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Keskitalo et al.

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(54) **METHOD AND APPARATUS FOR FACILITATING COMMUNICATIONS FOR BROWSER-BASED APPLICATIONS**

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Related U.S. Application Data

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G06F 15/16 (2006.01)
H04L 29/08 (2006.01)

(52) **U.S. Cl.**
CPC ***H04L 67/02*** (2013.01); ***H04L 29/0809*** (2013.01); ***H04L 29/08621*** (2013.01); ***H04L 67/146*** (2013.01)

(58) **Field of Classification Search**
CPC ... H04L 67/02; H04L 67/146; H04L 29/0809; H04L 29/08621
See application file for complete search history.

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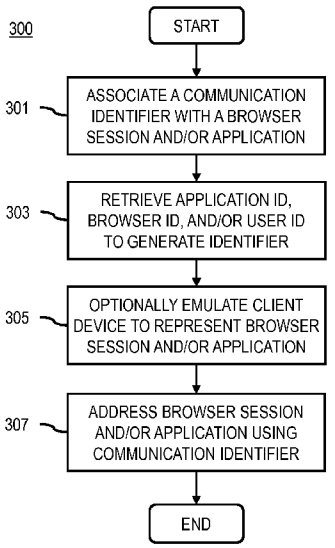
(57) **ABSTRACT**

An approach is presented for facilitating communications for browser-based applications. A data communication platform determines to associate a communication identifier with a browser session. The browser session hosts, at least in part, a web application. The communication identifier facilitates addressing of the browser session, the web application, or a combination thereof via a process that is not specific to the browser session, the web application, or a combination thereof.

10 Claims, 10 Drawing Sheets



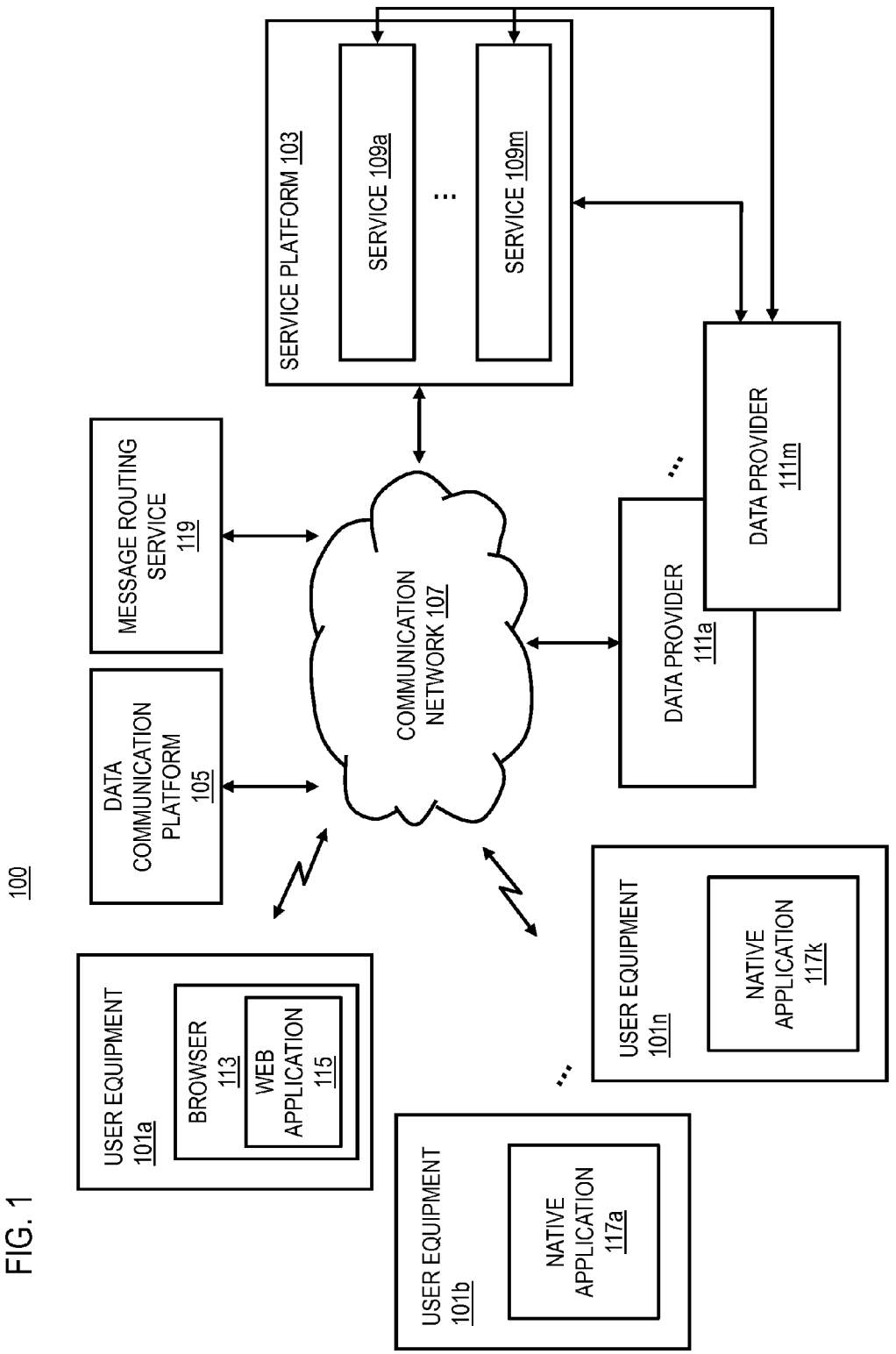

100
SERVICE PLATFORM 103
SERVICE 109a
SERVICE 109m
MESSAGE ROUTING SERVICE 119
DATA COMMUNICATION PLATFORM 105
COMMUNICATION NETWORK 107
DATA PROVIDER 111a
DATA PROVIDER 111m
USER EQUIPMENT 101a
BROWSER 113
WEB APPLICATION 115
USER EQUIPMENT 101b
NATIVE APPLICATION 117a
USER EQUIPMENT 101n
NATIVE APPLICATION 117k

FIG. 1

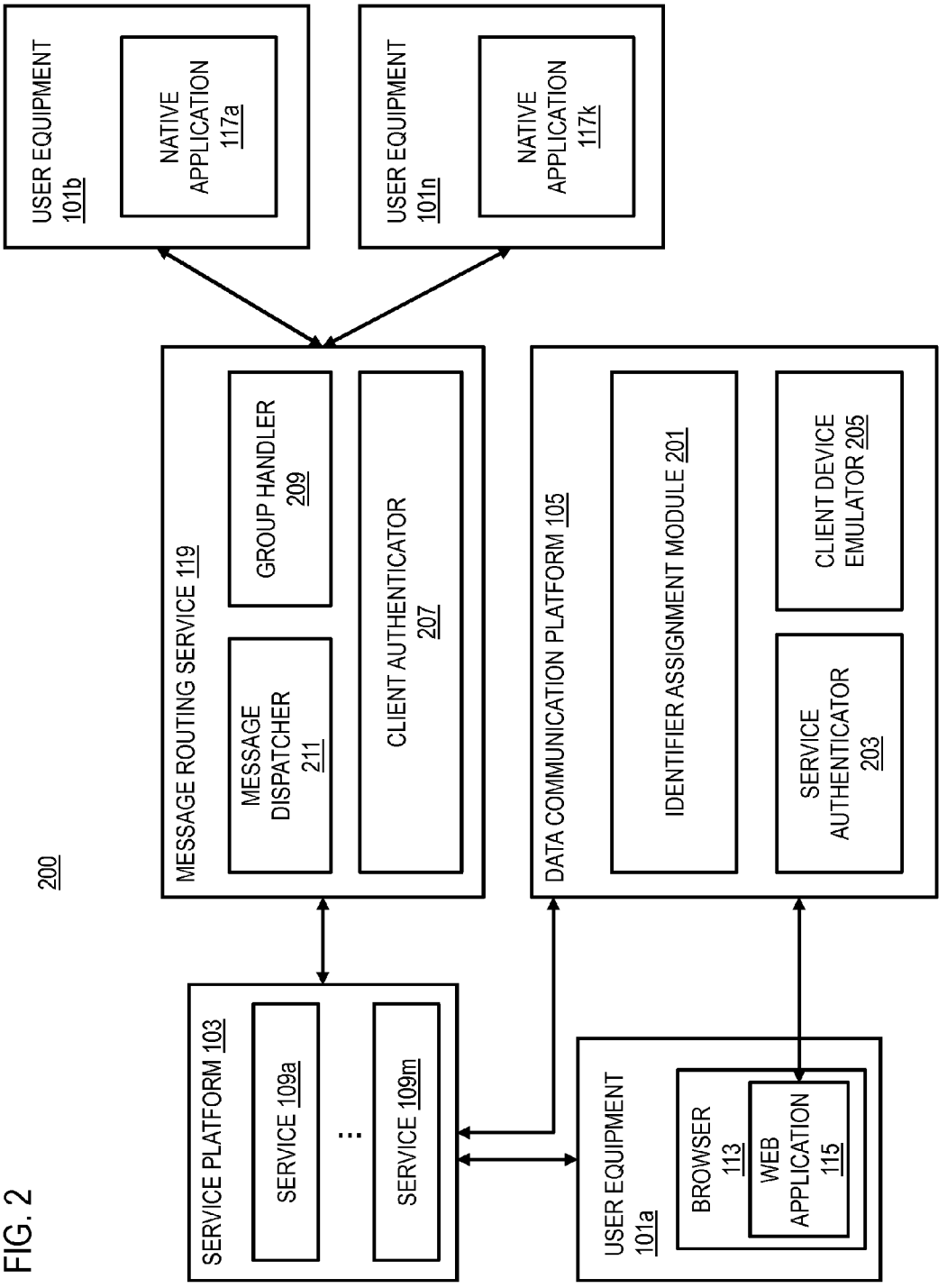

200
USER EQUIPMENT 101b
NATIVE APPLICATION 117a
USER EQUIPMENT 101n
NATIVE APPLICATION 117k
MESSAGE ROUTING SERVICE 119
GROUP HANDLER 209
MESSAGE DISPATCHER 211
CLIENT AUTHENTICATOR 207
DATA COMMUNICATION PLATFORM 105
IDENTIFIER ASSIGNMENT MODULE 201
CLIENT DEVICE EMULATOR 205
SERVICE AUTHENTICATOR 203
SERVICE PLATFORM 103
SERVICE 109a
SERVICE 109m
USER EQUIPMENT 101a
BROWSER 113
WEB APPLICATION 115

FIG. 2

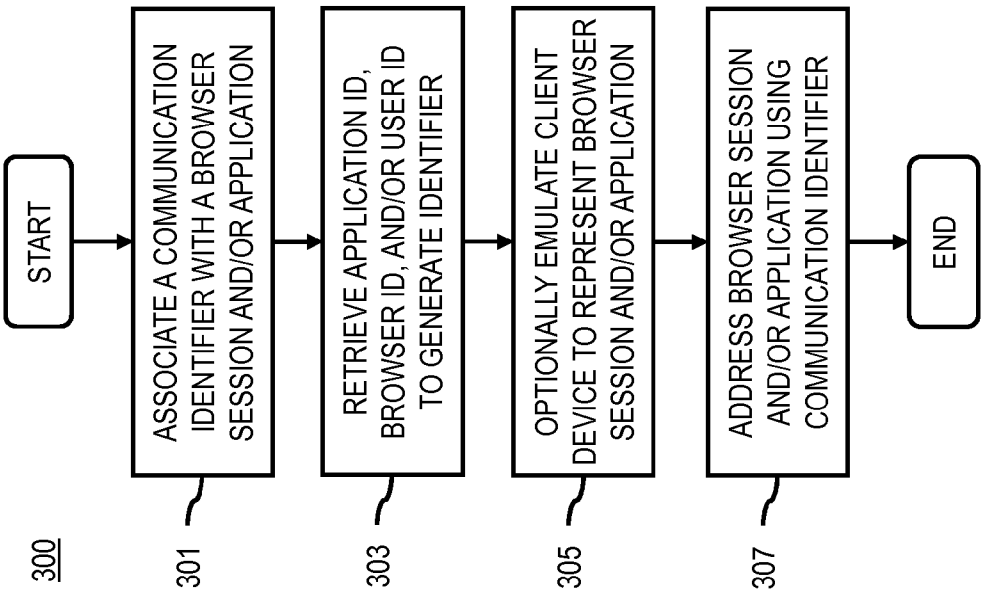

300
START
ASSOCIATE A COMMUNICATION IDENTIFIER WITH A BROWSER SESSION AND/OR APPLICATION
301
RETRIEVE APPLICATION ID, BROWSER ID, AND/OR USER ID TO GENERATE IDENTIFIER
303
OPTIONALLY EMULATE CLIENT DEVICE TO REPRESENT BROWSER SESSION AND/OR APPLICATION
305
ADDRESS BROWSER SESSION AND/OR APPLICATION USING COMMUNICATION IDENTIFIER
307
END

FIG. 3

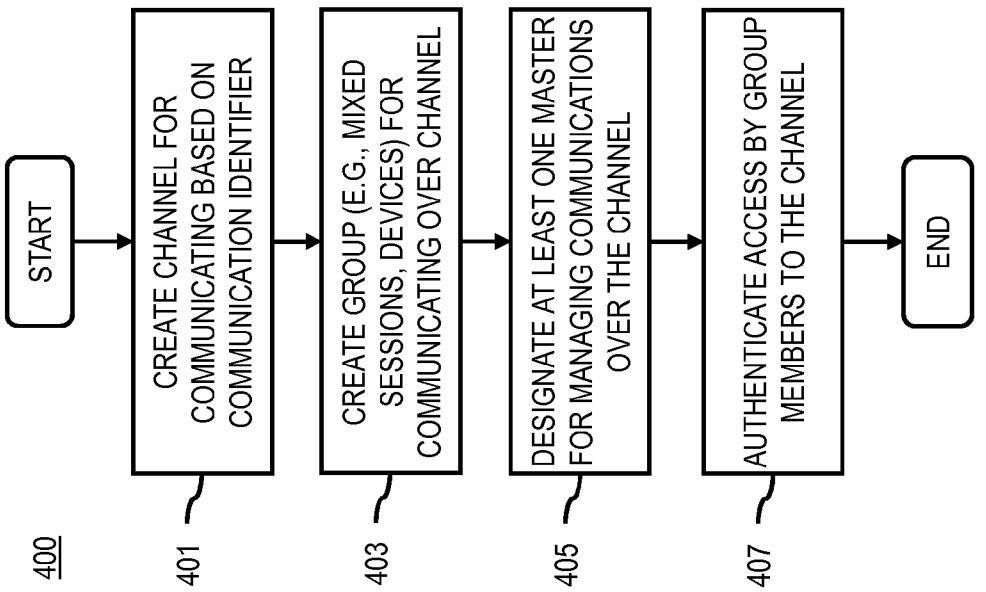

400
START
CREATE CHANNEL FOR COMMUNICATING BASED ON COMMUNICATION IDENTIFIER
401
CREATE GROUP (E.G., MIXED SESSIONS, DEVICES) FOR COMMUNICATING OVER CHANNEL
403
DESIGNATE AT LEAST ONE MASTER FOR MANAGING COMMUNICATIONS OVER THE CHANNEL
405
AUTHENTICATE ACCESS BY GROUP MEMBERS TO THE CHANNEL
407
END

FIG. 4

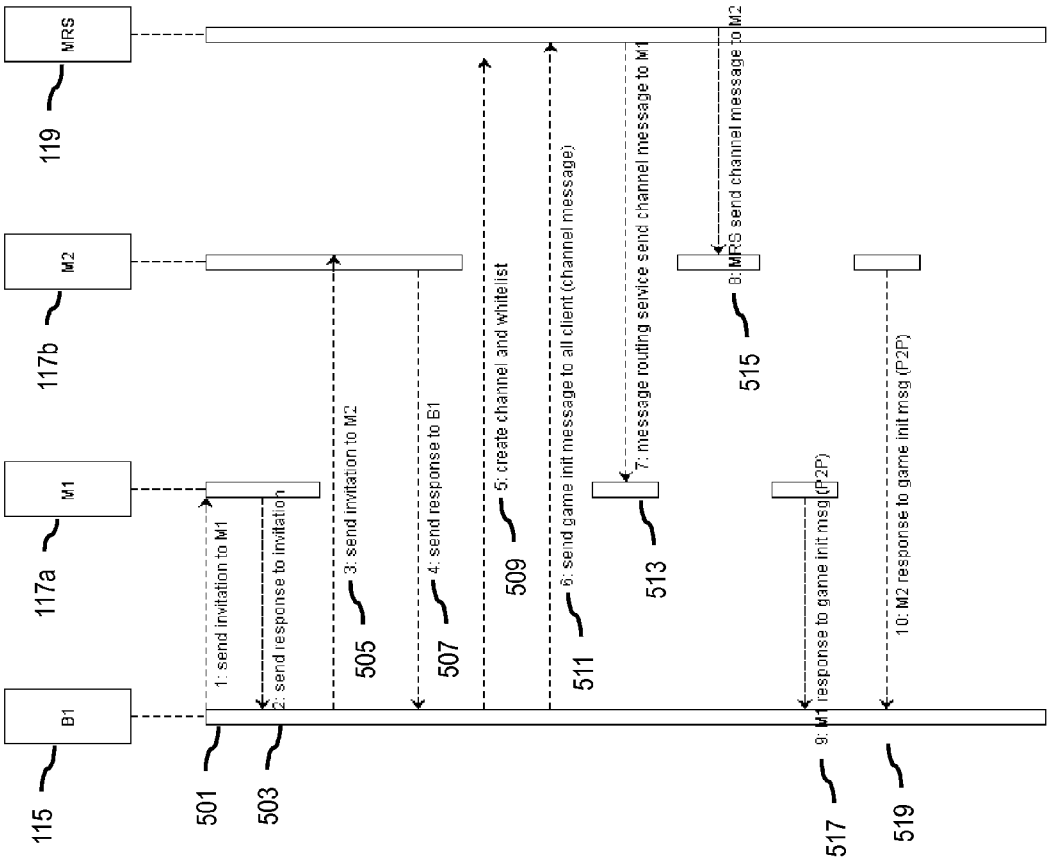

MRS
M2
M1
B1
119
117b
117a
115
1: send invitation to M1
2: send response to invitation
3: send invitation to M2
4: send response to B1
5: create channel and whitelist
6: send game init message to all client (channel message)
7: message routing service send channel message to M1
8: MRS send channel message to M2
9: M1 response to game init msg (P2P)
10: M2 response to game init msg (P2P)
501
503
505
507
509
511
513
515
517
519

FIG. 5

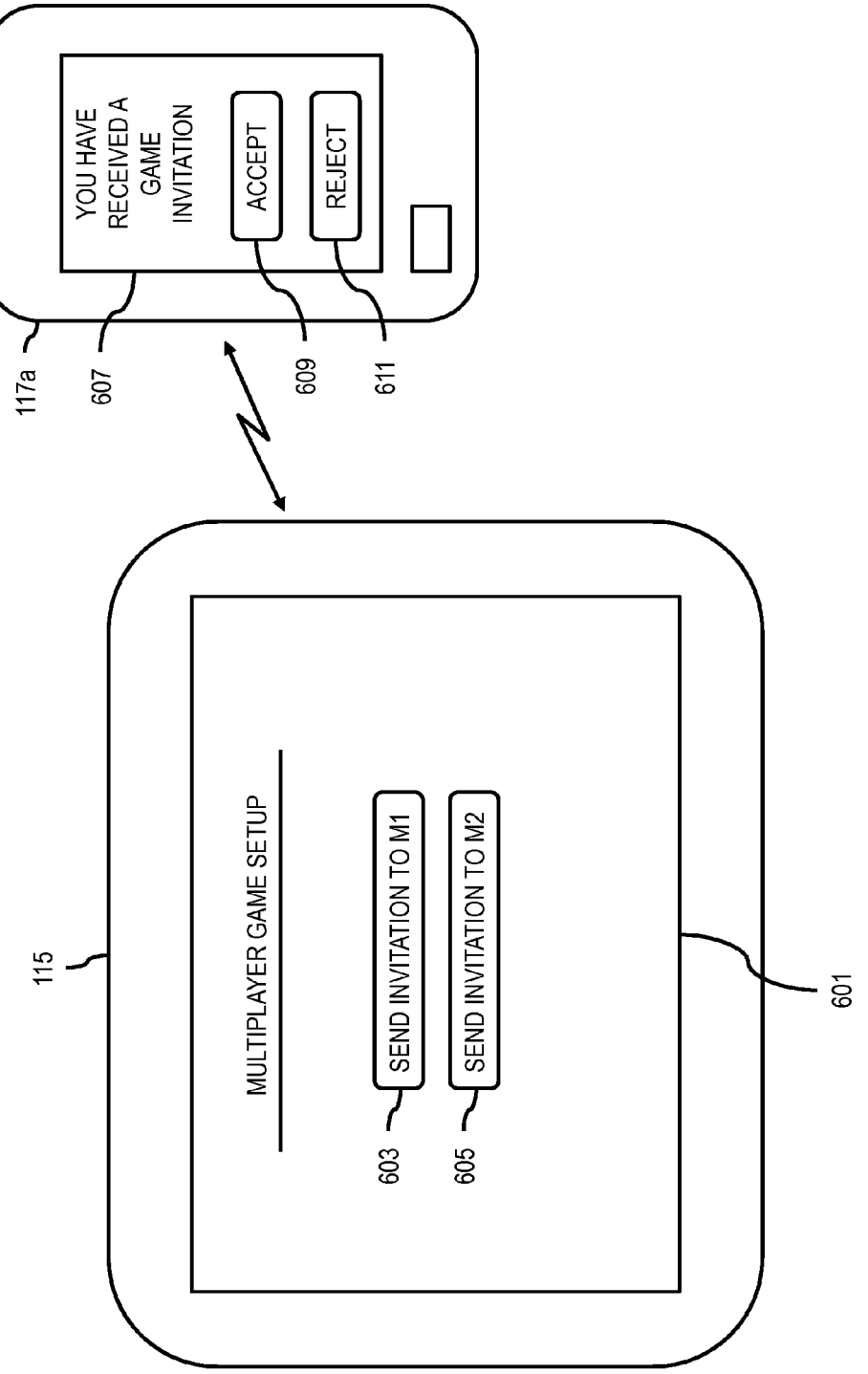

YOU HAVE RECEIVED A GAME INVITATION
ACCEPT
REJECT
117a
607
609
611
MULTIPLAYER GAME SETUP
SEND INVITATION TO M1
SEND INVITATION TO M2
603
605
115
601

FIG. 6A

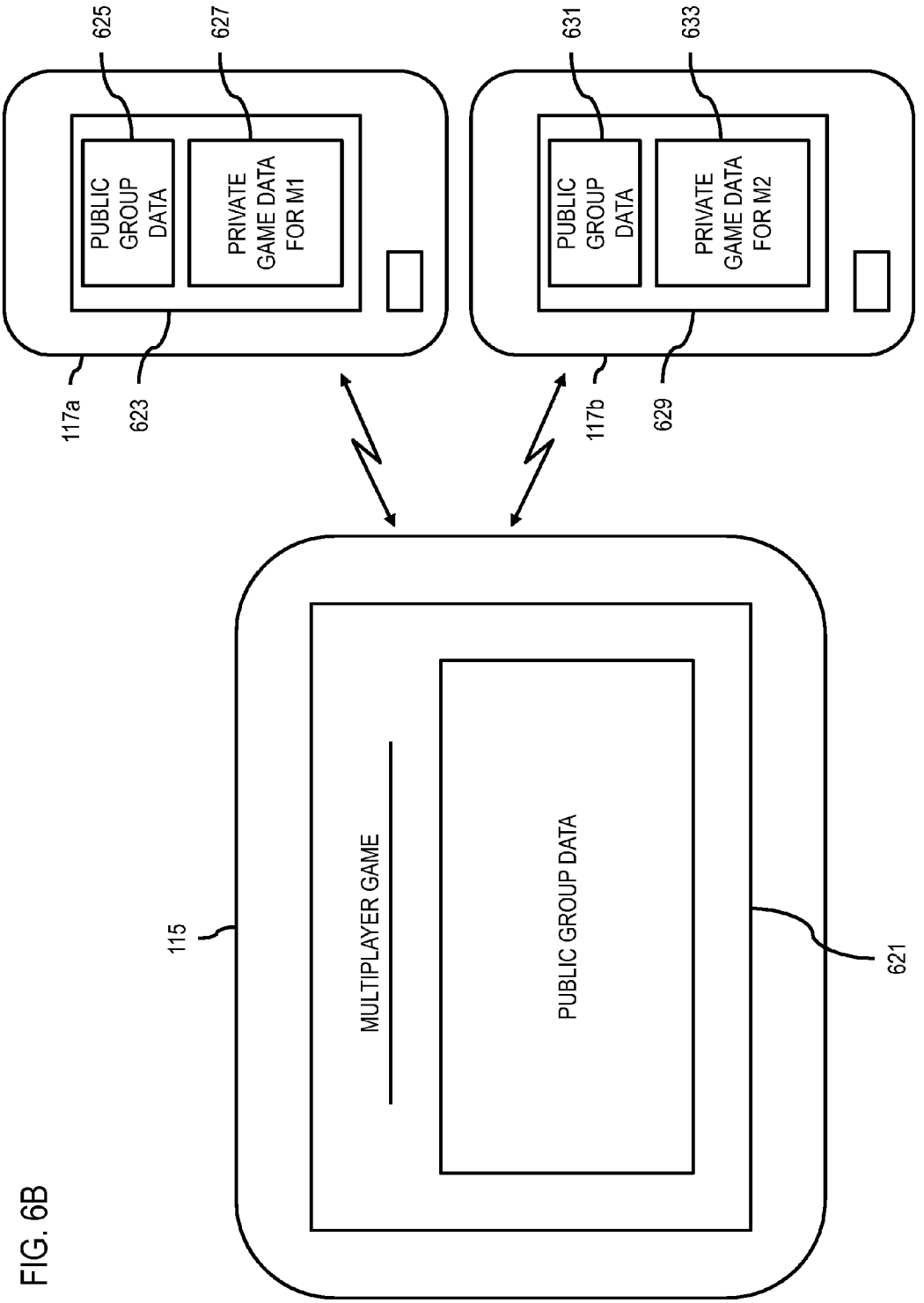

625
627
631
633
PUBLIC GROUP DATA
PRIVATE GAME DATA FOR M1
PUBLIC GROUP DATA
PRIVATE GAME DATA FOR M2
117a
623
117b
629
115
MULTIPLAYER GAME
PUBLIC GROUP DATA
621

FIG. 6B

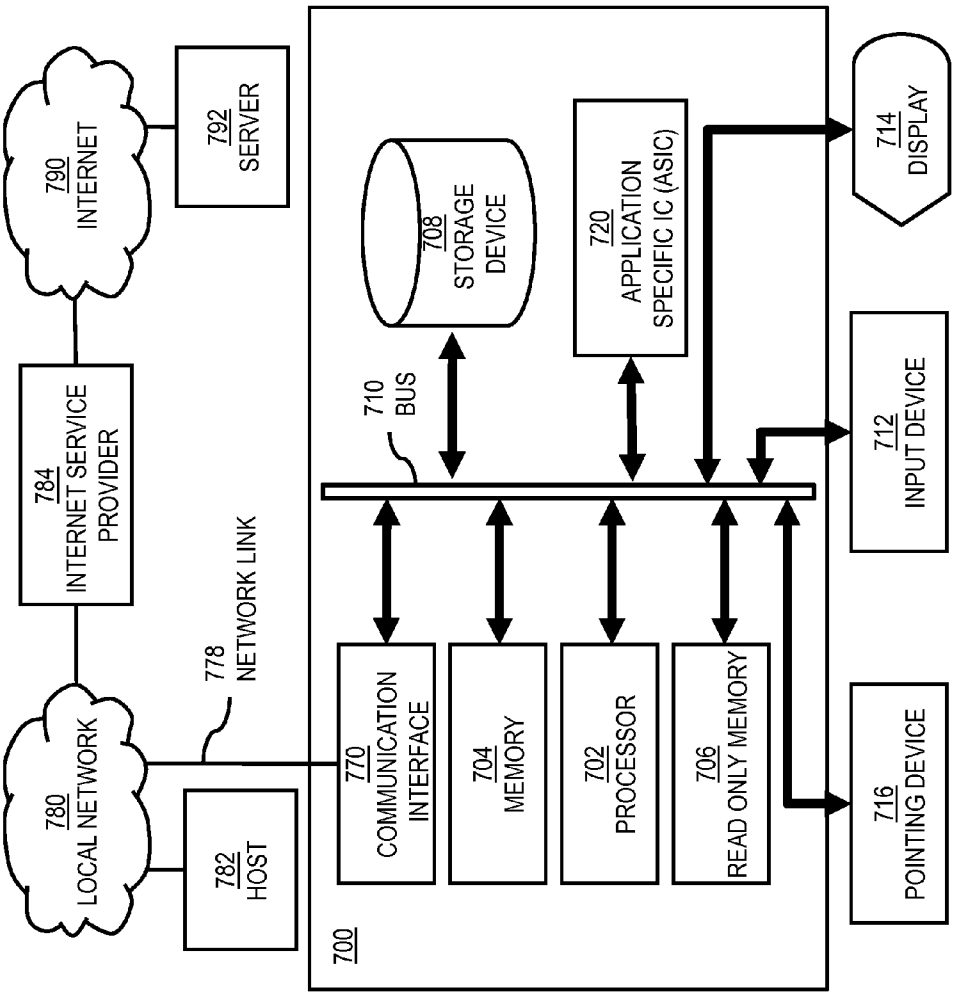

700
780 LOCAL NETWORK
782 HOST
784 INTERNET SERVICE PROVIDER
790 INTERNET
792 SERVER
778 NETWORK LINK
770 COMMUNICATION INTERFACE
704 MEMORY
702 PROCESSOR
706 READ ONLY MEMORY
710 BUS
708 STORAGE DEVICE
720 APPLICATION SPECIFIC IC (ASIC)
714 DISPLAY
712 INPUT DEVICE
716 POINTING DEVICE

FIG. 7

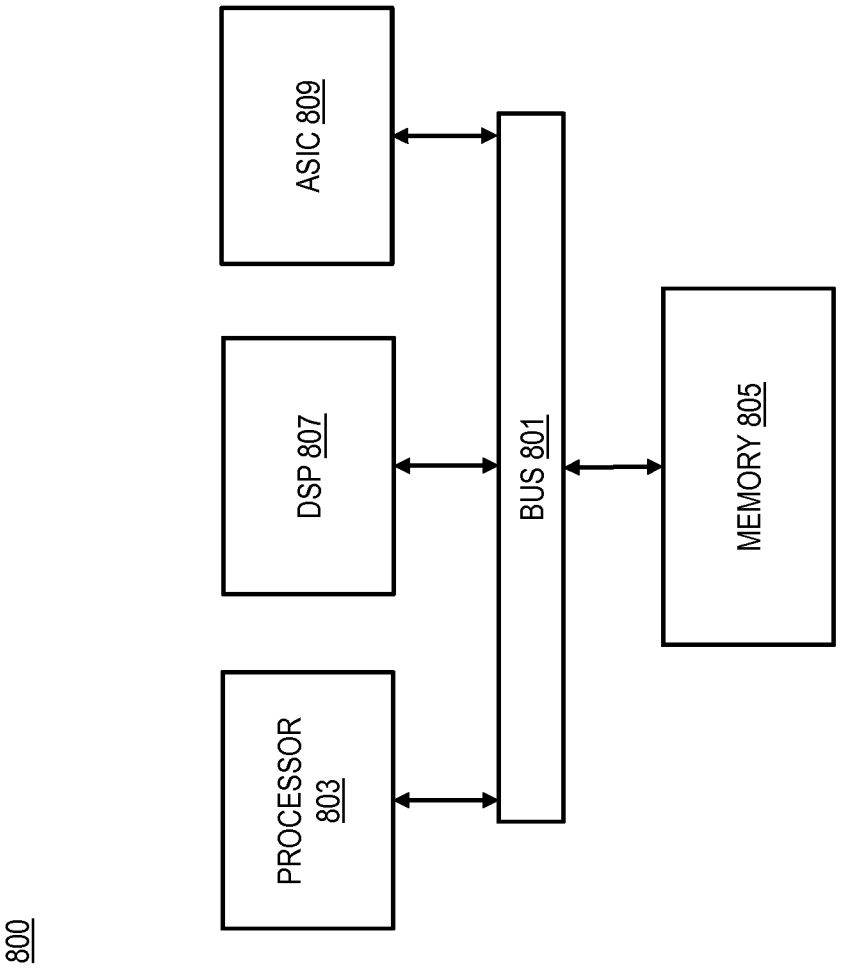


FIG. 8

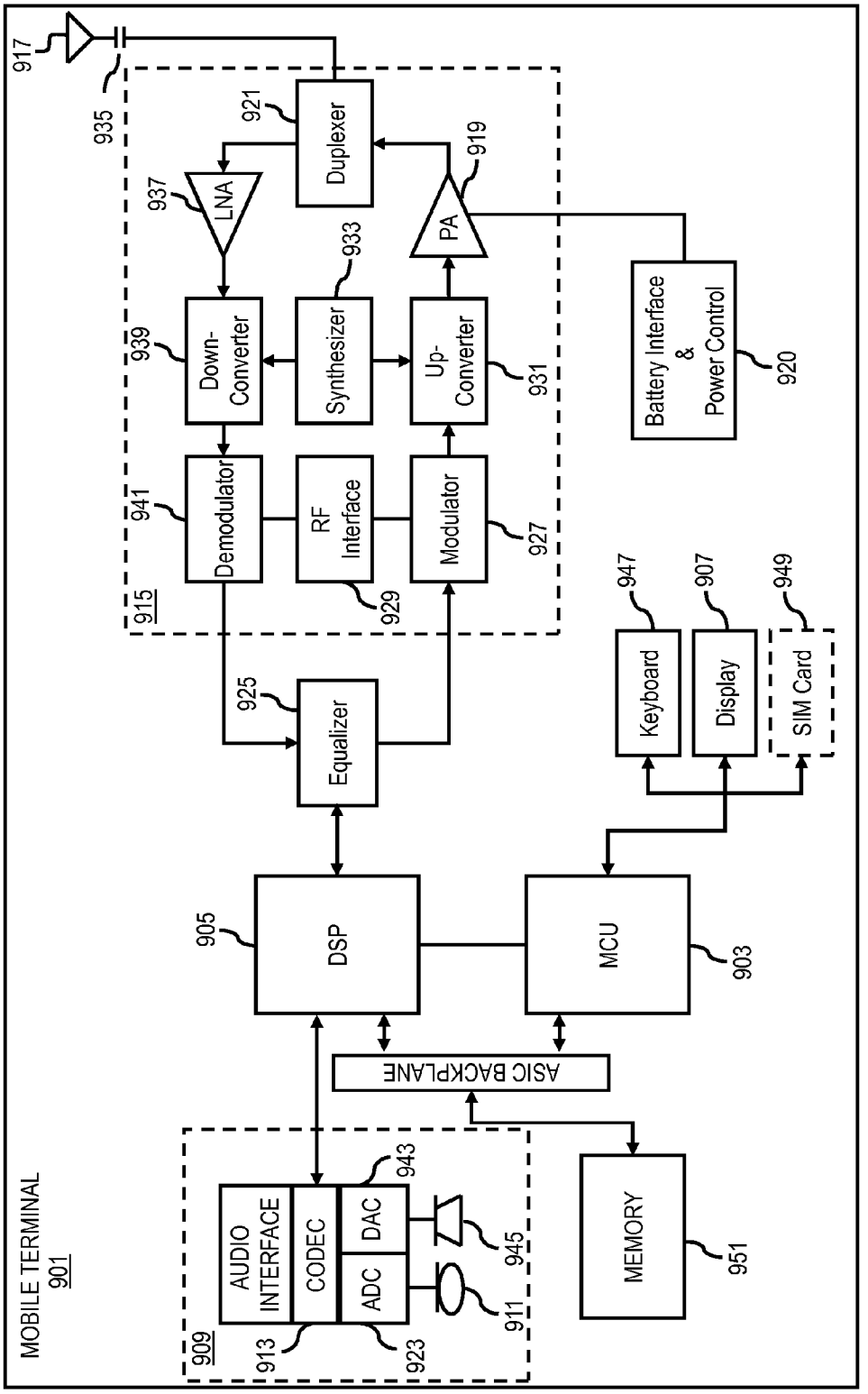

MOBILE TERMINAL
901
917
935
921
Duplexer
919
937
LNA
PA
933
939
Down-Converter
Synthesizer
Up-Converter
931
Battery Interface & Power Control
920
941
Demodulator
RF Interface
Modulator
927
915
929
947
907
949
Keyboard
Display
SIM Card
925
Equalizer
905
DSP
MCU
903
ASIC BACKPLANE
909
AUDIO INTERFACE
CODEC
DAC
ADC
943
945
911
913
923
MEMORY
951

FIG. 9

METHOD AND APPARATUS FOR FACILITATING COMMUNICATIONS FOR BROWSER-BASED APPLICATIONS

RELATED APPLICATIONS

This application claims the benefit of the earlier filing date under 35 U.S.C. §119(e) of U.S. Provisional Application Ser. No. 61/437,908 filed Jan. 31, 2011, entitled "Method and Apparatus for Facilitating Communications for Browser-based Applications," the entirety of which is incorporated herein by reference.

BACKGROUND

Service providers and device manufacturers (e.g., wireless, cellular, etc.) are continually challenged to deliver value and convenience to consumers by, for example, providing compelling network services. One area of interest has been the development of applications (e.g., web applications developed using standard web technologies) for delivering these services and other functions through web browsers. For example, as the numbers of operating system platforms (e.g., mobile operating systems) proliferate, service providers are making increasing use of web applications as a means for cross-platform development. In many cases, such web applications are used in a mixed environment where the web applications interoperate with native applications. Accordingly, service providers and device manufacturers face significant technical challenges to enabling communications (e.g., data exchanges) between web applications and native applications, particularly with respect to addressability of the web applications over a communication network.

SOME EXAMPLE EMBODIMENTS

Therefore, there is a need for an approach for facilitating communications for web applications and/or their associated browser sessions.

According to one embodiment, a method comprises determining to associate a communication identifier with a browser session. The browser session hosts, at least in part, a web application. The communication identifier facilitates addressing of the browser session, the web application, or a combination thereof via a process that is not specific to the browser session, the web application, or a combination thereof.

According to another embodiment, an apparatus comprises at least one processor, and at least one memory including computer program code, the at least one memory and the computer program code configured to, with the at least one processor, cause, at least in part, the apparatus to determine to associate a communication identifier with a browser session. The browser session hosts, at least in part, a web application. The communication identifier facilitates addressing of the browser session, the web application, or a combination thereof via a process that is not specific to the browser session, the web application, or a combination thereof.

According to another embodiment, a computer-readable storage medium carries one or more sequences of one or more instructions which, when executed by one or more processors, cause, at least in part, an apparatus to determine to associate a communication identifier with a browser session. The browser session hosts, at least in part, a web application. The communication identifier facilitates addressing of the browser session, the web application, or a combination thereof via a process that is not specific to the browser session, the web application, or a combination thereof.

According to another embodiment, an apparatus comprises means for determining to associate a communication identifier with a browser session. The browser session hosts, at least in part, a web application. The communication identifier facilitates addressing of the browser session, the web application, or a combination thereof via a process that is not specific to the browser session, the web application, or a combination thereof.

In addition, for various example embodiments of the invention, the following is applicable: a method comprising facilitating a processing of and/or processing (1) data and/or (2) information and/or (3) at least one signal, the (1) data and/or (2) information and/or (3) at least one signal based, at least in part, on (including derived at least in part from) any one or any combination of methods (or processes) disclosed in this application as relevant to any embodiment of the invention.

For various example embodiments of the invention, the following is also applicable: a method comprising facilitating access to at least one interface configured to allow access to at least one service, the at least one service configured to perform any one or any combination of network or service provider methods (or processes) disclosed in this application.

For various example embodiments of the invention, the following is also applicable: a method comprising facilitating creating and/or facilitating modifying (1) at least one device user interface element and/or (2) at least one device user interface functionality, the (1) at least one device user interface element and/or (2) at least one device user interface functionality based, at least in part, on data and/or information resulting from one or any combination of methods or processes disclosed in this application as relevant to any embodiment of the invention, and/or at least one signal resulting from one or any combination of methods (or processes) disclosed in this application as relevant to any embodiment of the invention.

For various example embodiments of the invention, the following is also applicable: a method comprising creating and/or modifying (1) at least one device user interface element and/or (2) at least one device user interface functionality, the (1) at least one device user interface element and/or (2) at least one device user interface functionality based at least in part on data and/or information resulting from one or any combination of methods (or processes) disclosed in this application as relevant to any embodiment of the invention, and/or at least one signal resulting from one or any combination of methods (or processes) disclosed in this application as relevant to any embodiment of the invention.

In various example embodiments, the methods (or processes) can be accomplished on the service provider side or on the mobile device side or in any shared way between service provider and mobile device with actions being performed on both sides.

For various example embodiments, the following is applicable: An apparatus comprising means for performing the method of any of originally filed claims **1-10**, **21-30**, and **46-48**.

Still other aspects, features, and advantages of the invention are readily apparent from the following detailed description, simply by illustrating a number of particular embodiments and implementations, including the best mode contemplated for carrying out the invention. The invention is also capable of other and different embodiments, and its several details can be modified in various obvious respects, all without departing from the spirit and scope of the invention.

Accordingly, the drawings and description are to be regarded as illustrative in nature, and not as restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

The embodiments of the invention are illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings:

FIG. **1** is a diagram of a system capable of facilitating communications for browser-based applications, according to one embodiment;

FIG. **2** is a diagram of the components of the data communication platform and a message routing service, according to one embodiment;

FIG. **3** is a flowchart of a process for facilitating communications for browser-based applications, according to one embodiment;

FIG. **4** is a flowchart of a process for providing browser-based group communications, according to one embodiment;

FIG. **5** is a ladder diagram that illustrates a sequence of messages and processes used for facilitating browser-based group communications, according to one embodiment;

FIGS. **6**A and **6**B are diagrams of user interfaces used in the processes of FIGS. **3**-**5** for facilitating browser-based group communications including private and public data, according to various embodiments;

FIG. **7** is a diagram of hardware that can be used to implement an embodiment of the invention;

FIG. **8** is a diagram of a chip set that can be used to implement an embodiment of the invention; and

FIG. **9** is a diagram of a mobile terminal (e.g., handset) that can be used to implement an embodiment of the invention.

DESCRIPTION OF SOME EMBODIMENTS

Examples of a method, apparatus, and computer program for facilitating communications for browser-based applications are disclosed. In the following description, for the purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the embodiments of the invention. It is apparent, however, to one skilled in the art that the embodiments of the invention may be practiced without these specific details or with an equivalent arrangement. In other instances, well-known structures and devices are shown in block diagram form in order to avoid unnecessarily obscuring the embodiments of the invention.

FIG. **1** is a diagram of a system capable of providing communication with a service using a recipient identifier, according to one embodiment. As discussed above, service providers are making increased use of web-based applications for providing access to various services and functions. In many cases, such services include facilitating multiparty communications (e.g., data exchanges) with servers operated by the service providers, content providers, and the like, as well as other peer nodes or devices within a network. For example, an instant messaging service may provide multiparty communications sessions via both web-based access (e.g., via a web-application) or access via a native client (e.g., an executable application running natively at a device).

However, under a traditional communication systems and networks (e.g., the Internet via, for instance, transmission control protocol/Internet Protocol (TCP/IP)), the addressing of web-applications versus native applications to support multiparty communications can differ substantially. Therefore, service providers and device manufacturers face significant technical challenges to providing functions in a web application that are equivalent to functions provided in a native application. For example, native applications are typically addressable directly via the IP address assigned to the host device because they typically use TCP/IP-based connections to the communication network. Web applications, however, typically operate within another host application (e.g., a web browser) that is in turn executed on a host device operating using a hypertext transport protocol (HTTP), Websockets, or other browser-based connection. Under this scenario, conventional security policies standards generally do not allow the web-application to access or otherwise use the IP address assigned to the mobile device or the host web application.

Instead, services providers that want to provide addressability of a browser session or the web application executing within the browser session (e.g., to provide for multipart communications) have historically had to operate application specific servers to facilitate such routing. For example, such application specific servers often maintain addressing information for communications, messages, data, etc. that are to be shared among its client web applications, native applications, and/or other devices within the specific service. Developing, operating, and maintaining application specific services to route and address messages present substantial resource burdens that can often discourage service providers and developers from offering such services.

To address this problem, a system **100** of FIG. **1** introduces the capability to facilitate communications (e.g., multiparty communications) for browser-based applications and/or sessions by identifying web applications and/or browser sessions that host those web applications with communication identifiers (IDs) that are addressable using general processes (e.g., communication processes) that are not specific to any particular web application or service. In this way, the web application and/or browser session can address other instances of the application, other applications (e.g., both web-based and native applications), other devices, etc. over a communication network (e.g., the Internet) by using the communication IDs. In one embodiment, the system **100** enables a web application identify itself with a communication ID based, at least in part, on an application ID, a user ID, and/or a random browser ID. In another embodiment, the communication ID that is based on the application ID, the user ID, and/or random browser ID can be processed by a web front end component into an externally addressable ID such as an IP address under TCP/IP. Accordingly, under this embodiment, the system **100** determines, at least in part, one or more user IDs, one or more device IDs associated with the device, one or more application IDs associated with the application, one or more browser IDs, or a combination thereof, which are used to generate the communication ID.

In another embodiment, a front end component of the system **100** can emulate a client device that has an externally addressable ID (e.g., an IP address) to represent the web application and/or browser session. In yet another embodiment, the communication ID can be an IP address; and, thus, the communication ID need not be processed into an externally addressable ID capable of being routed using general transport protocols (e.g., TCP/IP).

After the communication ID is associated with the web application and/or browser session, the system **100** may then facilitate communications between the web application or browser session and other applications, device, services, applications, etc. over the communication network using generic communication routing processes (e.g., a general message routing service or other standards-based processes (e.g., TCP/IP-based processes)). For example, the data may include messages for notification such as a status update

message of another user from a social networking service, and the status update message is to be presented via an application in a device as the notification.

Because of the direct addressability of browser applications and/or sessions as discussed in the various embodiments described herein, a web application can exchange both private and public data with other components of a communication network without relying on application-specific servers to facilitate the process. As a result, the system **100** enables the web application to engage in more advanced communication roles using existing communications infrastructure. For example, a web application operating with the addressability provided by a communication as described in various embodiments can act as a "master node" to manage and communicate among a group of other nodes (e.g., not native application nodes and web application nodes) via dedicated channels. In this way, service providers can (e.g., more easily and with less resource burden) support multiparty communication services. For example, a service may provide a multiparty game that includes public information (e.g., a game board) that is, for instance, hosted in a browser session presented on a television. At the same time, individual players can join in the game session by joining in a group or communication channel hosted by a master (e.g., typically the client presenting the public information). In one embodiment, the individual players can join in via their own web applications or sessions or by executing native applications on their individual devices. Thus, the group can support both homogenous (e.g., all web applications or all native applications) or a mixed (e.g., combination of both web and native applications) modes of operation. The master web application can then address and direct private data or communications (e.g., game pieces private to each player) to the individual players.

As shown in FIG. **1**, the system **100** comprises user equipment (UEs) **101***a*-**101***n* having connectivity to a service platform **103** and a data communication platform **105** via a communication network **107**. In one embodiment, the source of the data available for user access may be the service platform **103**, the one or more services **109***a*-**109***m* of the service platform **103**, the one or more data providers **111***a*-**111***k*, and/or other data services available over the communication network **107**. For example, a service **109***a* may obtain data (e.g., notification messages or media content) from a data provider **111***a* to deliver the obtained data to at least one of the UEs **101***a*-**101***n*. The service platform **103**, services **109***a*-**109***m*, and/or content providers **111***a*-**111***k* may provide data such that the data may be sent to the UE **101** via the communication network **107**. Each of the services **109***a*-**109***m*, for instance, may provide different content and/or different types of services (e.g., a social networking service, a messaging service or a music service). Some of services **109***a*-**109***m* may be provided with a different quality of service like guaranteed throughput based on the service level agreement between the data communication and service provider. The communication ID (e.g., assigned by the data communication platform **105**) may be used to address and mediate the data among the data sources (e.g., services **109***a*-**109***m*, data providers **111***a*-**111***k*), the UEs **101***a*-**101***n*, the browser **113** or the web application **115** executing within the UE **101***a*, the native applications **117***a*-**117***k* executing within the UEs **101***b*-**101***n*.

Although FIG. **1** shows only UE **101***a* executing a web application **115** and UEs **101***b*-**101***n* executing the native applications **117**, it is contemplated that the UEs **101***a*-**101***n* can execute any combination of web applications **113** and/or native applications **117** in both homogenous and mixed modes of operation. For example, the web application **115** and native application **117** may be instant messaging clients that receive message notifications from a corresponding service **109** (e.g., instant messaging service). In various embodiments of the approach described herein, the web application **113** may request or otherwise receive a communication identifier from the data communication platform **105** for addressing and routing data (e.g., messages, notifications, etc.) that are transmitted between the service **109** to the client applications (e.g., web application **115**, native applications **117**).

In one embodiment, the web application **115** and/or the browser **113** may send a communication request to the data communication platform **105** to provide communication ID assignment and/or client emulation to facilitate addressability of communications from the web application **115** or the browser session **113**. Although, the data communication platform **105** is shown as a separate component of the system **100**, it is contemplated that the data communication platform **105** or one or more of its functions can be performed or otherwise incorporated in the service platform **103**, the services **109***a*-**109***m*, the data providers **111***a*-**111***m*, the UEs **101***a*-**101***n*, or any other component of the system **100** or communication network **107**.

In one embodiment, the web application **115**/browser **113** and the data communication platform **105** work in cooperation to enable the generation of communication IDs or emulation of client devices based on the communication IDs. For example, the data communication platform **105** can protect potentially sensitive identifiers (e.g., device identifiers, user identifiers, etc.) from exposure to third-party applications and/or services by requesting authentication from the web application **115**. In one embodiment, the authentication may be provide using a "single sign on (SSO)" authentication system wherein one set of authentication credentials can be used to authenticate access to a group of services. Once the data communication platform **105** associates a communication ID or IDs to the web application **115**, communication between the web application **115** can facilitated through generic processes (e.g., processes not specific to the service **109** or application corresponding to the web application **115**).

As shown FIG. **1**, one generic process is the message routing service **119** which can aggregate message from multiple application and services **109** and distribute them to the appropriate clients (e.g., the web application **115**, native applications **117**). In one embodiment, the web application **115** may use any other generic message or data transport protocols including TCP/IP for both server-based communications and peer-to-peer (e.g., direct client to client addressing within a service **109**). The interactions among the web application **115**, native applications **117**, the data communication platform **105**, and the message routing service **119** are described in more detail with respect to FIG. **2** below.

By way of example, the communication network **107** of system **100** includes one or more networks such as a data network (not shown), a wireless network (not shown), a telephony network (not shown), or any combination thereof. It is contemplated that the data network may be any local area network (LAN), metropolitan area network (MAN), wide area network (WAN), a public data network (e.g., the Internet), short range wireless network, or any other suitable packet-switched network, such as a commercially owned, proprietary packet-switched network, e.g., a proprietary cable or fiber-optic network, and the like, or any combination thereof. In addition, the wireless network may be, for example, a cellular network and may employ various technologies including enhanced data rates for global evolution (EDGE), general packet radio service (GPRS), global system for mobile communications (GSM), Internet protocol multimedia subsystem (IMS), universal mobile telecommunica-

tions system (UMTS), etc., as well as any other suitable wireless medium, e.g., worldwide interoperability for microwave access (WiMAX), Long Term Evolution (LTE) networks, code division multiple access (CDMA), wideband code division multiple access (WCDMA), wireless fidelity (WiFi), wireless LAN (WLAN), Bluetooth®, Internet Protocol (IP) data casting, satellite, mobile ad-hoc network (MANET), and the like, or any combination thereof

The UE **101** is any type of mobile terminal, fixed terminal, or portable terminal including a mobile handset, station, unit, device, multimedia computer, multimedia tablet, Internet node, communicator, desktop computer, laptop computer, notebook computer, netbook computer, tablet computer, personal communication system (PCS) device, personal navigation device, personal digital assistants (PDAs), audio/video player, digital camera/camcorder, positioning device, television receiver, radio broadcast receiver, electronic book device, game device, or any combination thereof, including the accessories and peripherals of these devices, or any combination thereof. It is also contemplated that the UE **101** can support any type of interface to the user (such as "wearable" circuitry, etc.).

By way of example, the UE **101**, a service **109** and the data communication platform **105** communicate with each other and other components of the communication network **107** using well known, new or still developing protocols. In this context, a protocol includes a set of rules defining how the network nodes within the communication network **107** interact with each other based on information sent over the communication links. The protocols are effective at different layers of operation within each node, from generating and receiving physical signals of various types, to selecting a link for transferring those signals, to the format of information indicated by those signals, to identifying which software application executing on a computer system sends or receives the information. The conceptually different layers of protocols for exchanging information over a network are described in the Open Systems Interconnection (OSI) Reference Model.

Communications between the network nodes are typically effected by exchanging discrete packets of data. Each packet typically comprises (1) header information associated with a particular protocol, and (2) payload information that follows the header information and contains information that may be processed independently of that particular protocol. In some protocols, the packet includes (3) trailer information following the payload and indicating the end of the payload information. The header includes information such as the source of the packet, its destination, the length of the payload, and other properties used by the protocol. Often, the data in the payload for the particular protocol includes a header and payload for a different protocol associated with a different, higher layer of the OSI Reference Model. The header for a particular protocol typically indicates a type for the next protocol contained in its payload. The higher layer protocol is said to be encapsulated in the lower layer protocol. The headers included in a packet traversing multiple heterogeneous networks, such as the Internet, typically include a physical (layer 1) header, a data-link (layer 2) header, an internetwork (layer 3) header and a transport (layer 4) header, and various application headers (layer 5, layer 6 and layer 7) as defined by the OSI Reference Model.

In one embodiment, the web application **115** and the native applications **117** interact with the data communication platform **105**, the service platform **103**, the services **109***a*-**109***m*, and/or the data providers **111***a*-**111***m* according to a client-server model. It is noted that the client-server model of computer process interaction is widely known and used. According to the client-server model, a client process sends a message including a request to a server process, and the server process responds by providing a service. The server process may also return a message with a response to the client process. Often the client process and server process execute on different computer devices, called hosts, and communicate via a network using one or more protocols for network communications. The term "server" is conventionally used to refer to the process that provides the service, or the host computer on which the process operates. Similarly, the term "client" is conventionally used to refer to the process that makes the request, or the host computer on which the process operates. As used herein, the terms "client" and "server" refer to the processes, rather than the host computers, unless otherwise clear from the context. In addition, the process performed by a server can be broken up to run as multiple processes on multiple hosts (sometimes called tiers) for reasons that include reliability, scalability, and redundancy, among others.

FIG. **2** is a diagram of the components of the data communication platform **105** and a message routing service **119**, according to one embodiment. By way of example, the data communication platform **105** and the message routing service **119** include one or more components for enabling addressability and communication with a web application using a communication ID. It is contemplated that the functions of these components may be combined in one or more components or performed by other components of equivalent functionality.

In this embodiment, the data communication platform **105** includes an identifier assignment module **201**, a service authenticator **203**, and a client device emulator **205**. As shown, the data communication platform **105** interacts with the service platform **103** and/or the services **109***a*-**109***m* to facilitate communications (e.g., enable addressability) with a web application **115** executing within a browser **113** on a UE **101***a*. More specifically, a web front end of a service **109** can serve the web application **115** to the browser **113**. The browser **113** (e.g., through interaction with the web front end of the service **109** or directly) can then interact with the data communication platform **105** so that the data communication platform **105** can associate a communication ID with the web application **115** or the browser **113** to facilitate communications or addressability through a generic communication process (e.g., the message routing service **113**) that is not specific to any one application or service **109**.

For example, when interacting through the service **109**, the web application **115** and/or browser **113** communicates with the web front end of the service **109** via, for instance, a Hypertext Transfer Protocol (HTTP), WebSockets, or other similar protocol for exchanging information between a web server and a browser. The service **109** then interacts with the data communication platform **105** associate a communication ID with the client web application **115** and/or browser session **113**. For example, the identifier assignment module **201** enables the web application **115**, the browser **113**, and/or the web front end of the service to identify the web application **115** with, for instance, one or more application IDs, one or more user IDs, and/or one or more browser IDs (e.g., randomly generate browser IDs) to create a unique communication ID for message routing and addressability. For example, the communication ID may mediate the data exchanged between the web application **115**/browser **113** and the service platform **103**, the service **109**, the data provider **111**, and/or other UEs (e.g., UEs **101***b*-**101***n* executing respective native client applications **117***a*-**117***k*).

In one embodiment, to ensure that only authorized services **109** are able to communicate using various embodiments of the non-service specific processes described herein, the service authenticator **203** may request authentication from the web application **115** and/or the service **109**. This authentication may include, for instance, single sign on (SSO) or other credentials to indicate that that the web application **115** and/or the service **109** has sufficient rights and/or access to associate the requested communication identifier.

In one embodiment, the identifier assignment module **201** may generate the communication ID as an IP address or otherwise associated the communication ID with IP address. As a result, communications between the web application **115** and other components of the communication network **107** can be transported using standard protocols (e.g., TCP/IP). Moreover, the client device emulator **205** can use the assigned IP address or the communication ID (e.g., if the communication ID is defined as an IP address) to effectively emulate a client device to represent the web application **115**. In this way, web application **115** (e.g., through the associated IP address or client device emulation) appears as any other client over the communication network **107**.

In one embodiment, after association of a communication ID with the web application **115**, communications to and/or from the web application **115** can be handled by a generic communication process such as the message routing service **119**. As previously described, the message routing service **119** aggregates and routes messages, data, and/or communications among multiple applications, services, clients, etc. In certain embodiments, the message routing service **119** aggregates communication data to optimize network bandwidth, resource consumption, energy consumption, and the like for related services **109** and devices (e.g., UEs **101**). In one embodiment, these optimizations are performed by the message routing service **119** based on the data, messages, and other communications that are routed through the service **119**.

In one embodiment, the message routing service **119** sees the web application **115** and/or the browser **113** as any other client when the web application **115** and/or the browser **113** seeks access through the web front end of the service **109**. For example, all participating clients have a unique address web, wherein the unique address (e.g., the communication ID) of the web application **115** provided by the data communication platform **105**.

As shown, the message routing service **119** includes at a client authenticator **207**, a group handler **209**, and a message dispatcher **211**. The client authenticator **207** ensures that the participating clients are authenticated to engage in communications over the message routing service **119**. In one embodiment, the client authenticator **207** can check authentication credentials associated with the clients (e.g., the web application **115**, the native applications **117**, or a combination thereof), the service **109**, the service platform **103**, the UEs **101**, or other related component of the system **100**. As previously discussed, the authentication may be facilitated by SSO credentials to reduce the number authentication credentials that are maintained by the clients.

In one embodiment, the message routing service **119** can facilitate group or multiparty communications among the web application **115**, the native applications **117** (e.g., executing on different UEs **101***b*-**101***n*), the service platform **103**. More specifically, the group handler **209** enables any one of the clients to create a group and associated communication channels for multiparty communications. By way of example, one of the client participants (e.g., the web application **115**, the native applications **117**) can serve as a master of the group. In one embodiment, the master defines the group and the applicable group messaging rules for storage and enforcement at the group handler **209**. For example, the group messaging rules may specify how to communicate (e.g. types of communications), what to communicate, when to communicate, what types of information (e.g., private/public data) to communicate, etc.

In one embodiment, the master can also mediate messages among group members whereby group members can send messages to the master who then determines whether to share the messages with other group members via, for instance, the message dispatcher **211** of the message routing service **119**. In addition or alternatively, group members may send broadcast messages or messages to other members of the group.

By way of example, the message routing service **119** manages/controls any incoming and outgoing communications such as transfer of the files or data among clients of the services **109** based, at least in part, on the communication ID as described above. In addition, the message routing service **119** can route messages based, at least in part, on additional information that may be associated with or encoded in the communication ID including user identifiers, device identifiers, the application identifiers, browser identifiers, and the like associated with the web application **115**, the browser **113**, the UEs **101**, the native applications **117**, and other components of the services **109**.

In one embodiment, the client authenticator **207** authenticates the web application **115** and/or browser **113** such that communication between the message routing service **119** and the various components and other clients of the services **109** may be enabled. In one embodiment, communications originating from the web application **115**/browser **113** may include one or more recipient identifiers so that the message dispatcher **211** of the message routing service **119** can determine intended recipients. For example, the recipient identifier may mediate the data exchanged between the web application **115**/browser **113** and the service platform **103**, the service **109**, the data provider **111**, and/or other clients. In particular, the recipient identifier may be used to route the data from the service **109** to a corresponding application (e.g., another web application **115** or native application **117**) in another corresponding device (e.g., the UEs **101**).

In some embodiments, the message dispatcher **211** can also encrypt the communications facilitated by the message routing service **119**. This encryption may include key-based encryption (e.g., via a public key infrastructure (PKI)). The key encryption keys may be shared among the components (e.g., web application **115**, browser **113**, native applications **117**) participating in the communications. The message dispatcher **211** also provides an interface to the services **109***a*-**109***n* and/or the service platform **103** (e.g., via a web front end) to receive and transmit data to the web application **115** and/or browser **113**.

In another embodiment, the data communication platform **105** enables the web application **115** and/or the browser **113** to be addressed and communicate over the communication network **107** without using the message routing service **119**. Instead, because addressability over the communication network **107** is provided by the communication ID, the web application **115** and/or browser **113** can communicate using any generic protocol available over the communication network **107** (e.g., TCP/IP). In this way, the web application **115** and/or browser **113** can directly address peer components (e.g., other web applications **115**, native applications **117**, other services **109**, etc.).

FIG. **3** is a flowchart of a process for facilitating communications for browser-based applications, according to one

embodiment. In one embodiment, the data communication platform **105** performs the process **300** and is implemented in, for instance, with a computer system as shown in FIG. **7** or a chip set including a processor and a memory as shown in FIG. **8**. In step **301**, the data communication platform **105** determines to associate a communication ID with a browser session **113**. In one embodiment, the browser session **113** hosts, at least in part, a browser or web application **115**, and the communication ID facilitates addressing of the browser session **113**, the web application **115**, or a combination thereof via a process that is not specific to the browser session **113**, the web application **115**, or a combination thereof.

In step **303**, the data communication platform **105** optionally retrieves and then processes and/or facilitates a processing of an application ID associated with the web application **115**, a browser ID associated with the browser session **113**, a user identifier, or a combination thereof to generate the communication ID or metadata associated with the communication ID. In some embodiments, the browser ID or any of the other associated IDs (e.g., the application ID, user ID, etc.) may be randomized to ensure that the resulting communication ID is sufficiently unique to the web application **115** and/or the browser **113**. As previously discussed, in one embodiment, the communication ID can be an IP address to enable addressability over the communication network **107** using standard communication protocols (e.g., TCP/IP).

In one embodiment, the communication ID is determined or otherwise generated such that the application ID, the browser ID, the user ID, etc. can be derived or decoded to facilitate routing of the communication. For example, the message routing service **119** can determine the application ID, the browser ID, the user ID, and the like associated with the communication ID to identify the device (e.g., the UEs **101**) and then the application within the device that is involved in a particular communication session or instance.

In another embodiment, the communication ID and/or any of the associated IDs (e.g., the application ID, browser ID, user ID, etc.) may be encrypted to protect privacy. In some embodiments, the data communication platform **105** and/or the message routing service **119** may also generate a message authentication code (e.g., a Hash-based Message Authentication Code (HMAC)) to accompany the communication ID and/or communication messages identified by the communication ID. By way of example, the encryption may be based on a symmetric cipher, such as a strong symmetric cipher (e.g., 256 bit AES) or an asymmetric cipher. In one embodiment, this encryption using the cipher may include selecting a primary key for the cipher based on the service identifiers and generating a secondary key based on a HMAC constructed from the service identifiers and predetermined parameters (e.g., service level), etc. associated with a particular service **109** of the service platform **103**.

In one embodiment, the data communication platform **105** determines to cause, at least in part, emulation of a client device to represent the browser session, the web application, or a combination thereof based, at least in part, on the communication (step **305**). The addressing of the browser session **113**, the web application **115**, or a combination thereof is performed via the emulated client device. In this way, the web application **115** (e.g., via the emulated client device) appears as any other client on the communication network **107** with respect to a corresponding service **109** or application (e.g., other web applications **115** and/or native applications **117**).

In step **307**, the web application **115** and/or the browser **113** is then addressed using, for instance, generic communication processes to facilitate communications between the web application **115**/browser **113** and other components of the communication network **107** (e.g., other clients or servers). As discussed above, an example of a generic communication process is the message routing service **119**. In one embodiment, the generic communication process may also be a peer-to-peer service wherein the clients of the service (e.g., the web application **115**, browser **113**, native applications **117**, etc.) communicate directly using, for instance, standard peer-to-peer protocols.

FIG. **4** is a flowchart of a process for providing browser-based group communications, according to one embodiment. In one embodiment, the data communication platform **105** performs the process **400** and is implemented in, for instance, computer system as shown in FIG. **7** or a chip set including a processor and a memory as shown in FIG. **8**. In addition or alternatively, the message routing service **119** may perform all or a portion of the process **400**. As shown in FIG. **4**, by enabling the generic addressability of web applications **115** and or browser sessions **113**, the data communication platform **105** can be used to facilitate group or multiparty communications in a mixed environment of both web applications **115** and native applications **117**.

In step **401**, the data communication platform **105** determines to cause, at least in part, creation of a channel for exchanging data between the browser session **113**, the web application **115**, or a combination thereof and one or more other browser sessions **113**, one or more other web applications **115**, one or more devices (e.g., UEs **101**), one or more applications executing at the devices (e.g., native applications **117**), or a combination thereof. This creation of the channel is based, at least in part, on the communication ID. In other words, the channel is created using the generic addressability of the communication ID so that a specialized server specific to the web application **115** involved in the multiparty communication is not needed. For example, the group handler **209** of the message routing service **119** which can support group communications generally for any of the services **109** can use the communication ID to properly route and address the communications to and from the participating web applications **115**.

The data communication platform **105** and/or the message routing service **119** then determines to cause, at least in part, creation of a group of the participating components including the browser session **113**, the web application **115**, the one or more other browser sessions **113**, the one or more other web applications **115**, the one or more devices (e.g., UEs **101**), the one or more applications executing at the devices (e.g., native applications **117**), or a combination thereof (step **403**). For example, the founding member of the group may send invitations to the other components to join and participate in the group. It is contemplated that the group may be formed to support any multiparty communication purposes including, e.g., group gaming, group collaboration, group data sharing, etc.

Optionally, the data communication platform **105** and/or the message routing service **119** determine to designate at least one master from among the group members. In one embodiment, the at least one master manages data exchanges and/or communications among the group over the channel (step **405**).

In step **407**, before initiation of group or multiparty communications, the data communication platform **105** and/or the message routing service **119** determines to authenticate access to the channel. By way of example, the authentication may be performed using SSO authentication credentials as described previously. It is also contemplated that any authen-

tication process for ensuring that only authorized devices and/or users can participate in the multiparty communications may be used.

The processes shown in FIGS. **3** and **4** are advantageous in that these processes provide an efficient way to facilitate communications involving web applications **115** and/or browser sessions **113** by, for instance, reducing the resource burdens (e.g., computing resources, bandwidth resources, energy resources, etc.) associated with maintaining a specialized or service-specific server to support addressability of the web applications **115**/browsers **113**. The data communication platform **105** is a means for achieving this advantage.

FIG. **5** is a ladder diagram that illustrates a sequence of messages and processes used for facilitating browser-based group communications, according to one embodiment. More specifically, FIG. **5** illustrates a process for using the processes of FIGS. **3** and **4** to support multiparty communications for initiating and conducting a multiparty gaming session in a mixed environment of both browser-based web applications **115** and mobile devices (e.g., UEs **101**) executing native applications **117**.

The processes represented in FIG. **5** are a web application **115** (B**1**), a first native application **117***a* executing on a mobile device (M**1**), a second native application **117***b* executing on a mobile device (M**2**), and a message routing service **119** (MRS). In this example, the web application **115** and the native applications **117***a* and **117***b* are interacting to provide a multiparty gaming service with using a server specific to the gaming service for multiparty communications. In one embodiment, it is contemplated that the web application **115** is hosted or executed on, for instance, a web-enabled television or other central device supporting a large community display. Moreover, it is assumed that the web-application **115** has already been associated with a communication ID (e.g., via the processes described above) to enable communications via the message routing service **119** (e.g., a generic communication process that is not specific to the web applications and/or the native applications **117**). In addition, the native applications **117** are executed on mobile devices with individual displays that are directly accessible via conventional approaches.

In step **502**, the web application **115** (B**1**) is acting as a master of a group or multiparty game session and sends an invitation to the native application **117***a* on the first mobile device (M**1**) to join the multiparty game session. In one embodiment, the invitation may be send as a peer-to-peer (P2P) message directly to native application **117***a* for presentation in the application **117***a*'s user interface. The direct message may be addressed and/or routed using the communication ID associated with the web application **115**. In addition or alternatively, the invitation may be sent via an alternate mode of communication such as e-mail or text messaging. At step **503**, the native application **117***a* sends a response message directed to the web application **115**. Similarly, the response message may be addressed via the associated communication ID of the web application **115** or transmitted using an alternate mode of communication.

At step **505**, the web application **115** also sends an invitation to join the multiparty session to the native application **117***b* executing on the second mobile device (M**2**). The native application **117***b* may provide response message to the web application **115** in the same way as described with respect to the native application **117***a* (step **507**).

On receiving the responses to the invitations, the web application **115** creates a communication channel and specifies a "whitelist" of nodes (e.g., the native applications **117***a* and **117***b*) that have accepted the invitation and want to participate in the multiparty session (step **509**). The channel and whitelist are sent to the message routing service **119** (MRS) so that the group information (e.g., the whitelist) can be used to identify and route messages to group members. In one embodiment, the channel represents a communication path between the web application **115** and the native applications **117***a* and **117***b* facilitated by the message routing service **119** (e.g., via the group handler **209** of the message routing service **119**). For example, messages directed to the channel can be routed to one or more of the group participants.

To initiate the multiparty gaming session, the web application **115** then sends a game initialization message (init message) as a channel message to the message routing service **119** for broadcast to the group members (e.g., the native applications **117***a* and **117***b*) (step **511**). In response, the message routing service **119** routes the init message to the participating native application **117***a* (step **513**) and the participating native application **117***b* (step **515**).

On receiving the init message, the native application **117***a* sends a confirmation or other response to the init message directly to the web application **115** (step **517**). In this case, because the init message response need only be sent to the master (e.g., the web application **115**), the native application **117***a* can send the response as a direct P2P message rather than a channel message that is routed through the message routing service **119**. Similarly, the native application **117***b* can send its response to the init message to the web application **115** (step **519**). Based, on the responses, the web application **115** can determine to, for instance, commence the multiparty session.

FIGS. **6**A and **6**B are diagrams of user interfaces used in the processes of FIGS. **3**-**5** for facilitating browser-based group communications including private and public data, according to various embodiments. As described above, the system **100** can be used to facilitate multiparty communications and sessions. In one embodiment, the multiparty session can support group gaming in, for instance, a communal environment (e.g., a living room environment). For example, the game may be a board game with the board displayed in a television set equipped with a browser engine. As shown in FIG. **6**A, the game is hosted in the browser engine of the television as a web application **115**. More specifically, FIG. **6**A displays a user interface (UI) **601** of the web application **115** for setting up the multiplayer game session. As part of this setup process, the UI **601** presents options **603** and **605** to send invitation to the join the group gaming session to mobile devices M**1** and M**2** respectively.

By selecting the option **603** to send an invitation to, for instance, the mobile device M**1**, the web application **115** generates and transmits the invitation. This invitation is received a native application **117***a* that is a client of the game session. Alternatively, it is contemplated that instead of the native application **117***a* the invited mobile device can execute another instance of the web application **115** in a browser application. In other words, all participants (including the master) can be either native or browser based. If browser-based, the system **100** provides for and enables universal addressability of the browser or corresponding web application **115** without need for specialized or service-specific servers to route communications to the web application **115**. On receiving the invitation, the native application **117***a* presents a UI **609** to alert the user of the device that a game invitation has been received. The UI **609** also provides options **609** and **611** to respectively accept or reject the invitation.

If one or more of the invitations are accepted, the web application **115** can initialize or commence the gaming session. As shown in FIG. **6**B, on commencing the gaming

session, the web application **115** displays a UI **621** that presents public group data. For example, if the gaming session is providing a group board game, the public group data may comprise a representation of the game board. In another example, if the game is a card game, the public group data may display the public or community cards. If the master is a browser-equipped television, the public data can be displayed on the television. It is contemplated that the master can also be designated a master of the group. In this case, sharing of the view might be restricted to the small screen of the mobile device or provide over the devices video output (e.g., a composite video output, an HDMI video output, or other video interface).

In one embodiment, if a master drops out of the session, another participant may be designated as the new master. The transition from the dropped master to the master can be managed by any one of the participating applications (e.g., other web applications **115** or native applications **117**). In some embodiments, multiple masters can be designated in one multiparty session to facilitate, for instance, formation of multiple teams for competing or use during the session.

At the same time, the web application **115** (e.g., as the designated master) can transmit private data to the participating native applications **117***a* and **117***b* (or other participating web applications **115**) for display in their respective UIs to preserve their privacy. For example, the application **117***a* of the mobile device M**1** can display a UI **623** that can include a public data portion **625** and a private game data portion **627**. The public data portion **625** can provide another view or a personalized view of the public data. For example, the public data portion **625** may display a portion of the game board that may be of particular interest to the user of the mobile device M**1**. The private game data portion **627** may display games pieces that are specific to the user that need not or is not to be displayed to all members. For example, in a card game, the private data portion **627** may display the cards that the user of the mobile device M**1** is holding. Similarly, the application **117***b* of another participating mobile device M**2** may display its respective public data portion **631** and private game data **633**.

The processes described herein for facilitating communications for browser-based applications may be advantageously implemented via software, hardware, firmware or a combination of software and/or firmware and/or hardware. For example, the processes described herein, may be advantageously implemented via processor(s), Digital Signal Processing (DSP) chip, an Application Specific Integrated Circuit (ASIC), Field Programmable Gate Arrays (FPGAs), etc. Such exemplary hardware for performing the described functions is detailed below.

FIG. **7** illustrates a computer system **700** upon which an embodiment of the invention may be implemented. Although computer system **700** is depicted with respect to a particular device or equipment, it is contemplated that other devices or equipment (e.g., network elements, servers, etc.) within FIG. **7** can deploy the illustrated hardware and components of system **700**. Computer system **700** is programmed (e.g., via computer program code or instructions) to facilitate communications for browser-based applications as described herein and includes a communication mechanism such as a bus **710** for passing information between other internal and external components of the computer system **700**. Information (also called data) is represented as a physical expression of a measurable phenomenon, typically electric voltages, but including, in other embodiments, such phenomena as magnetic, electromagnetic, pressure, chemical, biological, molecular, atomic, sub-atomic and quantum interactions. For example, north and south magnetic fields, or a zero and non-zero electric voltage, represent two states (0, 1) of a binary digit (bit). Other phenomena can represent digits of a higher base. A superposition of multiple simultaneous quantum states before measurement represents a quantum bit (qubit). A sequence of one or more digits constitutes digital data that is used to represent a number or code for a character. In some embodiments, information called analog data is represented by a near continuum of measurable values within a particular range. Computer system **700**, or a portion thereof, constitutes a means for performing one or more steps of facilitating communications for browser-based applications.

A bus **710** includes one or more parallel conductors of information so that information is transferred quickly among devices coupled to the bus **710**. One or more processors **702** for processing information are coupled with the bus **710**.

A processor (or multiple processors) **702** performs a set of operations on information as specified by computer program code related to facilitating communications for browser-based applications. The computer program code is a set of instructions or statements providing instructions for the operation of the processor and/or the computer system to perform specified functions. The code, for example, may be written in a computer programming language that is compiled into a native instruction set of the processor. The code may also be written directly using the native instruction set (e.g., machine language). The set of operations include bringing information in from the bus **710** and placing information on the bus **710**. The set of operations also typically include comparing two or more units of information, shifting positions of units of information, and combining two or more units of information, such as by addition or multiplication or logical operations like OR, exclusive OR (XOR), and AND. Each operation of the set of operations that can be performed by the processor is represented to the processor by information called instructions, such as an operation code of one or more digits. A sequence of operations to be executed by the processor **702**, such as a sequence of operation codes, constitute processor instructions, also called computer system instructions or, simply, computer instructions. Processors may be implemented as mechanical, electrical, magnetic, optical, chemical or quantum components, among others, alone or in combination.

Computer system **700** also includes a memory **704** coupled to bus **710**. The memory **704**, such as a random access memory (RAM) or any other dynamic storage device, stores information including processor instructions for facilitating communications for browser-based applications. Dynamic memory allows information stored therein to be changed by the computer system **700**. RAM allows a unit of information stored at a location called a memory address to be stored and retrieved independently of information at neighboring addresses. The memory **704** is also used by the processor **702** to store temporary values during execution of processor instructions. The computer system **700** also includes a read only memory (ROM) **706** or any other static storage device coupled to the bus **710** for storing static information, including instructions, that is not changed by the computer system **700**. Some memory is composed of volatile storage that loses the information stored thereon when power is lost. Also coupled to bus **710** is a non-volatile (persistent) storage device **708**, such as a magnetic disk, optical disk or flash card, for storing information, including instructions, that persists even when the computer system **700** is turned off or otherwise loses power.

Information, including instructions for facilitating communications for browser-based applications, is provided to

the bus **710** for use by the processor from an external input device **712**, such as a keyboard containing alphanumeric keys operated by a human user, or a sensor. A sensor detects conditions in its vicinity and transforms those detections into physical expression compatible with the measurable phenomenon used to represent information in computer system **700**. Other external devices coupled to bus **710**, used primarily for interacting with humans, include a display device **714**, such as a cathode ray tube (CRT), a liquid crystal display (LCD), a light emitting diode (LED) display, an organic LED (OLED) display, a plasma screen, or a printer for presenting text or images, and a pointing device **716**, such as a mouse, a trackball, cursor direction keys, or a motion sensor, for controlling a position of a small cursor image presented on the display **714** and issuing commands associated with graphical elements presented on the display **714**. In some embodiments, for example, in embodiments in which the computer system **700** performs all functions automatically without human input, one or more of external input device **712**, display device **714** and pointing device **716** is omitted.

In the illustrated embodiment, special purpose hardware, such as an application specific integrated circuit (ASIC) **720**, is coupled to bus **710**. The special purpose hardware is configured to perform operations not performed by processor **702** quickly enough for special purposes. Examples of ASICs include graphics accelerator cards for generating images for display **714**, cryptographic boards for encrypting and decrypting messages sent over a network, speech recognition, and interfaces to special external devices, such as robotic arms and medical scanning equipment that repeatedly perform some complex sequence of operations that are more efficiently implemented in hardware.

Computer system **700** also includes one or more instances of a communications interface **770** coupled to bus **710**. Communication interface **770** provides a one-way or two-way communication coupling to a variety of external devices that operate with their own processors, such as printers, scanners and external disks. In general the coupling is with a network link **778** that is connected to a local network **780** to which a variety of external devices with their own processors are connected. For example, communication interface **770** may be a parallel port or a serial port or a universal serial bus (USB) port on a personal computer. In some embodiments, communications interface **770** is an integrated services digital network (ISDN) card or a digital subscriber line (DSL) card or a telephone modem that provides an information communication connection to a corresponding type of telephone line. In some embodiments, a communication interface **770** is a cable modem that converts signals on bus **710** into signals for a communication connection over a coaxial cable or into optical signals for a communication connection over a fiber optic cable. As another example, communications interface **770** may be a local area network (LAN) card to provide a data communication connection to a compatible LAN, such as Ethernet. Wireless links may also be implemented. For wireless links, the communications interface **770** sends or receives or both sends and receives electrical, acoustic or electromagnetic signals, including infrared and optical signals, that carry information streams, such as digital data. For example, in wireless handheld devices, such as mobile telephones like cell phones, the communications interface **770** includes a radio band electromagnetic transmitter and receiver called a radio transceiver. In certain embodiments, the communications interface **770** enables connection to the communication network **105** for facilitating communications for browser-based applications.

The term "computer-readable medium" as used herein refers to any medium that participates in providing information to processor **702**, including instructions for execution. Such a medium may take many forms, including, but not limited to computer-readable storage medium (e.g., non-volatile media, volatile media), and transmission media. Non-transitory media, such as non-volatile media, include, for example, optical or magnetic disks, such as storage device **708**. Volatile media include, for example, dynamic memory **704**. Transmission media include, for example, twisted pair cables, coaxial cables, copper wire, fiber optic cables, and carrier waves that travel through space without wires or cables, such as acoustic waves and electromagnetic waves, including radio, optical and infrared waves. Signals include man-made transient variations in amplitude, frequency, phase, polarization or other physical properties transmitted through the transmission media. Common forms of computer-readable media include, for example, a floppy disk, a flexible disk, hard disk, magnetic tape, any other magnetic medium, a CD-ROM, CDRW, DVD, any other optical medium, punch cards, paper tape, optical mark sheets, any other physical medium with patterns of holes or other optically recognizable indicia, a RAM, a PROM, an EPROM, a FLASH-EPROM, an EEPROM, a flash memory, any other memory chip or cartridge, a carrier wave, or any other medium from which a computer can read. The term computer-readable storage medium is used herein to refer to any computer-readable medium except transmission media.

Logic encoded in one or more tangible media includes one or both of processor instructions on a computer-readable storage media and special purpose hardware, such as ASIC **720**.

Network link **778** typically provides information communication using transmission media through one or more networks to other devices that use or process the information. For example, network link **778** may provide a connection through local network **780** to a host computer **782** or to equipment **784** operated by an Internet Service Provider (ISP). ISP equipment **784** in turn provides data communication services through the public, world-wide packet-switching communication network of networks now commonly referred to as the Internet **790**.

A computer called a server host **792** connected to the Internet hosts a process that provides a service in response to information received over the Internet. For example, server host **792** hosts a process that provides information representing video data for presentation at display **714**. It is contemplated that the components of system **700** can be deployed in various configurations within other computer systems, e.g., host **782** and server **792**.

At least some embodiments of the invention are related to the use of computer system **700** for implementing some or all of the techniques described herein. According to one embodiment of the invention, those techniques are performed by computer system **700** in response to processor **702** executing one or more sequences of one or more processor instructions contained in memory **704**. Such instructions, also called computer instructions, software and program code, may be read into memory **704** from another computer-readable medium such as storage device **708** or network link **778**. Execution of the sequences of instructions contained in memory **704** causes processor **702** to perform one or more of the method steps described herein. In alternative embodiments, hardware, such as ASIC **720**, may be used in place of or in combination with software to implement the invention. Thus,

embodiments of the invention are not limited to any specific combination of hardware and software, unless otherwise explicitly stated herein.

The signals transmitted over network link **778** and other networks through communications interface **770**, carry information to and from computer system **700**. Computer system **700** can send and receive information, including program code, through the networks **780**, **790** among others, through network link **778** and communications interface **770**. In an example using the Internet **790**, a server host **792** transmits program code for a particular application, requested by a message sent from computer **700**, through Internet **790**, ISP equipment **784**, local network **780** and communications interface **770**. The received code may be executed by processor **702** as it is received, or may be stored in memory **704** or in storage device **708** or any other non-volatile storage for later execution, or both. In this manner, computer system **700** may obtain application program code in the form of signals on a carrier wave.

Various forms of computer readable media may be involved in carrying one or more sequence of instructions or data or both to processor **702** for execution. For example, instructions and data may initially be carried on a magnetic disk of a remote computer such as host **782**. The remote computer loads the instructions and data into its dynamic memory and sends the instructions and data over a telephone line using a modem. A modem local to the computer system **700** receives the instructions and data on a telephone line and uses an infra-red transmitter to convert the instructions and data to a signal on an infra-red carrier wave serving as the network link **778**. An infrared detector serving as communications interface **770** receives the instructions and data carried in the infrared signal and places information representing the instructions and data onto bus **710**. Bus **710** carries the information to memory **704** from which processor **702** retrieves and executes the instructions using some of the data sent with the instructions. The instructions and data received in memory **704** may optionally be stored on storage device **708**, either before or after execution by the processor **702**.

FIG. **8** illustrates a chip set or chip **800** upon which an embodiment of the invention may be implemented. Chip set **800** is programmed to facilitate communications for browser-based applications as described herein and includes, for instance, the processor and memory components described with respect to FIG. **7** incorporated in one or more physical packages (e.g., chips). By way of example, a physical package includes an arrangement of one or more materials, components, and/or wires on a structural assembly (e.g., a baseboard) to provide one or more characteristics such as physical strength, conservation of size, and/or limitation of electrical interaction. It is contemplated that in certain embodiments the chip set **800** can be implemented in a single chip. It is further contemplated that in certain embodiments the chip set or chip **800** can be implemented as a single "system on a chip." It is further contemplated that in certain embodiments a separate ASIC would not be used, for example, and that all relevant functions as disclosed herein would be performed by a processor or processors. Chip set or chip **800**, or a portion thereof, constitutes a means for performing one or more steps of providing user interface navigation information associated with the availability of functions. Chip set or chip **800**, or a portion thereof, constitutes a means for performing one or more steps of facilitating communications for browser-based applications.

In one embodiment, the chip set or chip **800** includes a communication mechanism such as a bus **801** for passing information among the components of the chip set **800**. A processor **803** has connectivity to the bus **801** to execute instructions and process information stored in, for example, a memory **805**. The processor **803** may include one or more processing cores with each core configured to perform independently. A multi-core processor enables multiprocessing within a single physical package. Examples of a multi-core processor include two, four, eight, or greater numbers of processing cores. Alternatively or in addition, the processor **803** may include one or more microprocessors configured in tandem via the bus **801** to enable independent execution of instructions, pipelining, and multithreading. The processor **803** may also be accompanied with one or more specialized components to perform certain processing functions and tasks such as one or more digital signal processors (DSP) **807**, or one or more application-specific integrated circuits (ASIC) **809**. A DSP **807** typically is configured to process real-world signals (e.g., sound) in real time independently of the processor **803**. Similarly, an ASIC **809** can be configured to performed specialized functions not easily performed by a more general purpose processor. Other specialized components to aid in performing the inventive functions described herein may include one or more field programmable gate arrays (FPGA) (not shown), one or more controllers (not shown), or one or more other special-purpose computer chips.

In one embodiment, the chip set or chip **800** includes merely one or more processors and some software and/or firmware supporting and/or relating to and/or for the one or more processors.

The processor **803** and accompanying components have connectivity to the memory **805** via the bus **801**. The memory **805** includes both dynamic memory (e.g., RAM, magnetic disk, writable optical disk, etc.) and static memory (e.g., ROM, CD-ROM, etc.) for storing executable instructions that when executed perform the inventive steps described herein to facilitate communications for browser-based applications. The memory **805** also stores the data associated with or generated by the execution of the inventive steps.

FIG. **9** is a diagram of exemplary components of a mobile terminal (e.g., handset) for communications, which is capable of operating in the system of FIG. **1**, according to one embodiment. In some embodiments, mobile terminal **901**, or a portion thereof, constitutes a means for performing one or more steps of facilitating communications for browser-based applications. Generally, a radio receiver is often defined in terms of front-end and back-end characteristics. The front-end of the receiver encompasses all of the Radio Frequency (RF) circuitry whereas the back-end encompasses all of the baseband processing circuitry. As used in this application, the term "circuitry" refers to both: (1) hardware-only implementations (such as implementations in only analog and/or digital circuitry), and (2) to combinations of circuitry and software (and/or firmware) (such as, if applicable to the particular context, to a combination of processor(s), including digital signal processor(s), software, and memory(ies) that work together to cause an apparatus, such as a mobile phone or server, to perform various functions). This definition of "circuitry" applies to all uses of this term in this application, including in any claims. As a further example, as used in this application and if applicable to the particular context, the term "circuitry" would also cover an implementation of merely a processor (or multiple processors) and its (or their) accompanying software/or firmware. The term "circuitry" would also cover if applicable to the particular context, for example, a baseband integrated circuit or applications processor integrated circuit in a mobile phone or a similar integrated circuit in a cellular network device or other network devices.

Pertinent internal components of the telephone include a Main Control Unit (MCU) **903**, a Digital Signal Processor (DSP) **905**, and a receiver/transmitter unit including a microphone gain control unit and a speaker gain control unit. A main display unit **907** provides a display to the user in support of various applications and mobile terminal functions that perform or support the steps of facilitating communications for browser-based applications. The display **907** includes display circuitry configured to display at least a portion of a user interface of the mobile terminal (e.g., mobile telephone). Additionally, the display **907** and display circuitry are configured to facilitate user control of at least some functions of the mobile terminal. An audio function circuitry **909** includes a microphone **911** and microphone amplifier that amplifies the speech signal output from the microphone **911**. The amplified speech signal output from the microphone **911** is fed to a coder/decoder (CODEC) **913**.

A radio section **915** amplifies power and converts frequency in order to communicate with a base station, which is included in a mobile communication system, via antenna **917**. The power amplifier (PA) **919** and the transmitter/modulation circuitry are operationally responsive to the MCU **903**, with an output from the PA **919** coupled to the duplexer **921** or circulator or antenna switch, as known in the art. The PA **919** also couples to a battery interface and power control unit **920**.

In use, a user of mobile terminal **901** speaks into the microphone **911** and his or her voice along with any detected background noise is converted into an analog voltage. The analog voltage is then converted into a digital signal through the Analog to Digital Converter (ADC) **923**. The control unit **903** routes the digital signal into the DSP **905** for processing therein, such as speech encoding, channel encoding, encrypting, and interleaving. In one embodiment, the processed voice signals are encoded, by units not separately shown, using a cellular transmission protocol such as enhanced data rates for global evolution (EDGE), general packet radio service (GPRS), global system for mobile communications (GSM), Internet protocol multimedia subsystem (IMS), universal mobile telecommunications system (UMTS), etc., as well as any other suitable wireless medium, e.g., microwave access (WiMAX), Long Term Evolution (LTE) networks, code division multiple access (CDMA), wideband code division multiple access (WCDMA), wireless fidelity (WiFi), satellite, and the like, or any combination thereof

The encoded signals are then routed to an equalizer **925** for compensation of any frequency-dependent impairments that occur during transmission though the air such as phase and amplitude distortion. After equalizing the bit stream, the modulator **927** combines the signal with a RF signal generated in the RF interface **929**. The modulator **927** generates a sine wave by way of frequency or phase modulation. In order to prepare the signal for transmission, an up-converter **931** combines the sine wave output from the modulator **927** with another sine wave generated by a synthesizer **933** to achieve the desired frequency of transmission. The signal is then sent through a PA **919** to increase the signal to an appropriate power level. In practical systems, the PA **919** acts as a variable gain amplifier whose gain is controlled by the DSP **905** from information received from a network base station. The signal is then filtered within the duplexer **921** and optionally sent to an antenna coupler **935** to match impedances to provide maximum power transfer. Finally, the signal is transmitted via antenna **917** to a local base station. An automatic gain control (AGC) can be supplied to control the gain of the final stages of the receiver. The signals may be forwarded from there to a remote telephone which may be another cellular telephone, any other mobile phone or a land-line connected to a Public Switched Telephone Network (PSTN), or other telephony networks.

Voice signals transmitted to the mobile terminal **901** are received via antenna **917** and immediately amplified by a low noise amplifier (LNA) **937**. A down-converter **939** lowers the carrier frequency while the demodulator **941** strips away the RF leaving only a digital bit stream. The signal then goes through the equalizer **925** and is processed by the DSP **905**. A Digital to Analog Converter (DAC) **943** converts the signal and the resulting output is transmitted to the user through the speaker **945**, all under control of a Main Control Unit (MCU) **903** which can be implemented as a Central Processing Unit (CPU) (not shown).

The MCU **903** receives various signals including input signals from the keyboard **947**. The keyboard **947** and/or the MCU **903** in combination with other user input components (e.g., the microphone **911**) comprise a user interface circuitry for managing user input. The MCU **903** runs a user interface software to facilitate user control of at least some functions of the mobile terminal **901** to facilitate communications for browser-based applications. The MCU **903** also delivers a display command and a switch command to the display **907** and to the speech output switching controller, respectively. Further, the MCU **903** exchanges information with the DSP **905** and can access an optionally incorporated SIM card **949** and a memory **951**. In addition, the MCU **903** executes various control functions required of the terminal. The DSP **905** may, depending upon the implementation, perform any of a variety of conventional digital processing functions on the voice signals. Additionally, DSP **905** determines the background noise level of the local environment from the signals detected by microphone **911** and sets the gain of microphone **911** to a level selected to compensate for the natural tendency of the user of the mobile terminal **901**.

The CODEC **913** includes the ADC **923** and DAC **943**. The memory **951** stores various data including call incoming tone data and is capable of storing other data including music data received via, e.g., the global Internet. The software module could reside in RAM memory, flash memory, registers, or any other form of writable storage medium known in the art. The memory device **951** may be, but not limited to, a single memory, CD, DVD, ROM, RAM, EEPROM, optical storage, magnetic disk storage, flash memory storage, or any other non-volatile storage medium capable of storing digital data.

An optionally incorporated SIM card **949** carries, for instance, important information, such as the cellular phone number, the carrier supplying service, subscription details, and security information. The SIM card **949** serves primarily to identify the mobile terminal **901** on a radio network. The card **949** also contains a memory for storing a personal telephone number registry, text messages, and user specific mobile terminal settings.

While the invention has been described in connection with a number of embodiments and implementations, the invention is not so limited but covers various obvious modifications and equivalent arrangements, which fall within the purview of the appended claims. Although features of the invention are expressed in certain combinations among the claims, it is contemplated that these features can be arranged in any combination and order.

What is claimed is:

1. A method comprising facilitating a processing of and/or processing (1) data and/or (2) information and/or (3) at least one signal, the (1) data and/or (2) information and/or (3) at least one signal based, at least in part, on the following:

at least one determination, by at least one processor, to assign a communication identifier to a browser session at a client side;

a processing of an application identifier associated with a web application, a browser identifier associated with the browser session, a user identifier, or a combination thereof to generate the communication identifier,

wherein the browser session hosts, at least in part, the web application, and

wherein the communication identifier addresses communications directly to the browser session, the web application, or a combination thereof at the client side via a communication methodology that is not specific to browser session communications and web application communications;

at least one determination to cause, at least in part, creation of a channel for exchanging data between the browser session, the web application, or a combination thereof and one or more other browser sessions, one or more other web applications, one or more devices, or a combination thereof,

wherein the creation of the channel is based, at least in part, on the communication identifier;

at least one determination to cause, at least in part, creation of a group of the browser session, the web application, the one or more other browser sessions, the one or more other web applications, the one or more devices, or a combination thereof; and

at least one designation of at least one master from among the group,

wherein the at least one master manages data exchanges among the group over the channel wherein the communication methodology causes the web application and one or more client-side native applications to initiate communications among the group.

2. A method of claim **1**, wherein the communication methodology includes, at least in part, a message routing service, a peer-to-peer service, or a combination thereof.

3. A method of claim **1**, wherein the (1) data and/or (2) information and/or (3) at least one signal are further based, at least in part, on the following:

at least one determination to cause, at least in part, emulation of a client device to represent the browser session, the web application, or a combination thereof based, at least in part, on a communication,

wherein the addressing of the browser session, the web application, or a combination thereof is via the emulated client device.

4. A method of claim **1**, wherein the (1) data and/or (2) information and/or (3) at least one signal are further based, at least in part, on the following:

at least one determination to authenticate access to the channel.

5. A method comprising facilitating a processing of and/or processing (1) data and/or (2) information and/or (3) at least one signal, the (1) data and/or (2) information and/or (3) at least one signal based, at least in part, on the following:

at least one determination, by at least one processor, to assign a communication identifier to a browser session at a client side;

a processing of an application identifier associated with a web application, a browser identifier associated with the browser session, a user identifier, or a combination thereof to generate the communication identifier,

wherein the browser session hosts, at least in part, the web application, and

wherein the communication identifier addresses communications directly to the browser session, the web application, or a combination thereof at the client side via a communication methodology that is not specific to browser session communications and web application communications;

at least one determination to cause, at least in part, creation of a channel for exchanging data between the browser session, the web application, or a combination thereof and one or more other browser sessions, one or more other web applications, one or more devices, or a combination thereof,

wherein the creation of the channel is based, at least in part, on the communication identifier; and

at least one determination to cause, at least in part, creation of a group of the browser session, the web application, the one or more other browser sessions, the one or more other web applications, the one or more devices, or a combination thereof,

wherein the data exchanged over the channel includes at least in part data private to a subset of the group, data public to the group, or a combination thereof wherein the communication methodology causes the web application and one or more client-side native applications to initiate communcations among the group.

6. An apparatus comprising:

at least one processor; and

at least one memory including computer program code for one or more programs,

the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus to perform at least the following,

determine to assign a communication identifier to a browser session at a client side;

process and/or facilitate a processing of an application identifier associated with a web application, a browser identifier associated with the browser session, a user identifier, or a combination thereof to generate the communication identifier,

wherein the browser session hosts, at least in part, the web application, and

wherein the communication identifier addresses communications directly to the browser session, the web application, or a combination thereof at the client side via a communication methodology that is not specific to browser session communications and web application communications;

determine to cause, at least in part, creation of a channel for exchanging data between the browser session, the web application, or a combination thereof and one or more other browser sessions, one or more other web applications, one or more devices, or a combination thereof,

wherein the creation of the channel is based, at least in part, on the communication identifier;

determine to cause, at least in part, creation of a group of the browser session, the web application, the one or more other browser sessions, the one or more other web applications, the one or more devices, or a combination thereof; and

determine to designate at least one master from among the group,

wherein the at least one master manages data exchanges among the group over the channel wherein the communication methodology causes the web application and one more client-side native application to initiate communications among the group.

7. An apparatus of claim 6, wherein the communication methodology includes, at least in part, a message routing service, a peer-to-peer service, or a combination thereof.

8. An apparatus of claim 6, wherein the apparatus is further caused to:

determine to cause, at least in part, emulation of a client device to represent the browser session, the web application, or a combination thereof based, at least in part, on a communication,

wherein the addressing of the browser session, the web application, or a combination thereof is via the emulated client device.

9. An apparatus of claim 6, wherein the apparatus is further caused to:

determine to authenticate access to the channel.

10. An apparatus comprising:

at least one processor; and

at least one memory including computer program code for one or more programs,

the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus to perform at least the following, determine to assign a communication identifier to a browser session at a client side;

process and/or facilitate a processing of an application identifier associated with a web application, a browser identifier associated with the browser session, a user identifier, or a combination thereof to generate the communication identifier,

wherein the browser session hosts, at least in part, the web application, and

wherein the communication identifier addresses communications directly to the browser session, the web application, or a combination thereof at the client side via a communication methodology that is not specific to browser session communications and web application communications;

determine to cause, at least in part, creation of a channel for exchanging data between the browser session, the web application, or a combination thereof and one or more other browser sessions, one or more other web applications, one or more devices, or a combination thereof,

wherein the creation of the channel is based, at least in part, on the communication identifier; and

determine to cause, at least in part, creation of a group of the browser session, the web application, the one or more other browser sessions, the one or more other web applications, the one or more devices, or a combination thereof,

wherein the data exchanged over the channel includes at least in part data private to a subset of the group, data public to the group, or a combination thereof wherein the communication methodology causes the web application and one or more client-side native applications to initiate communications among the group.

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