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Live location sharing

Abstract

Techniques for live location sharing are described. A first mobile device and a second mobile device can communicate with one another using an IM program. The first mobile device can receive a user input to share a location of the first mobile device in the IM program. Sharing the location can include causing the second mobile device to display a location of the first mobile device in an IM program user interface on the second mobile device. Duration of sharing the location can be user-configurable. The second mobile device may or may not share a location of the second device for display in the IM program executing on the first mobile device.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS (1) This application is a continuation of U.S. patent application Ser. No. 16/532,349, entitled “Live Location Sharing,” filed Aug. 5, 2019, which is a continuation of U.S. patent application Ser. No. 14/503,270, entitled “Live Location Sharing,” filed Sep. 30, 2014, now U.S. Pat. No. 10,382,378, issued Aug. 13, 2019, which claims priority to U.S. Provisional Application No. 62/006,110, entitled “Live Location Sharing,” filed May 31, 2014, each of which are incorporated herein by reference. This application and U.S. patent application Ser. No. 14/503,270 is also related to U.S. patent application Ser. Nos. 14/503,355, 14/503,376, 14/503,386, all of which are entitled “Message User Interfaces for Capture and Transmittal of Media and Location Content,” all filed on May 31, 2014.

TECHNICAL FIELD
(1) This disclosure relates generally to location-based services.
BACKGROUND
(2) A mobile device may have an instant messaging (IM) program that allows a user of the mobile device to chat with another user over the Internet. The IM program can offer real-time (“live”) transmission of text from the mobile device to a device of the other user, and receive and display

real-time text received from the other device. The IM program can have a peer-to-peer or server-client architecture for transmitting the text in real-time.

SUMMARY

(3) Techniques for live location sharing are described. A first mobile device and a second mobile device can communicate with one another using an IM program. The first mobile device can receive a user input to share a location of the first mobile device in the IM program. Sharing the location can include causing the second mobile device to display a location of the first mobile device in an IM program user interface on the second mobile device. Duration of sharing the location can be user-configurable. The second mobile device may or may not share a location of the second device for display in the IM program executing on the first mobile device.

(4) The features described in this specification can be implemented to achieve one or more advantages. Compared to conventional IM program, the features described in this specification can allow chatting users to share more information. A user may see, in a user interface of the IM program, where the user's chatting partner is located. Likewise, the chatting partner can see where the user is located. Such information can enhance user experience, and can make tasks such as scheduling a gathering at a location easier. A user's privacy is protected according to the user's own preference as to with whom to share a location, and for how long.

(5) The details of one or more implementations of the subject matter are set forth in the accompanying drawings and the description below. Other features, aspects, and advantages of the subject matter will become apparent from the description, the drawings, and the claims.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) FIG. **1** is a diagram illustrating exemplary live location sharing.

(2) FIGS. **2**A-**2**D illustrate exemplary user interfaces for live location sharing.

(3) FIG. **3** is a block diagram illustrating exemplary interaction between mobile devices and their respective servers for live location sharing.

(4) FIG. **4** is a block diagram illustrating components of an exemplary server and an exemplary mobile device for live location sharing.

(5) FIG. **5** is a flowchart of an exemplary process of live location sharing.

(6) FIG. **6** is a flowchart of an exemplary process of live location sharing.

(7) FIG. **7** is a flowchart of an exemplary process of live location sharing.

(8) FIG. **8** is a block diagram illustrating an exemplary device architecture of a mobile device implementing the features and operations described in reference to FIGS. **1**-**7**.

(9) FIG. **9** is a block diagram of an exemplary network operating environment for the mobile devices of FIGS. **1**-**7**.

(10) FIG. **10** is a block diagram of an exemplary system architecture for implementing the features and operations of FIGS. **1**-**7**.

(11) Like reference symbols in the various drawings indicate like elements.

DETAILED DESCRIPTION

Exemplary Live Location Sharing

(12) FIG. **1** is a diagram illustrating exemplary live location sharing. Mobile device **102** can communicate with mobile device **104** over communications network **110** using an IM program. The IM program can be hosted on a server to which mobile device **102** and mobile device **104** connect. Alternatively, each of mobile device **102** and mobile device **104** can host a separate copy of an IM program. A first user of mobile device **102** and a second user of mobile device **104** may chat (**112**A, **112**B) with each other online using the IM program.

(13) During the chat, mobile device **104** can display location sharing interface **114** in response to an

input from the second user. Location sharing interface **114** allows the second user to enable location sharing. Location sharing can include allowing mobile device **102** to see a real-time location of mobile device **104** in the IM program. Allowing mobile device **102** to see the location of mobile device **104** can include allowing mobile device **102** to access the location through a server. The location can be stored on mobile device **104**, or submitted by mobile device **104** to be stored on the server temporarily for duration of location sharing.

(14) Mobile device **104** receives the input to enable location sharing. In response, mobile device **104** notifies mobile device **102** of the location sharing. Mobile device **102** acquires the location of mobile device **104**. Mobile device **102** can display virtual map **116** in the IM program. Mobile device **102** can represent the real-time location of mobile device **104** using marker **118** in virtual map **116**. Marker **118** can move in virtual map **116**, corresponding to physical movement of mobile device **104**.

Exemplary User Interface

(15) FIGS. **2**A-**2**D illustrate exemplary user interfaces for live location sharing. Each user interface can be a user interface of an IM program executing on either mobile device **102** or mobile device **104** of FIG. **1**. For convenience, each user interface will be described in reference to mobile device **102**.

(16) FIG. **2**A illustrates exemplary user interface **202** for initiating live location sharing. The live location sharing can be sharing a location of mobile device **102** with a device that is in communication with mobile device through an IM program. The sharing can be limited to the IM program, where the shared location is visible in an IM program on the other device.

(17) User interface **202** can include settings user interface item **204**. Settings user interface item **204** can have a label “details” or any other label indicating that a user can access detailed settings of the IM program. Upon receiving a user input in settings user interface item **204**, mobile device **102** can display a list of settings. One of the settings can be location sharing user interface item **206**. Location sharing user interface item **206** can include a virtual button that, when touched, can cause mobile device **102** to display location sharing user interface **208**.

(18) FIG. **2**B illustrates exemplary location sharing user interface **208**. Location sharing user interface **208** can include various user interface items for specifying when to share a location of mobile device **102** with another mobile device in an IM program. Location sharing user interface **208** can include virtual button **210** that, when selected, causes mobile device **102** to share location of mobile device **102** in an IM program for a first time period, e.g., one hour. Location sharing user interface **208** can include virtual button **212** that, when selected, causes mobile device **102** to share location of mobile device **102** in an IM program for a second time period, e.g., one day. Location sharing user interface **208** can include virtual button **214** that, when selected, causes mobile device **102** to share location of mobile device **102** in an IM program for a third time period, e.g., indefinitely. Location sharing user interface **208** can include virtual button **216** that, when selected, causes mobile device **102** to share location of mobile device **102** in an IM program with another device when mobile device **102** is in proximity with the other device and in communication with the other device. The proximity can be user defined, e.g., within a same country, within a same city, or within X miles or meters of one another.

(19) FIG. **2**C illustrates exemplary map user interface **218** of an IM program executing on mobile device **102**. Mobile device **102** can display map user interface **218** upon receiving a user confirmation for sharing the location. Map user interface **218** can include marker **220** indicating a current location of mobile device **102**, as can be visible in an IM program on another device that receives the shared location. Accordingly, a user of mobile device **102** can be aware of what a user of the other device sees.

(20) FIG. **2**D illustrates exemplary map user interface **222** of an IM program executing on mobile device **102**. Mobile device **102** is in communication with another mobile device using the IM program. Mobile device **102** shared location of mobile device **102** with the other device. The other

device, in return, shared location of that device with mobile device **102**. Mobile device **102** can display map user interface **222** that includes a virtual map, marker **224** indicating a real-time location of mobile device **102**, and marker **226** indicating the real-time location of the other device.

Exemplary System Components

(21) FIG. **3** is a block diagram illustrating exemplary interaction between mobile devices and their respective servers for live location sharing. Mobile device **102** and mobile device **104** can communicate with one another using communication channel **302**. Communication channel **302** can be a communication channel for IM programs and can be based on a first telephone number PN**1** of mobile device **102** and a second telephone number PN**2** of mobile device **104**. Mobile device **102** has logged into a user account on first server **304**. The user account is associated with an account identifier ID**1**, e.g., an account name. Mobile device **104** has logged into a user account on second server **306**. The user account is associated with an account identifier ID**2**.

(22) Mobile device **102** received a user input requesting mobile device **102** to share a location of mobile device **102** with mobile device **104** in the IM program. In response, mobile device **102** can submit request **308** to server **304** requesting server **304** to provide location sharing information for passing to mobile device **104** through communication channel **302**. In response, server **304** can provide mapping packet **310**A to mobile device **102**. Mapping packet **310**A can include PN**1** and ID**1**, and information on how long the location will be shared.

(23) Mobile device **102** can submit mapping packet **310**B, which can be the same as mapping packet **310**A, to mobile device **104** through communication channel **302**. Mobile device **104** provides the mapping packet **310**B to server **306** as request **310**C. Server **306** may already store the second telephone number PN**2** of mobile device **104** and account identifier ID**2**.

(24) Server **306** can submit the number PN**1** and ID**1** to an identity service (IDS) **312**. The IDS **312** can include one or more computers configured to determine, based on PN**1** and ID**1**, whether mobile device **102** is still logged in to server **304**. The IDS **312** can send token **314** to server **306**. Server **306** can submit token **314** to server **304**. Server **304** can retrieve location of mobile device **102** and provide the location to server **306**. Server **306** can, in turn, provide the location to mobile device **104** for displaying in the IM program.

(25) FIG. **4** is a block diagram illustrating components of an exemplary server and an exemplary mobile device for live location sharing. The server can be either server **304** or server **306** (of FIG. **3**). The mobile device can be either mobile device **102** or mobile device **104** (of FIG. **3**). For convenience, FIG. **4** will be described in reference to server **304** and mobile device **102**.

(26) Mobile device **102** can include instant messaging subsystem **402**. Instant messaging subsystem **402** is a component of mobile device **102** configured to execute an IM program and sharing a location of mobile device **102** in the IM program with another device. Instant messaging subsystem **402** can include location interface module **404** configured to share the location in the IM program. Instant messaging subsystem **402** can include map module **406** configured to display a map in the IM program, including displaying in the map the location of the mobile device **102** and, if a location of another device is shared, the location of the other device. Instant messaging subsystem **402** can include device communication module **408** configured to establish a telephone number based communication channel with another device and communicate with the other device using an IM program over that channel.

(27) Mobile device **102** can include server communication subsystem **410**. Server communication subsystem **410** is a component of mobile device **102** configured to send a request to server **304** for mapping packet upon receiving instructions from location interface module **404** to share location. Server communication subsystem **410** can receive the mapping packet from server **304**.

(28) If another device shares a location with mobile device **102**, the other device can notify mobile device **102** of the sharing through device communication module **408**. Location interface module **404** can then instruct server communication subsystem **410** to request the shared location from server **304**. Location interface module **404** can provide the shared location to location interface

module **404** for displaying in a map of the IM program.
(29) Mobile device **102** can include location subsystem **412**. Location subsystem **412** is a component of mobile device **102** configured to determine a location of mobile device **102**, for example, by using signals from a cellular communication system, one or more wireless access points, or a global satellite navigation system. Location subsystem **412** can provide the location to server communication subsystem **410** for submitting to the server for sharing.
Exemplary Procedures
(30) FIG. **5** is a flowchart of an exemplary process **500** of live location sharing. A first mobile device, e.g., mobile device **102**, can submit (**502**) a notification to a second mobile device, e.g., mobile device **104**, through an instant message program. The notification can indicate that the first mobile device shall provide a first location of the first mobile device for sharing with the second mobile device. At time of submitting the notification, the first mobile device and the second mobile device can be in communication through the instant message program. The communication can be established based on a phone number of the first mobile device and a phone number of the second mobile device.
(31) The first mobile device can receive (**504**), through the instant message program and from the second mobile device, a response to the notification. The response can be triggered by the notification. The response can be approved by a user of the second mobile device. The response can indicate that the second mobile device shall provide a second location of the second mobile device for sharing with the first mobile device.
(32) The first mobile device can obtain (**506**), from a server, the second location. The first mobile device can then provide (**508**) a marker representing the second location for display on a virtual map in the instant message program on the first mobile device. Likewise, the second mobile device can provide a marker representing the first location of the first mobile device for display on a virtual map in an instant message program on the second mobile device.
(33) The first mobile device can obtain, from the server, one or more updates of the second location. The updates can correspond to a movement of the second mobile device. The first mobile device can provide a representation of updated second location for display in the instant message program on the first mobile device. The representation of the updated second location can indicate a path of the movement.
(34) FIG. **6** is a flowchart of an exemplary process **600** of live location sharing. An instant message program executing on first mobile device, e.g., mobile device **102**, can receive (**602**) a notification to a second mobile device, e.g., mobile device **104**. The notification can indicate that the second mobile device shares a location of the second mobile device with the first mobile device. The notification can include a mapping packet including a phone number of the second mobile device and an account identifier of the second mobile device.
(35) The first mobile device can submit (**604**) and to a server, the mapping packet including the phone number and the account identifier for retrieving the location of the second mobile device.
(36) Upon successful authentication by the server indicating that the second mobile device is logged in and that a location of the second mobile device is available, the first mobile device can receive (**606**) the location from the server during a time period as specified by the second device for sharing the location. The time period can be an hour, a day, or an indefinite time period as specified by the second mobile device according to a user input in the instant message program.
(37) The first mobile device then provides (**608**) a marker representing the location for display on a virtual map in the instant message program on the first mobile device. During the time period, the first mobile device can provide the marker representing the location of the second mobile device for display in one or more other programs for displaying locations. The programs can include, for example, a “find my friend” application program.
(38) FIG. **7** is a flowchart of an exemplary process **700** of live location sharing. A first server, e.g., server **304** of FIG. **3** can receive (**702**) a mapping packet from an instant message program of a first

mobile device, e.g., mobile device **102**. The mapping packet can include a phone number of a second mobile device, e.g., mobile device **104**. The mapping packet can include an account identifier of the second mobile device. The mapping packet can indicate that the second mobile device has shared a location of the second mobile device with the first mobile device in the instant message program. The first server can be connected to the first mobile device by a communications network. The second server can be connected to the second mobile device by the communications network. The first mobile device and the second mobile device can be connected to one another by the same communications network or a different communications network.

(39) The first server can submit (**704**) the phone number and the account identifier to an identity service for determining whether the second mobile device is logged into the account on a second server. The identity service can provide a token indicating that the second mobile device is logged into the account.

(40) Upon receiving the token from the identity service, the first server can submit (**706**) a request to the second server for retrieving a current location of the second mobile device. The request can include the account identifier of the second mobile device. The current location of the second mobile device can be received by the second server from the second mobile device in response to an input on the second mobile device indicating that the second mobile device shares location of the second mobile device with the first mobile device.

(41) Upon receiving the current location from the second server, the first server can submit (**708**) the current location to the first mobile device for display in the instant message program.

Exemplary Mobile Device Architecture

(42) FIG. **8** is a block diagram of an exemplary architecture **800** for the mobile devices of FIGS. **1-7**. A mobile device (e.g., mobile device **102**) can include memory interface **802**, one or more data processors, image processors and/or processors **804**, and peripherals interface **806**. Memory interface **802**, one or more processors **804** and/or peripherals interface **806** can be separate components or can be integrated in one or more integrated circuits. Processors **804** can include application processors, baseband processors, and wireless processors. The various components in mobile device **102**, for example, can be coupled by one or more communication buses or signal lines.

(43) Sensors, devices, and subsystems can be coupled to peripherals interface **806** to facilitate multiple functionalities. For example, motion sensor **810**, light sensor **812**, and proximity sensor **814** can be coupled to peripherals interface **806** to facilitate orientation, lighting, and proximity functions of the mobile device. Location processor **815** (e.g., GPS receiver) can be connected to peripherals interface **806** to provide geopositioning. Electronic magnetometer **816** (e.g., an integrated circuit chip) can also be connected to peripherals interface **806** to provide data that can be used to determine the direction of magnetic North. Thus, electronic magnetometer **816** can be used as an electronic compass. Motion sensor **810** can include one or more accelerometers configured to determine change of speed and direction of movement of the mobile device. Barometer **818** can include one or more devices connected to peripherals interface **806** and configured to measure pressure of atmosphere around the mobile device.

(44) Camera subsystem **820** and an optical sensor **822**, e.g., a charged coupled device (CCD) or a complementary metal-oxide semiconductor (CMOS) optical sensor, can be utilized to facilitate camera functions, such as recording photographs and video clips.

(45) Communication functions can be facilitated through one or more wireless communication subsystems **824**, which can include radio frequency receivers and transmitters and/or optical (e.g., infrared) receivers and transmitters. The specific design and implementation of the communication subsystem **824** can depend on the communication network(s) over which a mobile device is intended to operate. For example, a mobile device can include communication subsystems **824** designed to operate over a GSM network, a GPRS network, an EDGE network, a Wi-Fi™ or WiMax™ network, and a Bluetooth™ network. In particular, the wireless communication

subsystems **824** can include hosting protocols such that the mobile device can be configured as a base station for other wireless devices.
(46) Audio subsystem **826** can be coupled to a speaker **828** and a microphone **830** to facilitate voice-enabled functions, such as voice recognition, voice replication, digital recording, and telephony functions. Audio subsystem **826** can be configured to receive voice commands from the user.
(47) I/O subsystem **840** can include touch surface controller **842** and/or other input controller(s) **844**. Touch surface controller **842** can be coupled to a touch surface **846** or pad. Touch surface **846** and touch surface controller **842** can, for example, detect contact and movement or break thereof using any of a plurality of touch sensitivity technologies, including but not limited to capacitive, resistive, infrared, and surface acoustic wave technologies, as well as other proximity sensor arrays or other elements for determining one or more points of contact with touch surface **846**. Touch surface **846** can include, for example, a touch screen.
(48) Other input controller(s) **844** can be coupled to other input/control devices **848**, such as one or more buttons, rocker switches, thumb-wheel, infrared port, USB port, and/or a pointer device such as a stylus. The one or more buttons (not shown) can include an up/down button for volume control of speaker **828** and/or microphone **830**.
(49) In one implementation, a pressing of the button for a first duration may disengage a lock of the touch surface **846**; and a pressing of the button for a second duration that is longer than the first duration may turn power to mobile device **102** on or off. The user may be able to customize a functionality of one or more of the buttons. The touch surface **846** can, for example, also be used to implement virtual or soft buttons and/or a keyboard.
(50) In some implementations, mobile device **102** can present recorded audio and/or video files, such as MP3, AAC, and MPEG files. In some implementations, mobile device **102** can include the functionality of an MP3 player. Mobile device **102** may, therefore, include a pin connector that is compatible with the MP3 player. Other input/output and control devices can also be used.
(51) Memory interface **802** can be coupled to memory **850**. Memory **850** can include high-speed random access memory and/or non-volatile memory, such as one or more magnetic disk storage devices, one or more optical storage devices, and/or flash memory (e.g., NAND, NOR). Memory **850** can store operating system **852**, such as Darwin, RTXC, LINUX, UNIX, OS X, WINDOWS, or an embedded operating system such as VxWorks. Operating system **852** may include instructions for handling basic system services and for performing hardware dependent tasks. In some implementations, operating system **852** can include a kernel (e.g., UNIX kernel).
(52) Memory **850** may also store communication instructions **854** to facilitate communicating with one or more additional devices, one or more computers and/or one or more servers. Memory **850** may include graphical user interface instructions **856** to facilitate graphic user interface processing; sensor processing instructions **858** to facilitate sensor-related processing and functions; phone instructions **860** to facilitate phone-related processes and functions; electronic messaging instructions **862** to facilitate electronic-messaging related processes and functions; web browsing instructions **864** to facilitate web browsing-related processes and functions; media processing instructions **866** to facilitate media processing-related processes and functions; GPS/Navigation instructions **868** to facilitate GPS and navigation-related processes and instructions; camera instructions **870** to facilitate camera-related processes and functions; magnetometer data **872** and calibration instructions **874** to facilitate magnetometer calibration. The memory **850** may also store other software instructions (not shown), such as security instructions, web video instructions to facilitate web video-related processes and functions, and/or web shopping instructions to facilitate web shopping-related processes and functions. In some implementations, the media processing instructions **866** are divided into audio processing instructions and video processing instructions to facilitate audio processing-related processes and functions and video processing-related processes and functions, respectively. An activation record and International Mobile Equipment Identity

(IMEI) or similar hardware identifier can also be stored in memory **850**. Memory **850** can store live location sharing instructions **876** that, when executed, can cause processor **804** to perform operations of live location sharing, e.g., procedures as described in reference to FIG. **5** and FIG. **6**.

(53) Each of the above identified instructions and applications can correspond to a set of instructions for performing one or more functions described above. These instructions need not be implemented as separate software programs, procedures, or modules. Memory **850** can include additional instructions or fewer instructions. Furthermore, various functions of the mobile device may be implemented in hardware and/or in software, including in one or more signal processing and/or application specific integrated circuits.

Exemplary Operating Environment

(54) FIG. **9** is a block diagram of an exemplary network operating environment **900** for the mobile devices of FIGS. **1-7**. Mobile devices **902***a* and **902***b* can, for example, communicate over one or more wired and/or wireless networks **910** in data communication. For example, a wireless network **912**, e.g., a cellular network, can communicate with a wide area network (WAN) **914**, such as the Internet, by use of a gateway **916**. Likewise, an access device **918**, such as an 802.11g wireless access point, can provide communication access to the wide area network **914**. Each of mobile devices **902***a* and **902***b* can be mobile device **102** and mobile device **104**, respectfully, configured to communicate with one another using an instant messaging program and to share a respective location in the instant messaging program.

(55) In some implementations, both voice and data communications can be established over wireless network **912** and the access device **918**. For example, mobile device **902***a* can place and receive phone calls (e.g., using voice over Internet Protocol (VOIP) protocols), send and receive e-mail messages (e.g., using Post Office Protocol 3 (POP3)), and retrieve electronic documents and/or streams, such as web pages, photographs, and videos, over wireless network **912**, gateway **916**, and wide area network **914** (e.g., using Transmission Control Protocol/Internet Protocol (TCP/IP) or User Datagram Protocol (UDP)). Likewise, in some implementations, the mobile device **902***b* can place and receive phone calls, send and receive e-mail messages, and retrieve electronic documents over the access device **918** and the wide area network **914**. In some implementations, mobile device **902***a* or **902***b* can be physically connected to the access device **918** using one or more cables and the access device **918** can be a personal computer. In this configuration, mobile device **902***a* or **902***b* can be referred to as a “tethered” device.

(56) Mobile devices **902***a* and **902***b* can also establish communications by other means. For example, wireless device **902***a* can communicate with other wireless devices, e.g., other mobile devices, cell phones, etc., over the wireless network **912**. Likewise, mobile devices **902***a* and **902***b* can establish peer-to-peer communications **920**, e.g., a personal area network, by use of one or more communication subsystems, such as the Bluetooth™ communication devices. Other communication protocols and topologies can also be implemented.

(57) The mobile device **902***a* or **902***b* can, for example, communicate with one or more services **930** and **940** over the one or more wired and/or wireless networks. For example, instant messaging services **930** can allow mobile devices **902***a* and **902***b* to communicate with one another using an instant messaging program. Location service **940** can provide the location and map data to mobile devices **902***a* and **902***b* for determining locations of mobile devices **902***a* and **902***b*.

(58) Mobile device **902***a* or **902***b* can also access other data and content over the one or more wired and/or wireless networks. For example, content publishers, such as news sites, Really Simple Syndication (RSS) feeds, web sites, blogs, social networking sites, developer networks, etc., can be accessed by mobile device **902***a* or **902***b*. Such access can be provided by invocation of a web browsing function or application (e.g., a browser) in response to a user touching, for example, a Web object.

(59) A number of implementations of the invention have been described. Nevertheless, it will be understood that various modifications can be made without departing from the spirit and scope of

the invention.

Exemplary System Architecture

(60) FIG. **10** is a block diagram of an exemplary system architecture for implementing the features and operations of FIGS. **1-7**. Other architectures are possible, including architectures with more or fewer components. In some implementations, architecture **1000** includes one or more processors **1002** (e.g., dual-core Intel® Xeon® Processors), one or more output devices **1004** (e.g., LCD), one or more network interfaces **1006**, one or more input devices **1008** (e.g., mouse, keyboard, touch-sensitive display) and one or more computer-readable media **1012** (e.g., RAM, ROM, SDRAM, hard disk, optical disk, flash memory, etc.). These components can exchange communications and data over one or more communication channels **1010** (e.g., buses), which can utilize various hardware and software for facilitating the transfer of data and control signals between components.

(61) The term "computer-readable medium" refers to a medium that participates in providing instructions to processor **1002** for execution, including without limitation, non-volatile media (e.g., optical or magnetic disks), volatile media (e.g., memory) and transmission media. Transmission media includes, without limitation, coaxial cables, copper wire and fiber optics.

(62) Computer-readable media **1012** can further include operating system **1014** (e.g., a Linux® operating system), network communication module **1016**, location sharing manager **1020**, location manager **1030**, and identity service manager **1040**. Operating system **1014** can be multi-user, multiprocessing, multitasking, multithreading, real time, etc. Operating system **1014** performs basic tasks, including but not limited to: recognizing input from and providing output to devices **1006**, **1008**; keeping track and managing files and directories on computer-readable media **1012** (e.g., memory or a storage device); controlling peripheral devices; and managing traffic on the one or more communication channels **1010**. Network communications module **1016** includes various components for establishing and maintaining network connections (e.g., software for implementing communication protocols, such as TCP/IP, HTTP, etc.).

(63) Location sharing manager **1020** can include computer instructions that, when executed, cause processor **1002** to perform operations of location sharing, e.g., procedure **700** as described in reference to FIG. **7**. Location manager **1030** can include computer instructions that, when executed, cause processor **1002** to provide location of mobile device and virtual maps to a mobile device. Identity service manager **1040** can include computer instructions that, when executed, cause processor **1002** to perform functions of identity services **312** as described in reference to FIG. **3**.

(64) Architecture **1000** can be implemented in a parallel processing or peer-to-peer infrastructure or on a single device with one or more processors. Software can include multiple software components or can be a single body of code.

(65) The described features can be implemented advantageously in one or more computer programs that are executable on a programmable system including at least one programmable processor coupled to receive data and instructions from, and to transmit data and instructions to, a data storage system, at least one input device, and at least one output device. A computer program is a set of instructions that can be used, directly or indirectly, in a computer to perform a certain activity or bring about a certain result. A computer program can be written in any form of programming language (e.g., Objective-C, Java), including compiled or interpreted languages, and it can be deployed in any form, including as a stand-alone program or as a module, component, subroutine, a browser-based web application, or other unit suitable for use in a computing environment.

(66) Suitable processors for the execution of a program of instructions include, by way of example, both general and special purpose microprocessors, and the sole processor or one of multiple processors or cores, of any kind of computer. Generally, a processor will receive instructions and data from a read-only memory or a random access memory or both. The essential elements of a computer are a processor for executing instructions and one or more memories for storing instructions and data. Generally, a computer will also include, or be operatively coupled to communicate with, one or more mass storage devices for storing data files; such devices include

magnetic disks, such as internal hard disks and removable disks; magneto-optical disks; and optical disks. Storage devices suitable for tangibly embodying computer program instructions and data include all forms of non-volatile memory, including by way of example semiconductor memory devices, such as EPROM, EEPROM, and flash memory devices; magnetic disks such as internal hard disks and removable disks; magneto-optical disks; and CD-ROM and DVD-ROM disks. The processor and the memory can be supplemented by, or incorporated in, ASICs (application-specific integrated circuits).

(67) To provide for interaction with a user, the features can be implemented on a computer having a display device such as a CRT (cathode ray tube) or LCD (liquid crystal display) monitor or a retina display device for displaying information to the user. The computer can have a touch surface input device (e.g., a touch screen) or a keyboard and a pointing device such as a mouse or a trackball by which the user can provide input to the computer. The computer can have a voice input device for receiving voice commands from the user.

(68) The features can be implemented in a computer system that includes a back-end component, such as a data server, or that includes a middleware component, such as an application server or an Internet server, or that includes a front-end component, such as a client computer having a graphical user interface or an Internet browser, or any combination of them. The components of the system can be connected by any form or medium of digital data communication such as a communication network. Examples of communication networks include, e.g., a LAN, a WAN, and the computers and networks forming the Internet.

(69) The computing system can include clients and servers. A client and server are generally remote from each other and typically interact through a communication network. The relationship of client and server arises by virtue of computer programs running on the respective computers and having a client-server relationship to each other. In some embodiments, a server transmits data (e.g., an HTML page) to a client device (e.g., for purposes of displaying data to and receiving user input from a user interacting with the client device). Data generated at the client device (e.g., a result of the user interaction) can be received from the client device at the server.

(70) A system of one or more computers can be configured to perform particular actions by virtue of having software, firmware, hardware, or a combination of them installed on the system that in operation causes or cause the system to perform the actions. One or more computer programs can be configured to perform particular actions by virtue of including instructions that, when executed by data processing apparatus, cause the apparatus to perform the actions.

(71) While this specification contains many specific implementation details, these should not be construed as limitations on the scope of any inventions or of what may be claimed, but rather as descriptions of features specific to particular embodiments of particular inventions. Certain features that are described in this specification in the context of separate embodiments can also be implemented in combination in a single embodiment. Conversely, various features that are described in the context of a single embodiment can also be implemented in multiple embodiments separately or in any suitable subcombination. Moreover, although features may be described above as acting in certain combinations and even initially claimed as such, one or more features from a claimed combination can in some cases be excised from the combination, and the claimed combination may be directed to a subcombination or variation of a subcombination.

(72) Similarly, while operations are depicted in the drawings in a particular order, this should not be understood as requiring that such operations be performed in the particular order shown or in sequential order, or that all illustrated operations be performed, to achieve desirable results. In certain circumstances, multitasking and parallel processing may be advantageous. Moreover, the separation of various system components in the embodiments described above should not be understood as requiring such separation in all embodiments, and it should be understood that the described program components and systems can generally be integrated together in a single software product or packaged into multiple software products.

(73) Thus, particular embodiments of the subject matter have been described. Other embodiments are within the scope of the following claims. In some cases, the actions recited in the claims can be performed in a different order and still achieve desirable results. In addition, the processes depicted in the accompanying figures do not necessarily require the particular order shown, or sequential order, to achieve desirable results. In certain implementations, multitasking and parallel processing may be advantageous.

Claims

1. A method for a messaging application, the method comprising: receiving, from a first mobile device associated with a first user account, a second user account identifier associated with a second user account and a notification from a second mobile device associated with the second user account indicating confirmation of a request to share a location of the second mobile device with the first user account; submitting, by the messaging application, the second user account identifier to one or more server computers for retrieving the location of the second mobile device; receiving, from the one or more server computers, the location of the second mobile device during a time period specified by the second user account for sharing the location of the second mobile device, wherein receiving the location of the second mobile device is based on a token that is indicative of successful authentication that the second user account is logged in using the second mobile device; and providing a marker representing the location for display on a map in a graphical user interface associated with the first user account.
2. The method of claim 1, wherein the messaging application is operating on the first mobile device.
3. The method of claim 1, wherein receiving the second user account identifier comprising receiving a mapping packet from the second mobile device that includes the second user account identifier, and wherein submitting, by the messaging application, the second user account identifier comprises submitting the mapping packet by the messaging application.
4. The method of claim 3, wherein the mapping packet further comprises information identifying the time period.
5. The method of claim 1, wherein providing the marker representing the location for display on the map in the graphical user interface comprises providing the marker for display on the map in the graphical user interface within the messaging application.
6. The method of claim 1, further comprising: during the time period, receiving an updated location of the second mobile device; and providing the marker representing the updated location for display on the map.
7. The method of claim 1, wherein the first mobile device and the second mobile device communicate via a communication channel associated with the messaging application.
8. One or more non-transitory computer-readable media comprising computer-executable instructions that, when executed by one or more processors, cause the one or more processors to perform operations comprising: receiving, from a first mobile device associated with a first user account, a second user account identifier associated with a second user account and a notification from a second mobile device associated with the second user account indicating confirmation of a request to share a location of the second mobile device with the first user account; submitting, by a messaging application, the second user account identifier to one or more server computers for retrieving the location of the second mobile device; receiving, from the one or more server computers, the location of the second mobile device during a time period specified by the second user account for sharing the location of the second mobile device, wherein receiving the location of the second mobile device is based on a token that is indicative of successful authentication that the second user account is logged in using the second mobile device; and providing a marker representing the location for display on a map in a graphical user interface associated with the first

user account.
9. The one or more non-transitory computer-readable media of claim 8, wherein the messaging application is operating on the first mobile device.
10. The one or more non-transitory computer-readable media of claim 8, wherein receiving the second user account identifier comprising receiving a mapping packet from the second mobile device that includes the second user account identifier, and wherein submitting, by the messaging application, the second user account identifier comprises submitting the mapping packet by the messaging application.
11. The one or more non-transitory computer-readable media of claim 10, wherein the mapping packet further comprises information identifying the time period.
12. The one or more non-transitory computer-readable media of claim 8, wherein providing the marker representing the location for display on the map in the graphical user interface comprises providing the marker for display on the map in the graphical user interface within the messaging application.
13. The one or more non-transitory computer-readable media of claim 8, wherein the operations further comprise: during the time period, receiving an updated location of the second mobile device; and providing the marker representing the updated location for display on the map.
14. The one or more non-transitory computer-readable media of claim 8, wherein the first mobile device and the second mobile device communicate via a communication channel associated with the messaging application.
15. A first mobile device, comprising: one or more processors; and a non-transitory computer readable storage media comprising computer-executable instructions that, when executed on the one or more processors, cause the one or more processors to: receive, from the first mobile device associated with a first user account, a second user account identifier associated with a second user account and a notification from a second mobile device associated with the second user account indicating confirmation of a request to share a location of the second mobile device with the first user account; submit, by a messaging application, the second user account identifier to one or more server computers for retrieving the location of the second mobile device; receive, from the one or more server computers, the location of the second mobile device during a time period specified by the second user account for sharing the location of the second mobile device, wherein receiving the location of the second mobile device is based on a token that is indicative of successful authentication that the second user account is logged in using the second mobile device; and provide a marker representing the location for display on a map in a graphical user interface associated with the first user account.
16. The first mobile device of claim 15, wherein the messaging application is operating on the first mobile device.
17. The first mobile device of claim 15, wherein receiving the second user account identifier comprising receiving a mapping packet from the second mobile device that includes the second user account identifier, and wherein submitting, by the messaging application, the second user account identifier comprises submitting the mapping packet by the messaging application.
18. The first mobile device of claim 17, wherein the mapping packet further comprises information identifying the time period.
19. The first mobile device of claim 15, wherein providing the marker representing the location for display on the map in the graphical user interface comprises providing the marker for display on the map in the graphical user interface within the messaging application.
20. The first mobile device of claim 15, wherein the non-transitory computer readable storage media comprises additional computer-executable instructions that, when executed on the one or more processors, cause the one or more processors to: during the time period, receive an updated location of the second mobile device; and provide the marker representing the updated location for display on the map.

21. The first mobile device of claim 15, wherein the first mobile device and the second mobile device communicate via a communication channel associated with the messaging application.