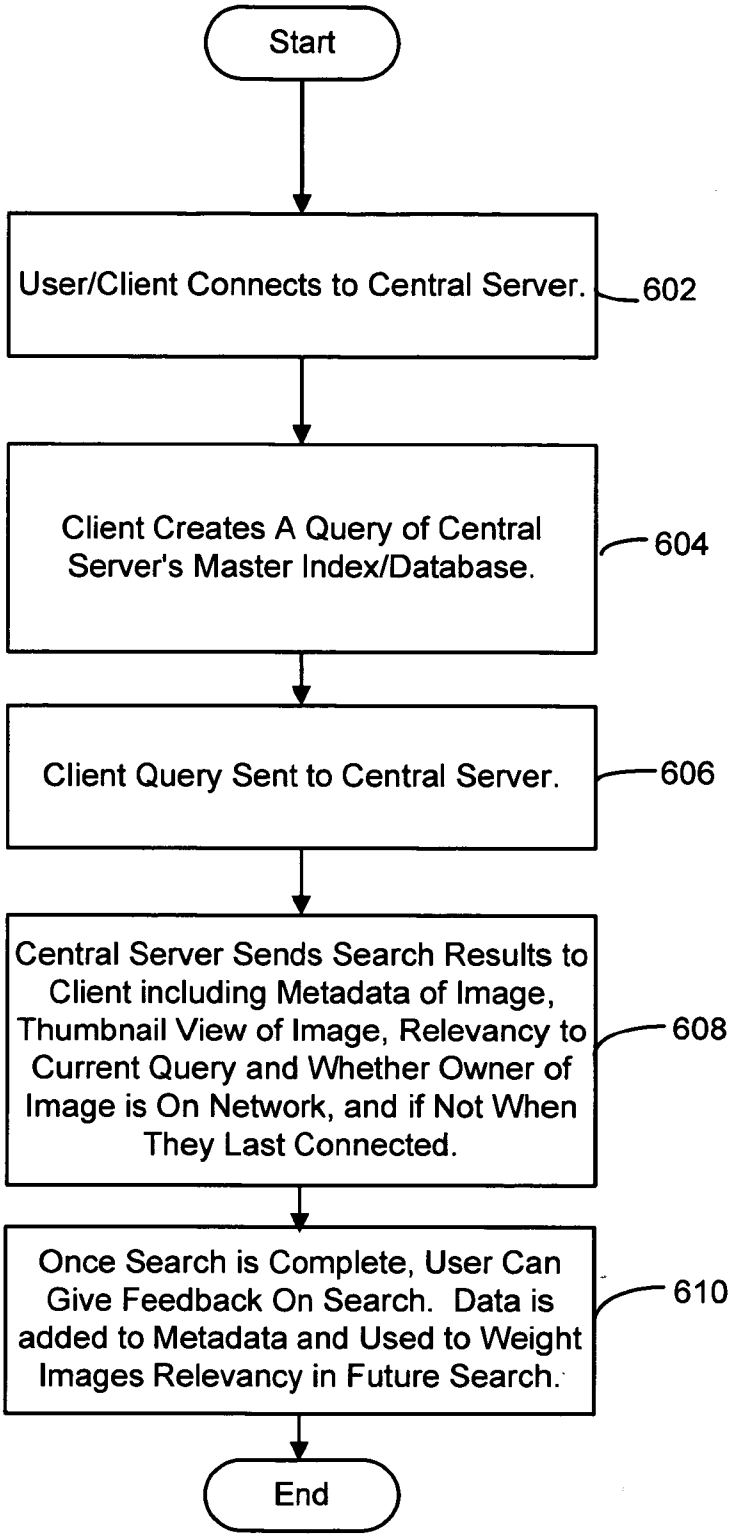

Start
User/Client Connects to Central Server.
602
Client Creates A Query of Central Server's Master Index/Database.
604
Client Query Sent to Central Server.
606
Central Server Sends Search Results to Client including Metadata of Image, Thumbnail View of Image, Relevancy to Current Query and Whether Owner of Image is On Network, and if Not When They Last Connected.
608
Once Search is Complete, User Can Give Feedback On Search. Data is added to Metadata and Used to Weight Images Relevancy in Future Search.
610
End

FIG. 6

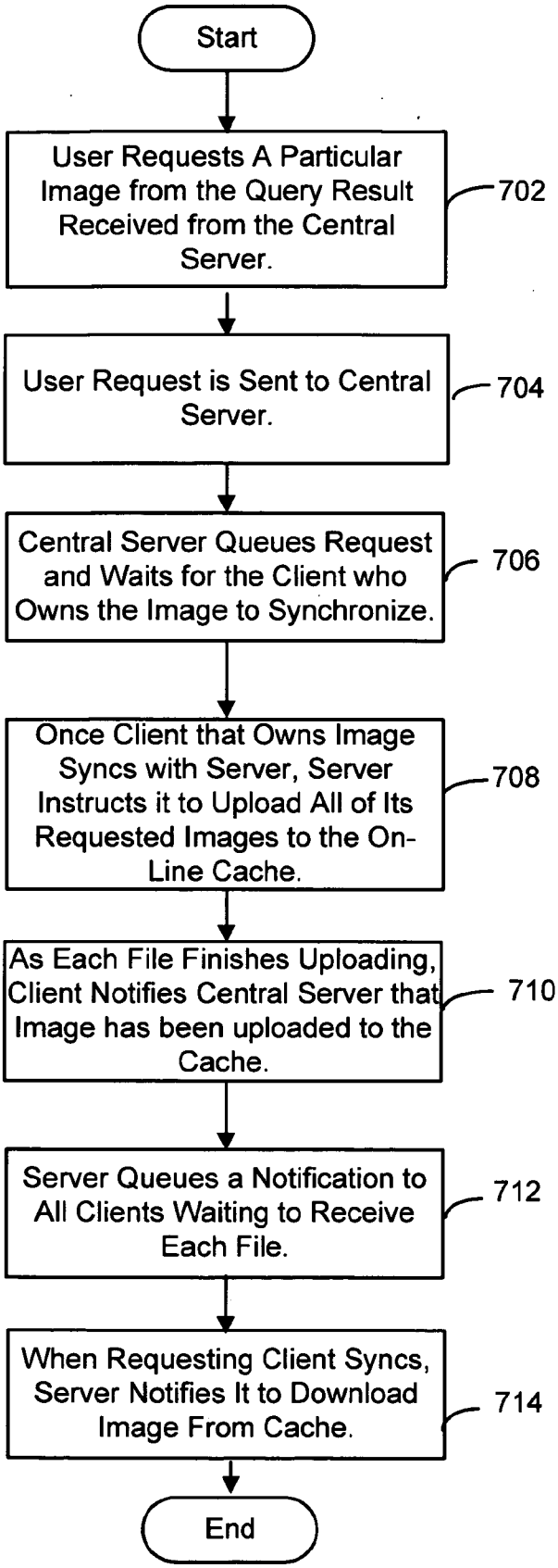
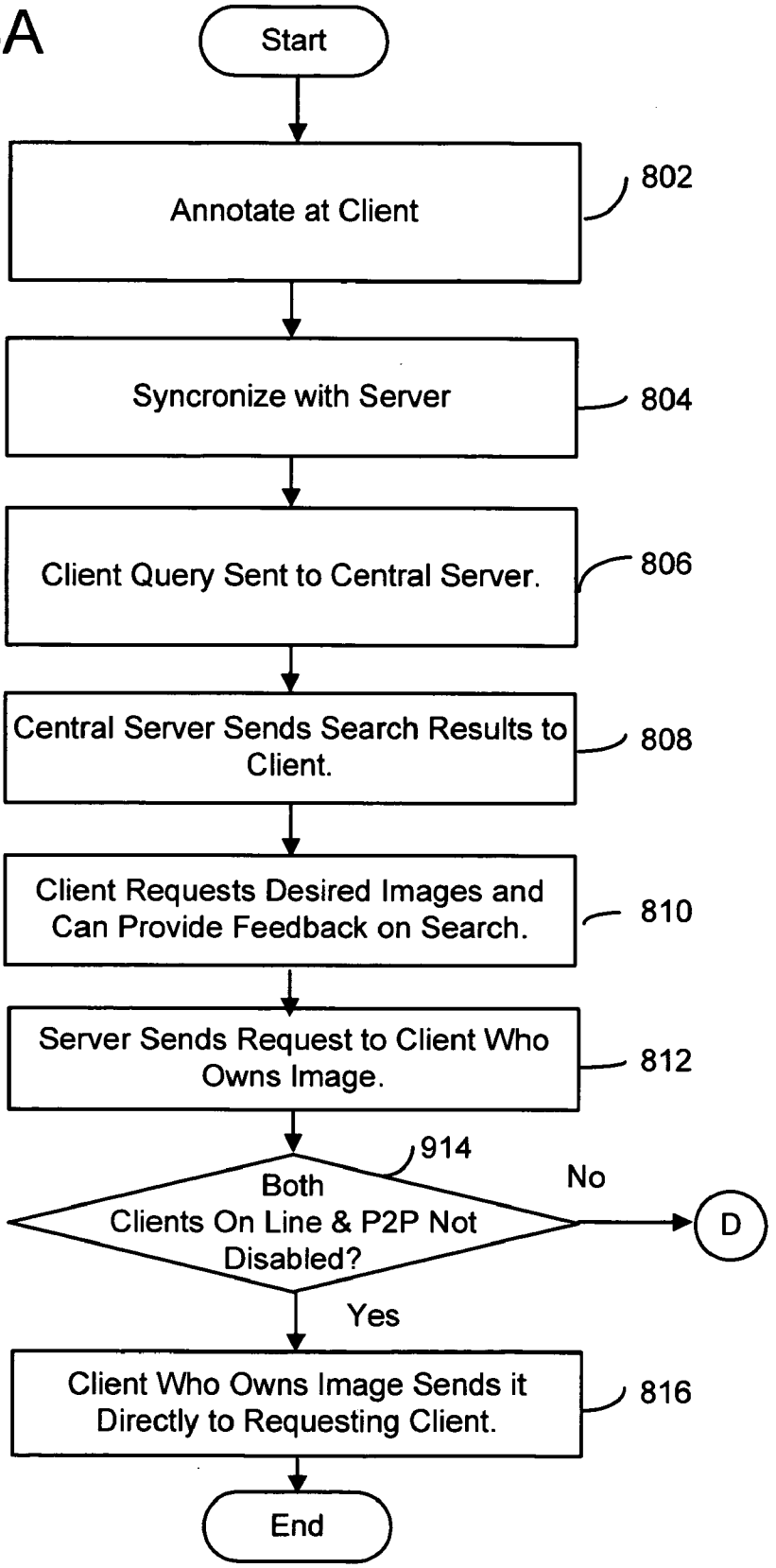

Start
User Requests A Particular Image from the Query Result Received from the Central Server.
702
User Request is Sent to Central Server.
704
Central Server Queues Request and Waits for the Client who Owns the Image to Synchronize.
706
Once Client that Owns Image Syncs with Server, Server Instructs it to Upload All of Its Requested Images to the On-Line Cache.
708
As Each File Finishes Uploading, Client Notifies Central Server that Image has been uploaded to the Cache.
710
Server Queues a Notification to All Clients Waiting to Receive Each File.
712
When Requesting Client Syncs, Server Notifies It to Download Image From Cache.
714
End

FIG. 7

FIG. 8A


Start
Annotate at Client
802
Syncronize with Server
804
Client Query Sent to Central Server.
806
Central Server Sends Search Results to Client.
808
Client Requests Desired Images and Can Provide Feedback on Search.
810
Server Sends Request to Client Who Owns Image.
812
914
Both Clients On Line & P2P Not Disabled?
No
D
Yes
Client Who Owns Image Sends it Directly to Requesting Client.
816
End

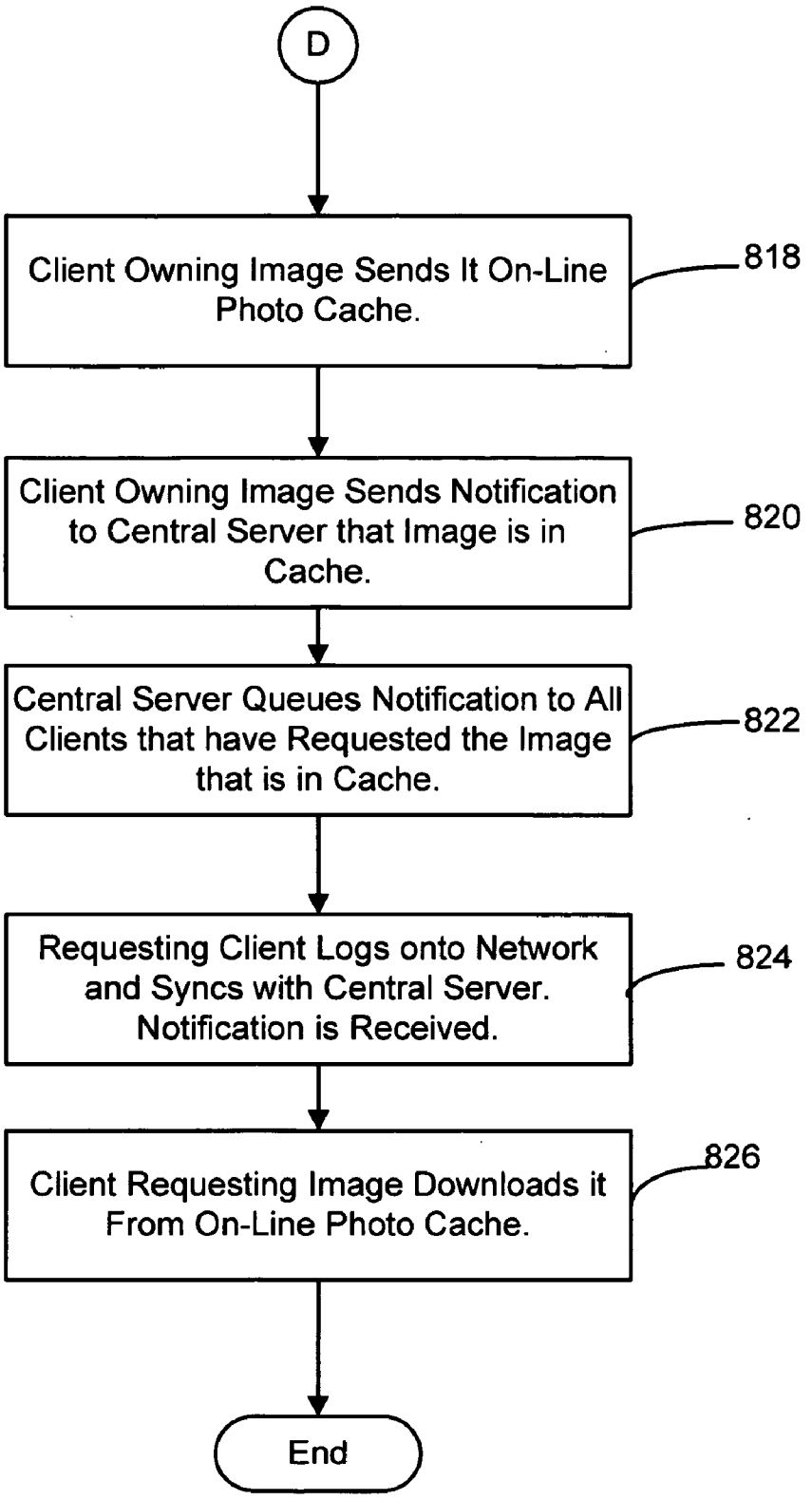

D
Client Owning Image Sends It On-Line Photo Cache.
818
Client Owning Image Sends Notification to Central Server that Image is in Cache.
820
Central Server Queues Notification to All Clients that have Requested the Image that is in Cache.
822
Requesting Client Logs onto Network and Syncs with Central Server. Notification is Received.
824
Client Requesting Image Downloads it From On-Line Photo Cache.
826
End

FIG. 8B

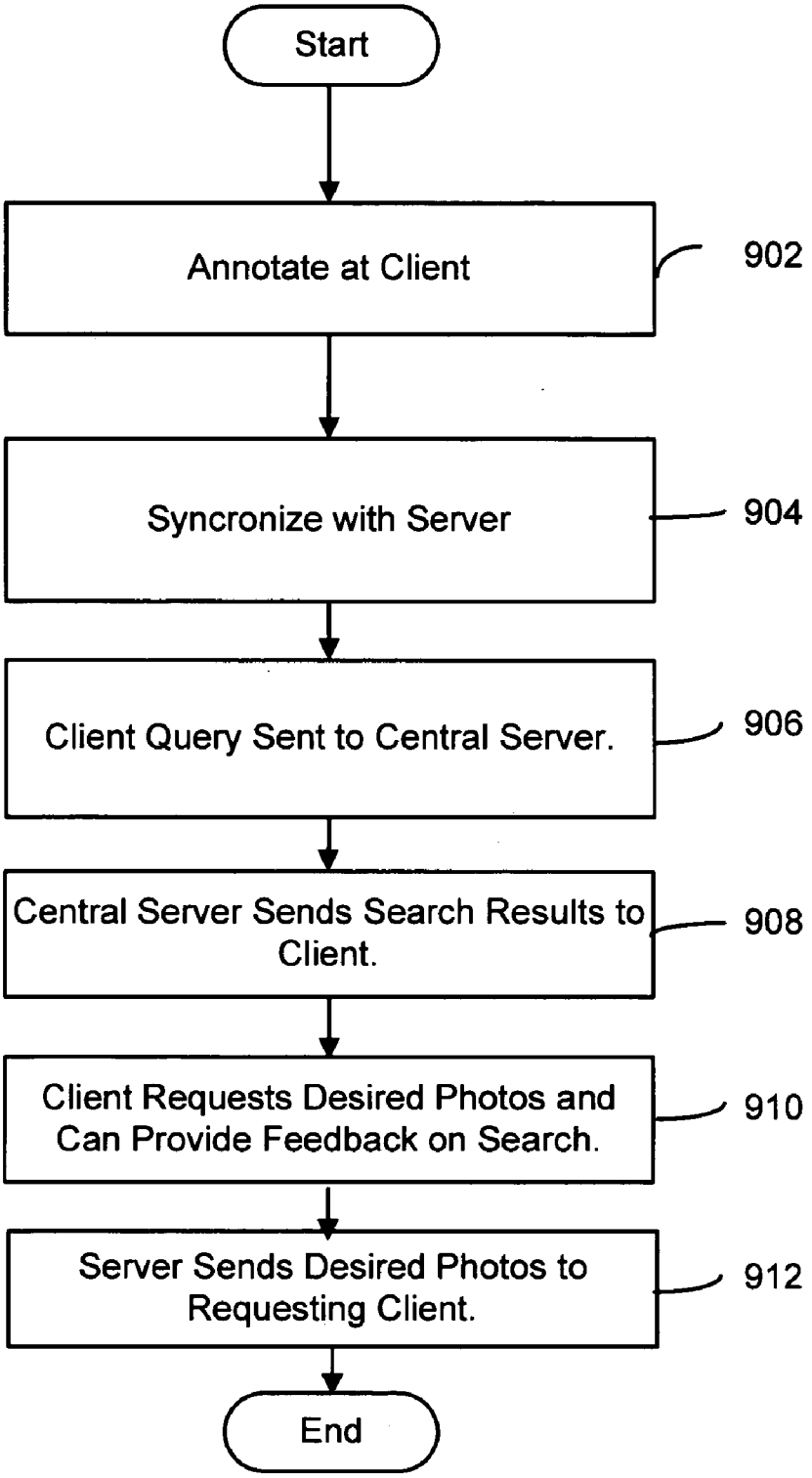

Start
Annotate at Client
902
Syncronize with Server
904
Client Query Sent to Central Server.
906
Central Server Sends Search Results to Client.
908
Client Requests Desired Photos and Can Provide Feedback on Search.
910
Server Sends Desired Photos to Requesting Client.
912
End

FIG. 9

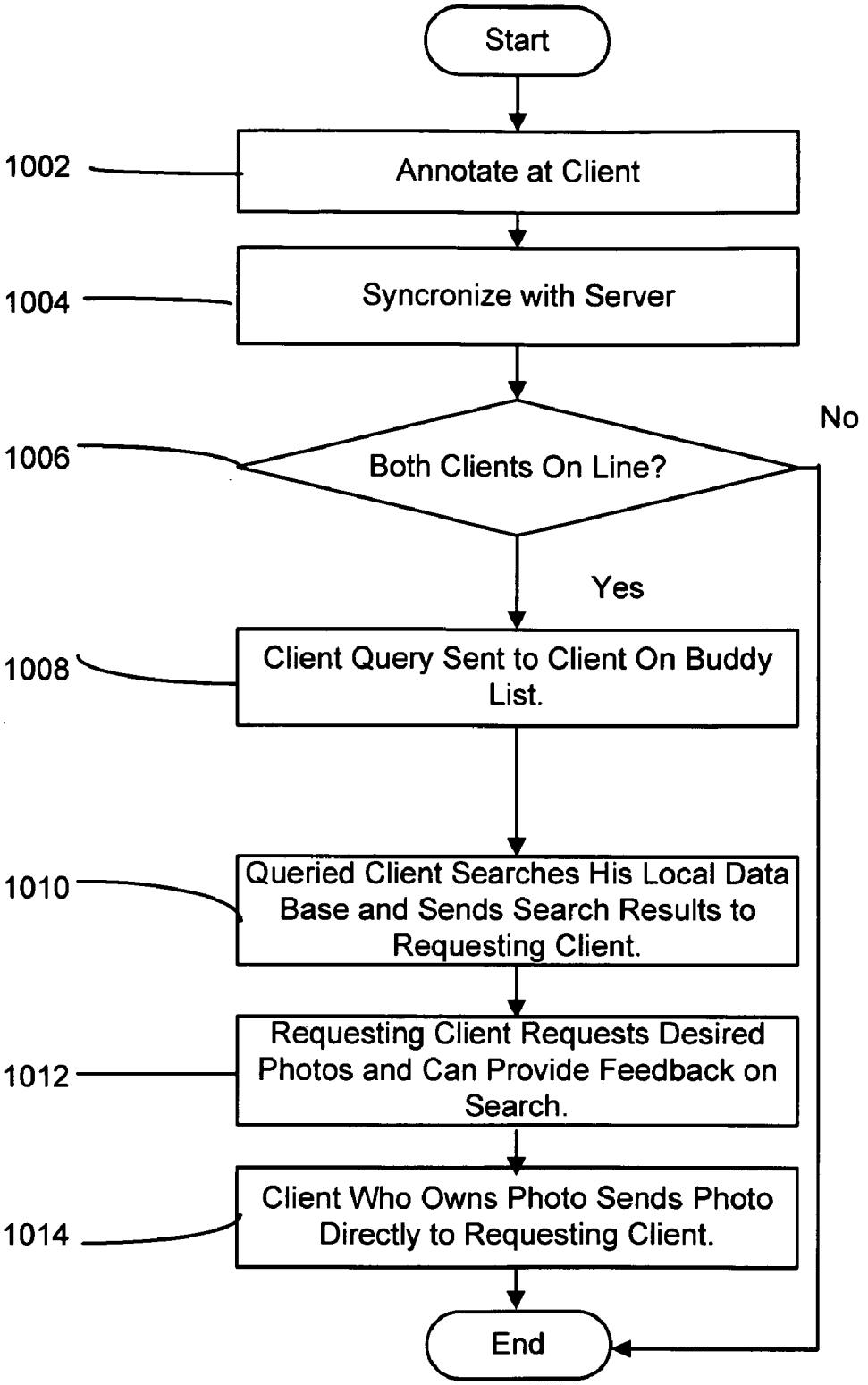

Start
1002
Annotate at Client
1004
Syncronize with Server
1006
Both Clients On Line?
No
Yes
1008
Client Query Sent to Client On Buddy List.
1010
Queried Client Searches His Local Data Base and Sends Search Results to Requesting Client.
1012
Requesting Client Requests Desired Photos and Can Provide Feedback on Search.
1014
Client Who Owns Photo Sends Photo Directly to Requesting Client.
End

FIG. 10

SYSTEM AND METHOD FOR EXCHANGING IMAGES

BACKGROUND OF INVENTION

[0001] 1. Technical Field

[0002] The invention is related to a system and method of providing an image-sharing environment.

[0003] 2. Background Art

[0004] Digital Photo and Video technology promises to enhance our use of photographs and video by making them easy to store, access, and share. (Henceforth, all further references to "photos" or "photographs" should be considered shorthand for "photos and videos.") Recent advances in media management and story telling have helped to deliver on this promise, but much work still remains.

[0005] The current model of photo sharing is through the use of online photo sharing websites. To share photographs on these websites, the user uploads copies of their photos to the hosting server, and their friends and family can view them by downloading them to their own computer or by viewing them while still resident on the server.

[0006] The current model of photo sharing is undesirable for several reasons. For example, the user already has the photos on their personal computer. Uploading them to a server is a slow and tedious additional step. In addition, many computer users that might like to share photographs are not computer savvy enough to upload them to the server.

[0007] As digital cameras become more affordable and digital photographs and images become more popular, more users will want to share photographs. At present, most servers impose a limit on the amount of space a user can use for photo-sharing typically, around 30 megabytes per user. As more and more users begin to use the available photo-sharing sites, servers will have to cut down on storage allotments to support more users. This problem is compounded by the fact that printers and displays are supporting higher and higher resolution images (and hence much greater sized files), so that each user has a larger number of higher resolution images that they want to share, yet less storage allotment is available for each user to share these photos. As the quality of digital images improves, and greater resolutions and file sizes result, this problem is sure to worsen.

[0008] Furthermore, most current photo-sharing systems are server-based, meaning that the images reside in a database on a server. The server model introduces a whole new level of management headache. The user must remember where on their computer their photographs are located to upload them to the server. If the user modifies a photograph—color corrects it, crops it, or removes red-eye—the user must remember to update it both on his local machine and on the photo site. Additionally, other users must be made aware that the photograph has changed. Other users too must know how to get to the site and how to find the modified image once there.

[0009] Another issue related to photo sites that allow sharing of photographs on the Internet is that photos are normally thought of as being extremely personal items. People are often hesitant to load their personal pictures up to a large server database, accessible to the entire world. For instance, pictures of one's children or pictures of the inside of one's home are typically held more closely than pictures of famous monuments or pictures of scenery taken on a family vacation. Most people do not want pictures of their children or family posted where they are available to anyone with access to the site.

[0010] Another problem associated with the management of photos is related to their indexing, search and retrieval. Consumer research has found that the organization and retrieval of photos and other digital images is a great source of frustration to many users of photo-sharing sites. There are a number of image management products that allow a user to search and retrieve visual information based on annotations associated with images. They allow a user to sort media by name, file type, or folder and browse through files as thumbnails or as textual lists. Some such image management products allow a user to perform key-word searches. They search the images based on keywords entered by the user and retrieve the images based on annotations or 'metadata' associated with each image. Metadata is basically data about data. For example, the title, subject, author, creation date, location, subject and size of a file constitute metadata about that file. The disadvantage with using this keyword scheme for image data retrieval is that it usually means that keywords and textual annotations must be manually entered for each image file. This is very time-consuming and labor-intensive. Additionally, for a search engine to identify an image based on such annotations, much annotation data must be entered for each image to increase the likelihood of obtaining a match between a user-entered keyword and an annotation related to a particular image.

[0011] Peer-to-Peer (P2P) is a much better model for sharing photographs and other images. The user can keep their photographs on their own computer, where they already are. Server storage limitations and problems related to updating multiple copies in different stores are resolved. The user can leverage existing "buddy lists" from Instant Messaging software to manage distribution of the photographs to selected circles of friends. A famous P2P file sharing system is Napster, where users exchange audio files over the Internet, each user maintaining their audio files on their own computer. The Napster servers maintain an index of all audio files and associated users that are on-line at a given time. The obvious problem with this P2P approach is that the two peers might not have their machines on at the same time.

[0012] For most people, having P2P ready access to a larger number of photos could enable many exciting new scenarios. For example, it could allow pictures of growing children to be automatically sent to a small circle of "photo" friends, conceivably as a screen saver that would automatically appear on these users computers automatically. However, If it were possible to at least potentially have access to a large number of peers, instead of Just the small circle of people, the possibilities grow. At first this seems like a useless feature for a photo database. After all, why would someone.want to look at the vacation photos from someone they didn't know? It is true that images are taken to capture a specific emotional, social moment. And it is further true that sharing this moment has historically been the primary use of photography. However, photographs also have another property: a photo is taken at a particular moment at a particular location. And this property in itself, when

extracted over a large number of photos, can become as important as the emotional context. It can, in fact, be used to enable a broad range of completely new photo capabilities. For instance, if every photograph ever taken was available in a single worldwide database, and could be queried by the date and location where it was taken, many useful scenarios can be envisioned. A traveler planning to go to Rome in February could look at all of the photos taken in Rome in February to determine what the weather is like there that time of year. It could allow people to see pictures of a newsworthy or entertainment event that occurred. It could allow people to locate photos of themselves at a particular place or event. It could allow people to independently verify images in advertisements such as what a particular hotel looks like.

[0013] Therefore, what is needed is a system and method for allowing users to easily share photos with a specific small group of people, a larger group of people, or the whole world. It should overcome the difficulties of loading a user's photos to a server database. It should overcome server storage limitations, and it should ensure that photographs/images throughout the system are updated when one copy of the photograph/image is updated. Furthermore, it should ensure that available photos are easily locatable by all users, and allow transfer of photos even when users desiring to exchange photos are not on-line at the same time. Last but not least, it should allow the user to maintain the desired level of privacy with respect to their photographs/images and limit access to them accordingly. A system and method that encourages user to share a greater number of images would provide for a system that allows photographs and other images to provide more utility than just their social and emotional benefits.

SUMMARY OF INVENTION

[0014] The system and method according to the present invention solves the problems associated with sharing photographs and other images on-line. It allows a user to easily share images with a specific small group of people, a larger group of people, or the whole world. It allows a user to keep the images on his or her own computer, vice a server, thereby overcoming problems associated with downloading the images to a website. It overcomes server storage limitations, resolves photo management/update issues, and provides for a less labor-intensive image annotation scheme. It also adequately addresses privacy concerns through a sophisticated access design.

[0015] The system and method according to the present invention provides for a peer-to-peer photo-sharing environment. The system and method according to the present invention includes: manual and automatic image annotation at the client; a periodic client-server synchronization; an master index of client photographs or images on a central server or a photo database that is resident on the central server, which is updated by the client-server synchronization function; end-user search functionality to search the master index or photo database; and transmission of images from one client to another client. In one embodiment, one client's new photographs are automatically displayed on another client's computer (e.g., via screen saver or another mechanism).

[0016] It should be noted that even though the traditional server-client photo-exchange system, where images are hosted on the server, have a multitude of drawbacks as discussed above, even these systems can be improved with many of the novel features of the present invention. Many of these novel features can also be used in a distributed file-sharing system wherein files belonging to one user may be replicated, encrypted, cut up, and stored on any of a number of computers belonging to the same computer network. Distributed file-sharing systems nevertheless present a seamless, transparent file and directory structure to the user such that the underlying mechanisms of file distribution are not explicitly visible to the user.

[0017] In general, the system and method according to the present invention includes a central server, one or more clients, and an on-line image/photo cache (Photograph and image will be used here interchangeably, as it should be understood that the present invention applies to all images, including video and other forms of digital imagery, not just digital photographs). These components can be arranged in various configurations.

[0018] Each client periodically connects to the Internet or other network hosting the photo-sharing system of the present invention. A local image index (a list of the images on their computer) and an image database are hosted on each client. The client provides images for image-sharing and typically searches a master image/photo index, containing all images available for sharing, for images/photographs that they would like to download.

[0019] The central server is on-line on the Internet or on another more localized network. It can host a master index of photographs/images or, alternately, the central server can employ a database of photographs/images that reside on the central server itself. The central server responds to client queries of the master index or database. The central server can store requested images to an on-line photo/image cache. This on-line cache is live on the Internet or other network. Typically, the central server sends images extracted from its master photo database or another client to the photo cache so that a requesting client can download these images. To do this, the server coordinates the transfer of one or more images requested by a client to the on-line photo cache and then coordinates transfer of the image(s) from the on-line photo cache to the client who requested it/them. Storing images to the cache solves two problems. It allows for quicker transfer of the requested images to the requesting client, since popular images can remain cached and cache memory is always faster than main RAM memory. Additionally, use of the cache allows for transfer of images between peers (client to client) even when both clients are not present on the Internet or other network at the same time.

[0020] It should be noted that if both clients (the client requesting the image and the client hosting the image) are on-line at the same time the two clients can transfer the image(s) in question directly, without use of the cache. That is, if both clients are on the network or Internet at the same time the transfer can be done P2P, without going through the server. Users can, however, disable the P2P feature on their computers or limit the P2P transfer to user's on their "buddy list", a circle of "photo friends" similar to that found in Instant Messaging applications. If the central server is configured with an image database containing all users images, instead of just a master index, it can also transfer images directly from its database to the requesting client/user, without employing use of the cache.

[0021] The invention employs a periodic client-server synchronization schema. The index of client photos that resides on the central server, or the photo database of the central server, is updated by the client-server synchronization function.

[0022] The system and method according to the present invention can include manual and automatic photo annotation at the user or client. These annotations are commonly referred to as metadata. This annotation data, or metadata, allows the user to effectively search and control access to the photo index or photo database. The metadata can include: the title, subject, author, creation date and time, location, subject and size of a file, level of privacy associated with the image, modification history, usage statistics (the number of times it was requested, posted, emailed), user rating, any and all user annotations, owner of the metadata and so on. Additionally, the owner of the metadata can be different from the owner of the photo that is, a different user can control a photo's metadata than the user that hosts the photo on their computer or the user that created the photograph.

[0023] Automatic annotations made by the system include the use face recognition techniques to identify a specific person within the images, automated vision techniques to determine whether an image is natural or man-made, and pixel comparison techniques using images of known type and origin. Additionally, the system and method according to the present invention automatically extracts various parameters of associated with the image, as available, such as creation date and time, location, size of file, and so on. Another automated annotation feature used by system is through the use of image hashing. That is, the system detects multiple images of the same object and combines metadata from the various sources to better annotate each of the images.

[0024] The system and method according to the present invention can include access control of images requested by the user or client. This access control is performed by using the metadata to control the search by the requesting client of the index or image/photo database. That is, metadata can be used to make certain images not available to certain users. The access control via metadata can also be made user-specific, governed by a user's "buddy list", a circle of user's that grant each other access to each other's photographs. The user also has some control as to access of his or her images and photographs. They can annotate each photograph with a different level of privacy, e.g., share with no one, share with some, and provide access to everyone. Therefore, the system and method according to the present invention actually limits access in two ways. First by using the user's privacy designation, and secondly by simply not searching for metadata when the search criteria are determined to be inaccessible to a particular user, or any user for that matter.

[0025] The various system configurations having been discussed above, the primary tasks performed by the system and method according to the present invention include: 1) image annotation; 2) synchronization of the central server with the client(s); 3) search and access and 4) image transfer.

[0026] A small photo exchange software application is always running in the background on the client, handled by a shell. This photo exchange application checks for new images being added and old images being taken away at the client. The client maintains its own local database of the images and a local index, and preserves a change log that records the alterations made to the database and the index since the last central server-client synchronization. When new images have been detected at the client, the system prompts the user to annotate them. Many types of metadata are possible. Some types of metadata utilized by the system and method according to the present invention are: 1) the date and time the image was taken; 2) the location on earth where the picture was taken and the orientation of the camera when the picture was taken; 3) the level of privacy associated with the image; 4) the author of the image; 5) modification history; 6) user rating; 7) system imputed location based on time a photo was taken; 8) usage statistics (e.g., how often and when an image was posted; how often an image was emailed, how relevant an image was found to be in a search); 9) any and all user annotations; 10) the owner of the metadata.

[0027] All changes to the client's database and index are kept in a change log. Periodically, the client will connect to the central server. When it does, the local database synchronizes with the server's master index. Images are added and subtracted from the server's master index, and metadata is be updated. Note that metadata can come from the server to the client, as well as from the client to the central server. Additionally, all metadata can reside on the central server, or just some portions of the metadata.

[0028] In one embodiment of the invention, data on the server is aged. If a user does not synchronize with the server for a long time, the relevance of their images will start to decrease. Eventually, their data will be removed entirely. This feature addresses the issue of one client requesting images from another client that never synchronizes with the central server.

[0029] In one embodiment of the present invention the client has four ways of primary ways of searching the database. These are: 1) by user; 2) by space-time; 3) by event; and 4) by key. Where applicable, these searches can be combined.

[0030] Additionally, automatic keys that use advanced imaging technology, such as "indoor vs. outdoor" and "natural vs. man-made" can be used. To perform the search, the user (via the client) searches the master index or master database in order to search for photos meeting the desired criteria. To do this, the client connects to the central server. The user creates a query of the central server's master index or master database (if such a database is employed in that particular embodiment of the invention). This query is sent to the central server. The central server sends the search results to the client. Each search can return, but is not limited to, in any combination, 1) the metadata of the photo; 2) a thumbnail of the photo; 3) relevancy to the current query; and 4) whether the owner is connected, and if so, at what speed, and if not, when they last connected.

[0031] If a user is on another user's photo "buddy list" (similar to that commonly found in instant messaging software), the user can search that user's computer for photographs or images directly. Various photo "buddy lists" can exist for each user, each providing a different level of access to image data.

[0032] Once a search is complete, the user can give feedback on the search, indicating which images they

thought closes matched their search criteria. This is added to the images' metadata, and used to weight their relevance in future searches. The hope is that over the long-term, a photo that is mislabeled or misannotated will eventually get several low votes, and the image's owner will correct the mislabeling.

[0033] If the user wants to get a particular image or photograph from the query result, he requests it from the central server. At the time the request is made, the user can also request a particular size. By default, the photo comes at its natural size. The user request is sent to the central server. The central server then queues the request, and waits for the client that owns the photo to synchronize with it. When a client synchronizes, the central server will instruct it to upload all of its requested images or photographs to the online cache. As each file finishes uploading, the client notifies the central server. The central server then queues a notification to all those clients waiting to receive the image file. When the client requesting the image synchronizes with the central server, the server instructs it to download the image from the cache. If both clients are online at the same time, the transfer can be done P2P, without going through the central server. However, users can disable the P2P feature on their machines, or limit it to people who are on their buddy list.

BRIEF DESCRIPTION OF DRAWINGS

[0034] The specific features, aspects, and advantages of the present invention will become better understood with regard to the following description, appended claims and accompanying drawings where:

[0035] **FIG. 1** is a diagram depicting a general purpose computing device constituting an exemplary system for implementing the present invention.

[0036] **FIG. 2** is a diagram depicting the system configuration for one embodiment of the present invention.

[0037] **FIG. 3** is a flow diagram depicting the general process actions steps of the system and method according to the present invention.

[0038] **FIG. 4** is a general flow diagram depicting the process action steps performed by the system and method according to the present invention in annotating a client's images.

[0039] **FIG. 5** is a general flow diagram depicting the process action steps performed by the system and method according to the present invention in synchronizing a client's local image/photographic database and index with the central server's master image index/database.

[0040] **FIG. 6** is a general flow diagram depicting the process action steps performed by the system and method according to the present invention in searching the central server's mater index/database and receiving a search result.

[0041] **FIG. 7** is a general flow diagram depicting the process action steps performed by the system and method according to one embodiment of the present invention in transferring the desired image to the client.

[0042] **FIG. 8A** is a general flow diagram depicting the general process action steps for the embodiment of the system and method according to the present invention employing a master index on a central server and an image cache.

[0043] **FIG. 8B** is a continuation of the flow diagram shown in **FIG. 9A**.

[0044] **FIG. 9** is a general flow diagram depicting the general process action steps for the embodiment of the system and method according to the present invention employing a client-server configuration, wherein the image database resides on the server.

[0045] **FIG. 10** is a general flow diagram depicting the general process action steps for the embodiment of the system and method according to the present invention wherein clients on the same buddy list search and transfer images directly to each other (peer to peer).

DETAILED DESCRIPTION

[0046] In the following description of the preferred embodiments of the present invention, reference is made to the accompanying drawings, which form a part hereof, and which is shown by way of illustration of specific embodiments in which the invention may be practiced. It is understood that other embodiments may be utilized and structural changes may be made without departing from the scope of the present invention.

[0047] Exemplary Operating Environment

[0048] **FIG. 1** illustrates an example of a suitable computing system environment **100** on which the invention may be implemented. The computing system environment **100** is only one example of a suitable computing environment and is not intended to suggest any limitation as to the scope of use or functionality of the invention. Neither should the computing environment **100** be interpreted as having any dependency or requirement relating to any one or combination of components illustrated in the exemplary operating environment **100**.

[0049] The invention is operational with numerous other general purpose or special purpose computing system environments or configurations. Examples of well known computing systems, environments, and/or configurations that may be suitable for use with the invention include, but are not limited to, personal computers, server computers, hand-held or laptop devices, multiprocessor systems, microprocessor-based systems, set top boxes, programmable consumer electronics, network PCs, minicomputers, mainframe computers, distributed computing environments that include any of the above systems or devices, and the like.

[0050] The invention may be described in the general context of computer-executable instructions, such as program modules, being executed by a computer. Generally, program modules include routines, programs, objects, components, data structures, etc. that perform particular tasks or implement particular abstract data types. The invention may also be practiced in distributed computing environments where tasks are performed by remote processing devices that are linked through a communications network. In a distributed computing environment, program modules may be located in both local and remote computer storage media including memory storage devices.

[0051] With reference to **FIG. 1**, an exemplary system for implementing the invention includes a general purpose computing device in the form of a computer **110**. Components of computer **110** may include, but are not limited to, a processing unit **120**, a system memory **130**, and a system bus **121** that couples various system components including the system memory to the processing unit **120**. The system bus **121** may be any of several types of bus structures including a memory bus or memory controller, a peripheral bus, and a local bus using any of a variety of bus architectures. By way of example, and not limitation, such architectures include Industry Standard Architecture (ISA) bus, Micro Channel Architecture (MCA) bus, Enhanced ISA (EISA) bus, Video Electronics Standards Association (VESA) local bus, and Peripheral Component Interconnect (PCI) bus also known as Mezzanine bus.

[0052] Computer **110** typically includes a variety of computer readable media. Computer readable media can be any available media that can be accessed by computer **110** and includes both volatile and nonvolatile media, removable and non-removable media. By way of example, and not limitation, computer readable media may comprise computer storage media and communication media. Computer storage media includes both volatile and nonvolatile, removable and non-removable media implemented in any method or technology for storage of information such as computer readable instructions, data structures, program modules or other data. Computer storage media includes, but is not limited to, RAM, ROM, EEPROM, flash memory or other memory technology, CD-ROM, digital versatile disks (DVD) or other optical disk storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or any other medium which can be used to store the desired information and which can be accessed by computer **110**. Communication media typically embodies computer readable instructions, data structures, program modules or other data in a modulated data signal such as a carrier wave or other transport mechanism and includes any information delivery media. The term "modulated data signal" means a signal that has one or more of its characteristics set or changed in such a manner as to encode information in the signal. By way of example, and not limitation, communication media includes wired media such as a wired network or direct-wired connection, and wireless media such as acoustic, RF, infrared and other wireless media. Combinations of the any of the above should also be included within the scope of computer readable media.

[0053] The system memory **130** includes computer storage media in the form of volatile and/or nonvolatile memory such as read only memory (ROM) **131** and random access memory (RAM) **132**. A basic input/output system **133** (BIOS), containing the basic routines that help to transfer information between elements within computer **110**, such as during start-up, is typically stored in ROM **131**. RAM **132** typically contains data and/or program modules that are immediately accessible to and/or presently being operated on by processing unit **120**. By way of example, and not limitation, **FIG. 1** illustrates operating system **134**, application programs **135**, other program modules **136**, and program data **137**.

[0054] The computer **110** may also include other removable/non-removable, volatile/nonvolatile computer storage media. By way of example only, **FIG. 1** illustrates a hard disk drive **141** that reads from or writes to non-removable, nonvolatile magnetic media, a magnetic disk drive **151** that reads from or writes to a removable, nonvolatile magnetic disk **152**, and an optical disk drive **155** that reads from or writes to a removable, nonvolatile optical disk **156** such as a CD ROM or other optical media. Other removable/non-removable, volatile/nonvolatile computer storage media that can be used in the exemplary operating environment include, but are not limited to, magnetic tape cassettes, flash memory cards, digital versatile disks, digital video tape, solid state RAM, solid state ROM, and the like. The hard disk drive **141** is typically connected to the system bus **121** through an non-removable memory interface such as interface **140**, and magnetic disk drive **151** and optical disk drive **155** are typically connected to the system bus **121** by a removable memory interface, such as interface **150**.

[0055] The drives and their associated computer storage media discussed above and illustrated in **FIG. 1**, provide storage of computer readable instructions, data structures, program modules and other data for the computer **110**. In **FIG. 1**, for example, hard disk drive **141** is illustrated as storing operating system **144**, application programs **145**, other program modules **146**, and program data **147**. Note that these components can either be the same as or different from operating system **134**, application programs **135**, other program modules **136**, and program data **137**. Operating system **144**, application programs **145**, other program modules **146**, and program data **147** are given different numbers here to illustrate that, at a minimum, they are different copies. A user may enter commands and information into the computer **110** through input devices such as a keyboard **162** and pointing device **161**, commonly referred to as a mouse, trackball or touch pad. Other input devices (not shown) may include a microphone, joystick, game pad, satellite dish, scanner, or the like. These and other input devices are often connected to the processing unit **120** through a user input interface **160** that is coupled to the system bus **121**, but may be connected by other interface and bus structures, such as a parallel port, game port or a universal serial bus (USB). A monitor **191** or other type of display device is also connected to the system bus **121** via an interface, such as a video interface **190**. In addition to the monitor, computers may also include other peripheral output devices such as speakers **197** and printer **196**, which may be connected through an output peripheral interface **195**. Of particular significance to the present invention, a camera **163** (such as a digital/electronic still or video camera, or film/photographic scanner) capable of capturing a sequence of images **164** can also be included as an input device to the personal computer **110**. Further, while just one camera is depicted, multiple cameras could be included as an input device to the personal computer **110**. The images **164** from the one or more cameras are input into the computer **110** via an appropriate camera interface **165**. This Interface **165** is connected to the system bus **121**, thereby allowing the images to be routed to and stored in the RAM **132**, or one of the other data storage devices associated with the computer **110**. However, It is noted that image data can be input into the computer **110** from any of the aforementioned computer-readable media as well, without requiring the use of the camera **163**.

[0056] The computer **110** may operate in a networked environment using logical connections to one or more remote computers, such as a remote computer **180**. The remote computer **180** may be a personal computer, a server,

a router, a network PC, a peer device or other common network node, and typically includes many or all of the elements. described above relative to the computer **110**, although only a memory storage device **181** has been illustrated in **FIG. 1**. The logical connections depicted in **FIG. 1** include a local area network (LAN) **171** and a wide area network (WAN) **173**, but may also include other networks. Such networking environments are commonplace in offices, enterprise-wide computer networks, intranets and the Internet.

[**0057**] When used in a LAN networking environment, the computer **110** is connected to the LAN **171** through a network interface or adapter **170**. When used in a WAN networking environment, the computer **110** typically includes a modem **172** or other means for establishing communications over the WAN **173**, such as the Internet. The modem **172**, which may be internal or external, may be connected to the system bus **121** via the user input interface **160**, or other appropriate mechanism. In a networked environment, program modules depicted relative to the computer **110**, or portions thereof, may be stored in the remote memory storage device. By way of example, and not limitation, **FIG. 1** illustrates remote application programs **185** as residing on memory device **181**. It will be appreciated that the network connections shown are exemplary and other means of establishing a communications link between the computers may be used.

[**0058**] The exemplary operating environment having now been discussed, the remaining parts of this description section will be devoted to a description of the program modules embodying the invention.

[**0059**] System Overview

[**0060**] The system and method according to the present invention provides for a peer-to-peer photo-sharing environment. However, many novel features of the present invention can be implemented equally well in a traditional server-client configuration.

[**0061**] In general, as shown in **FIG. 2**, the system and method according to the present invention typically includes a central server **202**, one or more clients **204**, **206**, and an on-line image cache **208**. However, some of these components may not be necessary in all embodiments of the invention.

[**0062**] Each client **204**, **206** periodically connects to the Internet or other network hosting the photo-sharing system of the present invention. Each client has a local image index **204***a*, **206***a* (a list of the images on their computer) and an image database **204***b*, **206***b*. The client provides images for image-sharing and typically searches a master image/photo index, containing all images available for sharing, for images/photographs that they would like to download.

[**0063**] The central server **202** is on-line on the Internet or on another more localized network. It can host a master index of photos **202***a*, or, alternately, the central server **202** can employ a database of photos **202***b* that reside on the server **202** itself. The central server **202** responds to client queries of the index **202***a* or database **202***b* and is responsible for coordinating transfer of photographs from a client **204** having a requested photograph (or the server photo database **202***b* in the embodiment where the photo database resides on the server) to the on-line cache **208** or requesting client **206**. The central server **202** can store requested images to the on-line image cache **208**. This on-line cache **208** is live on the Internet or other network. Typically, the central server **202** sends images extracted from its master photo database **202***b* or another client to the photo cache **208** so that a requesting client can download these images. To do this, the server **202** coordinates transfer of one or more images requested by a client **206** to the on-line photo cache **208** and then coordinates transfer of the image(s) from the on-line image cache **208** to the client **206** who requested it/them. Storing images to the cache solves two problems. It allows for quicker transfer of the requested images to the requesting client, since popular images can remain cached and there is no need to search and retrieve them from the client who owns them or from the server's master database if there is one. Additionally, use of the cache allows for transfer of images between peers (client to client) even when both clients are not present on the Internet or other network at the same time.

[**0064**] If both clients **204**,**206** are on-line, however, these clients **204**,**206** can coordinate the image transfer directly between them. That is, if both clients **204**, **206** are on the network or Internet at the same time the transfer can be done peer-to-peer (P2P), without using the cache **208**. Users can disable the P2P feature on their computers, however, or limit the P2P transfer to user's on their "buddy list", a circle of "photo friends" similar to that found in Instant Messaging applications. If the central server **202** is configured with a photo database **202***b* containing all users images, instead of just a master index **202***a*, it can also transfer images directly from its database **202***b* to the requesting client/user **206**, without employing use of the cache **208**.

[**0065**] The central server **202** can store requested images to the on-line photo/image cache **208**. This on-line cache **208** is live on the Internet or other network employed by the system and method according to the present invention. The server **202** either sends images extracted from its database **202***b* or another client **204** to the photo cache **208** so that a requesting client **206** can download these images.

[**0066**] The invention employs a periodic client-server synchronization schema. The master index **202***a* of client images that resides on the central server **202**, or the image database **202***b* of the central server **202**, is updated by the client-server synchronization function. The end-user (requesting client **206**) is provided with search functionality to search this master index **202***a* or photo database **202***b*. *Once the user locates the desired images the server* **202** coordinates the transmission of the relevant photos to the requesting client **206**, either from a hosting client **204** to the cache **208** or directly from the server database **202***b* to the requesting client **206**.

[**0067**] The system and method according to the present invention can include manual and automatic photo annotation at the user or client. This annotation data, or metadata, allows the user to effectively search and control access to the photo index or photo database. The owner of the metadata can be different from the owner of the photo that is, a different user can control a photo's metadata than the user that hosts the photo on their computer or the user that created the photo.

[**0068**] The system and method according to the present invention can include access control of images requested by

the user or client. This access control is performed by using the metadata to control the search by the requesting client of the index or image/photo database. That is, metadata can be used to make certain photos not available to certain users. For instance, if a certain user searches by a specific time and location and enters a keyword "young children", the system may bring up pictures related to the time and location in question, but not ones with young children. The access control via metadata can also be made user-specific, governed by a user's "buddy list", a circle of user's that grant each other access to each other's photographs. The user also has some control as to access of his or her images and photographs. For example, the user has an index of their photographs on their computer. They can annotate each photograph with a different level of privacy, e.g., share with no one, share with some, and provide access to everyone. Therefore, the system and method according to the present invention actually limits access in two ways. First by using the user's privacy designation, and secondly by simply not searching for metadata when the search criteria are determined to be inaccessible to a particular user, or any user for that matter.

[0069] System Operation

[0070] The various system configurations having been discussed above, the primary tasks performed by the system and method according to the present invention, shown in **FIG. 3**, include: 1) image annotation (process action **302**); 2) synchronization of the central server with the client(s) (process action **304**); 3) search and access (process action **306**) and 4) image transfer (process action **308**). These tasks will be described in more detail in the following paragraphs.

[0071] 1) Image Annotation

[0072] In the system and method according to the present invention a small photo exchange software application is always running in the background on the client, handled by a shell. As shown in **FIG. 4** in process action **402**, this photo/image exchange application **204***c* checks for new images being added and old images being taken away at the client. The client maintains its own local database **204***b* of the images and a local index **204***a*, and preserves a change log **204***d* that records the alterations made to the database **204***b* and the local index **204***a* since the last central server-client synchronization. When new images have been detected at the client, the system prompts the user to annotate them, as shown in process action **404**. These annotations are commonly referred to as metadata. Many types of metadata are possible. Some types of metadata utilized by the system and method according to the present invention are: 1) the date and time the image was taken; 2) the location on earth where the picture was taken; 3) the level of privacy associated with the image; 4) the author of the image; 5) modification history; 6) user rating; 7) system imputed location based on time a photo was taken; 8) usage statistics (e.g., how often and when an image was posted; how often an image was emailed, how relevant an image was found to be in a search); 9) any and all user annotations; 10) the owner of the metadata. These types of metadata are described more fully below.

[0073] a) The Date and Time the Image was Taken.

[0074] Many photographs are annotated with a time stamp when they are taken, as many cameras are now equipped with a time-date tagging feature. Ideally the client's computer time is synchronized to the camera time when the camera is docked and the images are downloaded from the camera to the computer. Additionally, other devices associated with cameras may also provide such a stamp, such cameras integrated with a cellular telephone. This time stamp may be used by the present invention to determine when a given photo was taken. However, this time stamp is not always reliable. For instance, many camera users do not initially set the time and date in the camera. Or the batteries may run out in the camera and the time may be incorrect. Therefore, the system and method according to the present invention provides the capability to override a camera-induced time stamp. For instance, at the time of docking the user's camera with their computer (the client), the user typically has a fairly good sense of when a picture was taken. Hence, one embodiment of the present invention prompts the user to annotate the picture when the camera is docked to the client and the pictures are transferred to the client. The system and method according to the present invention detects common mistakes and offers to correct them.

[0075] b) The Location on Earth where the Image was Taken.

[0076] In order to provide an image database that provides utility the utility of letting the user search images by time and location, identifying the location each image is taken is critical. Ideally, every camera used by the system and method according to the present invention has a Global Positioning System (GPS) unit, a compass, and a method for measuring the pitch and roll of the camera when photographs are taken. The GPS can provide location information in the form of latitude and longitude and is accurate to approximately one meter in non-military applications. The other devices allow measurement of the camera's orientation. Cameras that are integrated with these devices allow for tagging each image with geographic location (geolocation), camera orientation, and a time stamp. However, most camera systems today do not have a GPS built in. Therefore, the system and method according to the present invention has various other methods of obtaining location data. It encourages the user to annotate each picture with geolocation, if a GPS's location/time stamp is not available. The system helps the user be as specific as they can be without encouraging them to be more specific but incorrect. One embodiment of such a user-annotation system takes advantage of place-name-to-geolocation translation applications or services, whereby a user can type or select the text name of a place and the associated geolocation is returned. Alternatively, a user may be presented with a navigable map and asked to place photographs on the map in the approximate location they were taken. Often, time and location information can be used together to impute a location to a photograph. For example, if several photos are known to be close in time and taken with a single camera, and the location of one photograph is known, then a imputed location can be given to the photos created at very close to the same time. Alternately, if the camera used to take the photo is somehow linked with a cell phone, cell site location may also provide an indication of the location where the picture was taken. In short, any form of location information that can be correlated with the time stamp or the content of a photograph can be used to provide geolocation and camera orientation information.

[0077] c) Level of Privacy of the Image.

[0078] Each photograph in the system can be labeled as to its level of privacy. The system and method according to the present invention supports a "buddy list", a list of people the user trusts to view their photos. The system according to the present invention does not expose the owner of photos. Searching based on user name is limited to only those people in the user's buddy list. The system according to the present invention provides the user with the ability to tag some photos as being private. Photos can be private to one person or to the user's entire buddy list. Private photos cannot be seen by others. The present invention supports rules for doing public/private categorization automatically. The level of privacy assigned to each photograph is stored as metadata and set by the user, with one embodiment providing a default setting of completely private (access by the user only) and alternative default setting of completely public (accessible to all). Access to a photograph itself can require a net-aware system such as Microsoft Passport, which has the capacity to require users to authenticate themselves prior to accessing information available over a network.

[0079] d) Image Author.

[0080] The metadata includes the author of the image.

[0081] e) Image Modification History.

[0082] The modification history of each image is stored on the user's (client's) computer. Such modification history would include when the image was modified, how the image was modified, by whom the image was modified and any corresponding annotations made at the time of modification. This modification history is used by the system to update the central server's index or photo database.

[0083] f) User Rating.

[0084] One field of metadata, the user rating, allows the user to rate each image cited in a search to indicate how accurately it matched their search criteria. This user rating can provide the system with an indication of how closely the annotation of a photograph actually matches the photograph. This data is memorialized, added to the photos' metadata, and is used to weight their relevance in future searches. The hope is that over the long-term, an image that is mislabeled will eventually get several low votes. The low score will then come to the attention of the image's owner, and he will correct it.

[0085] g) Usage Statistics.

[0086] Another field of metadata, the usage statistics, allows the system to track how a given image has been used. Usage statistics can include, for example, age; how often the image was posted to a website; the times the image was posted to a website; the number of times the image was emailed; how relevant the image was found to be to a particular search; and how many times the image was requested from the server.

[0087] h) Owner of the Metadata.

[0088] The owner of the metadata is the party that has access rights to make changes to it. The owner of the metadata can be different from the owner of the photograph or image. That is, a different user can control a photograph's metadata than the user that hosts the photograph on their computer, or the user that created the photograph.

[0089] The system and method also automatically extracts available data associated with an image as it is available, and annotates the image accordingly (process action **406**). Automatic annotations made by the system include the use face recognition techniques to identify a specific person within the images, automated vision techniques to determine whether an image is natural or man-made, and pixel comparison techniques using images of known type and origin. Additionally, the system and method according to the present invention can automatically extract various parameters of associated with the image, as available, such as creation date and time, location, size of file, and so on. Another automated annotation feature used by the system is through the use of image hashing. That is, the system detects multiple images of the same object at various locations throughout the network and elsewhere, and combines metadata from the various sources to better annotate each of the images.

[0090] As shown in process action **408** of **FIG. 4**, once the annotation of a new image is complete the client **204** updates the modification log **204***c* that records modifications made to the client's local image database **204***b* and local index **204***a* since the client's last synchronization with the central server **202**.

[0091] 2) Client-Server Synchronization.

[0092] As discussed above, and shown in process actions **502** and **504**, all changes to the client's database and index are kept in a change or modification log **204***c*. *Periodically, the user (client* **204**) will connect to the central server **202**, as shown in process action **506**. When they do, their local index **204***a* and/or database **204***b* will synchronize with the master index **202***a* (process action **508**). Photos are added and subtracted from the server's master index **202***a*, and metadata is updated, as shown in process action **510**. Note that metadata can come from the server to the client, as well as from the client to the central server. For instance, if another client has annotated a copy of an image or photograph owned by a client the mater server can send this annotation data to the client who created the photograph. Additionally, all metadata can reside on the central server, or just some portions of the metadata.

[0093] In one embodiment of the invention, data on the server is aged. If a user does not synchronize with the server for a long time, the relevance of their images will start to decrease. Eventually, after a period of, say, two weeks, their data will be removed entirely. This feature addresses the issue of one client requesting images from another client that never synchronizes with the central server.

[0094] 3) Search.

[0095] The user (via the client) **206** searches the master index **202***a* or master database **202***b* in order to search for photos meeting the desired criteria. To do this, as shown in **FIG. 6** in process action **602**, the client **206** connects to the central server **202**. The user **206** creates a query of the central server's **202** master index **202***a* or master database **202***b* (is such a database is employed in that particular embodiment of the invention), as shown in process action **604**. The query is sent to the central server **202** (process action **606**). The central server **202** sends the search results to the client including (in any combination) the metadata of each image, a thumbnail view of each image, each image's

relevancy score to the current query and whether the owner of the image is on the network, and if not when they last connected (process action **608**).

[**0096**] In one embodiment of the present invention the client has four ways of primary ways of searching the database. These are: 1) by user; 2) by space-time; 3) by event; and 4) by key. Where applicable, these searches can be combined. Additionally, a search over any of the metadata associated with the photos is also possible. Each search can return, but is not limited to, in any combination: 1) the metadata of the photo; 2) a thumbnail view of the photo; 3) relevancy to the current query; and 4) whether the owner is connected, and if so, at what speed, and if not, when they last connected. The primary methods of searching the database are more fully described below.

[**0097**] a) User Search: If a user is on another user's photo "buddy list" (similar to that commonly found in instant messaging software), the user can search that user's computer for photographs or images directly. Various photo "buddy lists" can exist for each user, each providing a different level of access to image data. For instance, a user can have a "buddy list" or photo circle that only involves his family and closest friends. He might then annotate photographs of his family and home in his computer as being "closely held" and accessible only to the buddy list that involves his friends and closest family members. He might have another buddy list that involves just his business colleagues. He might then annotate other photographs, such as those of the office Christmas party, on his computer as being accessible only to his co-workers. Some photographs, such as those of he took of monuments and landscape on his last vacation, he may annotate as being accessible to the whole world (e.g., all users of the system and method according to the present invention).

[**0098**] One embodiment of the invention provides the ability to display one client's new photographs automatically on another client's computer (e.g., via screen saver or another mechanism).

[**0099**] b) Space-Time Search The space-time search works by letting the user select a place on earth at a time frame. However, either location or time can be omitted from the search criteria. All pictures that fall into the requested coordinates and time frame are returned. The query results are returned, ranked by specificity. For instance, a search on Paris will return pictures of the Eiffel Tower above pictures tagged simply as being "in France". Pictures with a GPS tag within Paris are considered more accurate than one that the user just said was in Paris. The search User Interface (UI) allows place names and famous landmarks to be entered simply, but also extends to exact specifications, such as longitude, latitude pairs from a GPS.

[**0100**] c) Event Search: At the simplest level, an event is basically a shortcut for a space-time coordinate. Many "events" are actually a collection of other events. For example, someone might want to see pictures from any concert on a band's tour, even if they do not know the times and locations of the shows. To facilitate this, the master photo exchange database, or a third party event register vendor, will contain a table of events, otherwise known as an event register, that cross-correlates events with location and time. A user can use the event register to find an image of a certain event. Likewise, a user can use an image known to be taken at a certain event to identify the event's time and location. Users can update the event register. Adding events to the table from live news sources is also possible.

[**0101**] d) Key Search: The system and method according to the present invention also supports user-defined key system. For instance, the system supports the user-defined key "picture of me". That is, users can tag any picture in the database as being a picture of them. Additionally, automatic keys that use advanced imaging technology, such as "indoor vs. outdoor" and "natural vs. man-made" can be used.

[**0102**] Keys can be computed and refined on the client machines. For example, a face recognition algorithm may be run over all photos on a client machine, to discover which photos contain Uncle Jim or Aunt Mary. This information could be stored as additional metadata in the central database, or it could be computed on the fly, when such a search is requested.

[**0103**] e) Search Feedback: Referring again to **FIG. 6**, process action **610**, once a search is complete, the user can give feedback on the search, indicating which images they thought most closely matched their search criteria. This feedback is added to the images' metadata, and used to weight their relevance in future searches. The hope is that over the long-term, a photo that is mislabeled or misannotated will eventually get several low votes, and the image's owner will correct the mislabeling.

[**0104**] 4) Image Transfer. Referring now to **FIG. 7**, if the user wants to get a particular image or photograph from the query result, he requests it from the central serve **202** (process actions **702**). At the time the request is made, the user can also request a particular size. By default, the photo comes at its natural size. The user request is sent to the central server (process action. **704**). The central server **202** then queues the request, and waits for the client **204** that owns the photo to synchronize with it (process action **706**). As shown in **FIG. 7**, process action **708**, when the client **204** synchronizes with the central server **202**, the server **202** will instruct it to upload all of its requested images or photographs to the online cache **208**. As each file finishes uploading, the client **204** notifies the central server **202** that the image has been uploaded to the cache **208** (process action **710**). The central server **202** then queues a notification to all those clients waiting to receive the image file (process action **712**). When the client **206** requesting the image synchronizes with the central server **202**, the server **202** instructs it to download the image from the cache **208** (process action **714**). If both clients **204**,**206** are online at the same time, the transfer can be done P2P, without going through the central server **202**. However, users can disable the P2P feature on their machines, or limit it to people who are on their buddy list.

Exemplary Implementations of the System and Method According to the Present Invention

[**0105**] The system and method according to the present invention having been described, it should be noted that the various features of the invention can be used in varying combinations and embodiments. Some exemplary implementations of the present invention are discussed in more detail below. These include: 1) an embodiment wherein a master image index, but not a photo database, resides on the server and a cache is used to transfer images; 2) an embodi-

ment wherein a master photo database resides a server, but a cache is not used to transfer images from peer-to-peer; and 3) an embodiment wherein a client directly the searches photo index and photo database of another client that is on the first client's buddy list and both client's are on-line.

[0106] 1) Embodiment wherein a Master Image Index, but not a Photo Database, Resides on a Server, and A Cache is used to Transfer Images.

[0107] **FIGS. 8A and 8B** depict a flow chart for an embodiment wherein a master image index, but not a photo database **202***b*, resides on the central server **202**. A cache **208** is used to transfer images peer-to-peer.

[0108] In this embodiment, manual and automatic annotations/metadata, as discussed previously, are made at the client **204**, **206** whenever images are added or deleted to the client's local database **204***b*, **206***b* (process actions **802**). A change log **204***c*, **206***c* is maintained to memorialize changes to the client's local index **204***a*, **206***a* and local image database **204***b*, **204***b*. The client periodically synchronizes with the central server **202**, as shown in process action **804**, and in the synchronization process the server's master index **202***a* is synchronized with the client's local index **204***a*, **206***a* via the modification/change log **204***c*, **206***c*, as discussed more fully above. If a client wishes to search the master index **202***a*, he creates a query, preferably by user, space-time, event or key, or any combination thereof, as discussed previously, and sends it to the central server **202** (process actions **806**, **808**). The central server **202**, searches the master index **202***a*, and returns search results to the client, as shown in process action **808**. Each search can return, but is not limited to, in any combination: the metadata of the photo; a thumbnail view of the photo; relevancy of the image to the current query; and whether the owner is connected, and if so, at what speed, and if not, when they last connected. Access to images returned in the search are again limited by using the user's privacy designation, and by simply not searching for metadata when the search criteria are determined to be inaccessible to a particular user, or any user for that matter. The client then requests the desired images found in the search results and can provide feedback as to images found in the search, as shown in process action **810**. The central server **202** then sends a request to the client who owns the desired image (process action **812**). If both the requesting client and the client hosting the desired image are both on-line and the requesting client has not disabled P2P transfer or limited it to his buddy list (or the hosting client is on the buddy list), the client that hosts the image can transfer the image directly to the client who requested it (process actions **814**, **816**). If both the requesting client and the hosting client are not on-line at the same time, or the requesting client has P2P file transfer disabled in general or with respect to the hosting client, the client owning the image sends it to the on-line image cache **208** (process action **818**). The client owning the image then informs the central server **202** that the image has been uploaded to the cache **208**, as shown in process **820**. The central server **202** then queues a notification to all clients that have requested the image that the image has been uploaded to the on-line image cache **208** (process action **822**). As shown in process action **824**, the next time the requesting client logs into the network and synchronizes with the central server **202**, the notification is received. The client requesting the image then downloads it from the on-line cache **208**, in a similar manner to that discussed previously.

[0109] 2) Embodiment wherein a Photo Database Resides on a Server.

[0110] **FIG. 9** depicts a general flow chart for an embodiment wherein a master image index **202***a* and a photo database **202***b*, reside on the central server **202**. No cache is used to transfer images peer-to-peer.

[0111] In this embodiment, manual and automatic annotations/metadata, as discussed previously, are made at the client **204**, **206** whenever images are added or deleted to the client's local database **204***b*, **206***b* (process actions **902**). A change log **204***c*, **206***c* is maintained to memorialize changes to the client's local index **204***a*, **206***a* and local image database **204***b*, **204***b*. The client periodically synchronizes with the central server **202**, as shown in process action **904**, and in the synchronization process the server's master index **202***a* and master database **202***b* is synchronized with the client's local index **204***a*, **206***a* and local database **204***b*, **206***b* via the modification/change log **204***c*, **206***c*. If a client wishes to search the master index **202***a*, he creates a query, preferably by user, space-time, event or key, or any combination thereof, as discussed previously, and sends it to the central server **202** (process actions **906**). The central server **202**, searches the master index **202***a* and master photo database **202***b*, and returns search results to the client, as shown in process action **908**. Each search can return, but is not limited to, in any combination: the metadata of the photo; a thumbnail view of the photo; relevancy of the image to the current query; and whether the owner is connected, and if so, at what speed, and if not, when they last connected. Access to images returned in the search are again limited by using the user's privacy designation, and by simply not searching for metadata when the search criteria are determined to be inaccessible to a particular user, or any user for that matter. The client then requests the desired images found in the search results from the central server **202** and can provide feedback as to images found in the search, as shown in process action **910**. The central server **202** then sends the requested image to the requesting client (process action **912**).

[0112] 3) Embodiment wherein a Client Directly Searches the Photo Index and Photo Database of Another Client that is on the First Client's Buddy List and Both Client's are On-Line.

[0113] **FIG. 10** depicts a flow chart for an embodiment of the present invention wherein a first client is on a second client's buddy list and wherein the first client has access to search the second client's local image index **206***a*, and photo database **204***b*. The transfer of the desired images occurs peer-to-peer without use of an on-line cache.

[0114] In this embodiment, manual and automatic annotations/metadata, as discussed previously, are made at the client **204**, **206** whenever images are added or deleted to the client's local database **204***b*, **206***b* (process actions **1002**). A change log **204***c*, **206***c* is maintained to memorialize changes to the client's local index **204***a*, **206***a* and local image database **204***b*, **204***b*. The client periodically synchronizes with the central server **202**, as shown in process action **1004**, and in the synchronization process the server's master index

202*a* is synchronized with the client's local index **204***a*, **206***a* via the modification/change log **204***c*, **206***c*, as discussed more fully above (process action **1004**) . In this synchronization process the option of updating the client's local index with new information on the server's master index can also be available [usage statistics, would be an example of such information]). If a first client **206** is on a second client's **204** buddy list and wishes to search the second client's local index **204***a* directly, and both clients **204**, **206** are on-line at the same time, the first client **206** creates a query of the second client's local index/local database **204***a*, **204***b* and sends it to the second client **204** (process actions **1006**, **1008**. The second client **204**, searches his local index **204***a* and local database **204***b*, and returns the search results to the client **206**, as shown in process action **1010**. Each search can return, but is not limited to, in any combination: the metadata of the photo; a thumbnail view of the photo; relevancy of the image to the current query; and whether the owner is connected, and if so, at what speed, and if not, when they last connected. Access to images returned in the search are again limited by using the user's privacy designation, and by simply not searching for metadata when the search criteria are determined to be inaccessible to a particular user, or any user for that matter. The first client **206** then requests the desired images found in the search results and can provide feedback as to images found in the search, as shown in process action **1012**. The second client **206**, the one hosting the requested image, then sends the image directly to the client requesting it, as shown in process action **1014**.

[**0115**] The foregoing description of the invention has been presented for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Many modifications and variations are possible in light of the above teaching. It is intended that the scope of the invention be limited not by this detailed description, but rather by the claims appended hereto.

1-18. (canceled)

19. A computer-implemented process for sharing images comprising the process actions of:

receiving at a central server a search query formatted using annotation data describing an image from a requesting client, said server hosting a master index of all images available for sharing;

searching said master index at said central server using annotation data provided in said search query and obtaining a result; and

sending said search result from said central server to said requesting client.

20. The computer-implemented process of claim 19 further comprising the process action of receiving feedback from said requesting client at said central server as to how well the images in the search result matched the search query.

21. The computer-implemented process of claim 20 further comprising the process action of using a user-rating annotation to weight an image's relevance in future searches.

22. The computer-implemented process of claim 19 wherein the process action of receiving a search query comprises at least one process action of:

receiving a search query from a requesting user said search query employing a user identifier, to locate all images owned by a certain user;

receiving a search query from a requesting user said search query employing location and/or time, to locate all images created in a given time span or at a given location, or created in a given time span and a given location;

receiving a search query from a requesting user said search query employing an event name; and

receiving a search query from a requesting user said search query employing a keyword.

23. The computer-implemented process of claim 22 wherein the process action of receiving a search query employing an event name further comprises the process actions of:

creating a table associating event name with location and time said event occurred;

processing a search query using location and time to identify said associated event name; and

processing a search query using event name to identify event time and location.

24. The computer-implemented process of claim 22 wherein the process action of receiving a search query employing a keyword further comprises at least one of:

using automatic keys identifying if the image was taken indoor versus outdoor, and

using automatic keys identifying if the image was depicts something natural versus something man-made.

25. The computer-implemented process of claim 19 wherein the search result includes at least one of:

annotation data associated with each image found in the search result;

a thumbnail view of the image found in the search result;

a relevancy score of the image to the search query; and

an indication as to whether the image is available on a network, and if not the last time it was available.

26. The computer-implemented process of claim 19 wherein the process action of returning a search result further comprises a process action of using annotation data to limit access to an image identified in a search as meeting the search criteria, by not returning said image to said requesting client.

27. The computer-implemented process of claim 19 further comprising the process actions of:

receiving a request from said requesting client for at least one desired image identified in said search of said central server's master index;

sending a notification from said central server to a client hosting said at least one desired image to load said requested image to an on-line cache;

loading said desired image to an on-line cache by said hosting client;

downloading said requested image from said cache by said requesting client.

28. The computer-implemented process of claim 19 further comprising the process actions of:

receiving a request from said requesting client for at least one desired image identified in by said search of said central server's master index;

retrieving said at least one desired image from a master image database residing on said central server and correlating with said master index;

sending said at least one desired image to said requesting client from said central server.

29. The computer-implemented process of claim 19 further comprising the process actions of:

receiving a request from said requesting client for at least one desired image identified in said search of said central server's master index to be sent to a receiving client;

retrieving said at least one desired image from a master image database residing on said central server and correlating with said master index;

formatting said at least one desired image to automatically appear on said receiving client's computer display;

sending said at least one desired image to said receiving client from said central server.

30. The computer-implemented process of claim 29 wherein said formatted at least one desired image appears as a screen-saver on a computer display of said receiving client.

31. The computer-implemented process of claim 19 further comprising the process actions of:

receiving a request from said requesting client for at least one desired image identified in by said search of said central server's master index;

verifying that said requesting client and a client hosting said at least one desired image are both on-line on a network;

sending a notification from said central server to a client hosting said at least one desired image to send said requested image to said requesting client.

32. The computer-implemented process of claim 31 further comprising the process action of said hosting client sending said at least one desired image to a requesting client.

33. The computer-implemented process of claim 19 further comprising the process actions of:

adding and removing images from the master index to coincide with changes made to a local index of images belonging to a client hosting said images using a modification log depicting changes made to said local index of said hosting client; and

updating said annotation data of images listed on said master index using said modification log.

34. A computer-readable medium having computer-executable instructions for transferring images, said computer executable instructions comprising:

inputting images at a first client;

annotating said images with metadata;

creating a local index of said images and local database of said images at said first client;

synchronizing said first client's local index with a master index of a central server, said master index comprising all images available for sharing.

searching by a second client of said central servers master index for a particular image using said metadata;

returning a search result from said central server to said second client; and

coordinating the transfer of a desired image found in said search result from said first client to said second client.

35. The computer-readable medium of claim 33 wherein the computer-executable instructions for returning a search result further comprises a process action of using metadata to limit access to an image identified in a search as meeting the search criteria by not returning said image in said search result.

36. The computer-readable medium of claim 34 wherein the computer-executable instructions for coordinating said transfer of the image further comprises:

requesting at least one image by said second client from said central server's master index;

sending a notification by said central server to said first client to load said requested image to an on-line cache;

loading said requested image to said on-line cache by said first client;

downloading said requested image from cache by said second client.

37. A system for transferring files, the system comprising:

a general purpose computing device; and

a computer program comprising program modules executable by the computing device, wherein the computing device is directed by the program modules of the computer program to,

input files at a first client;

annotate said files at said first client;

create a local index of said files and a local database of said files at said first client;

synchronize said first client's local index with a master index of a central server, said master index comprising all files available for sharing;

search by a remote client of said central server's master index for a particular file using said annotated data;

return a search result from said central server to said remote client; and

transfer a desired file found in said search result to said remote client.

38. The system of claim 37 wherein the computer module to annotate said file further comprises sub-modules to:

locate the same file as said file in other locations;

extract all annotation data from said file located in said other locations;

annotate said file with said annotation data extracted from said file in said other locations.

39. The system of claim 37 wherein the computer module to return a search result further comprises a sub-module to use annotation data to limit access to a file identified in a search as meeting a search criteria by not returning said image data in said search result.

40. The system of claim 37 wherein the computer module to transfer a file further comprises sub-modules to:

request at least one file by said remote client from said central server's master index;

send a notification from said central server to said first client to load said requested file to an on-line cache;

load said requested file to said on-line cache by said first client;

download said requested file from said on-line cache by said remote client.

41-54. (canceled)

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