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(54) **SECOND-SCREEN CONTROL AUTOMATIC PAIRING USING PUSH NOTIFICATIONS**

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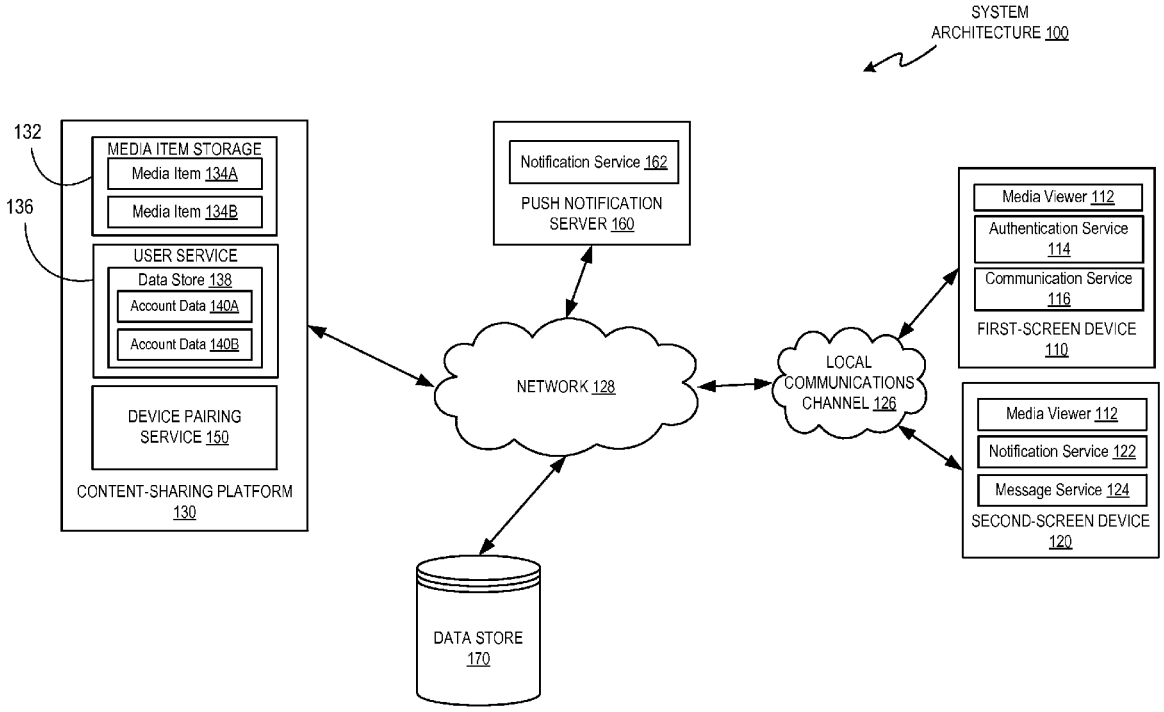
(57) **ABSTRACT**

A computer-implemented method for pairing multimedia devices is provided herein. The method may include operations of detecting a connection between a first-screen device and a pairing service, the first-screen device connecting to the pairing service through a local network and of generating a pairing code that is valid for a pairing session. The method may further include sending a request to a push notification server to send a push notification comprising the pairing code to a second-screen device, receiving the pairing code from the second-screen device, and associating the first-screen device and the second-screen devices as paired devices.



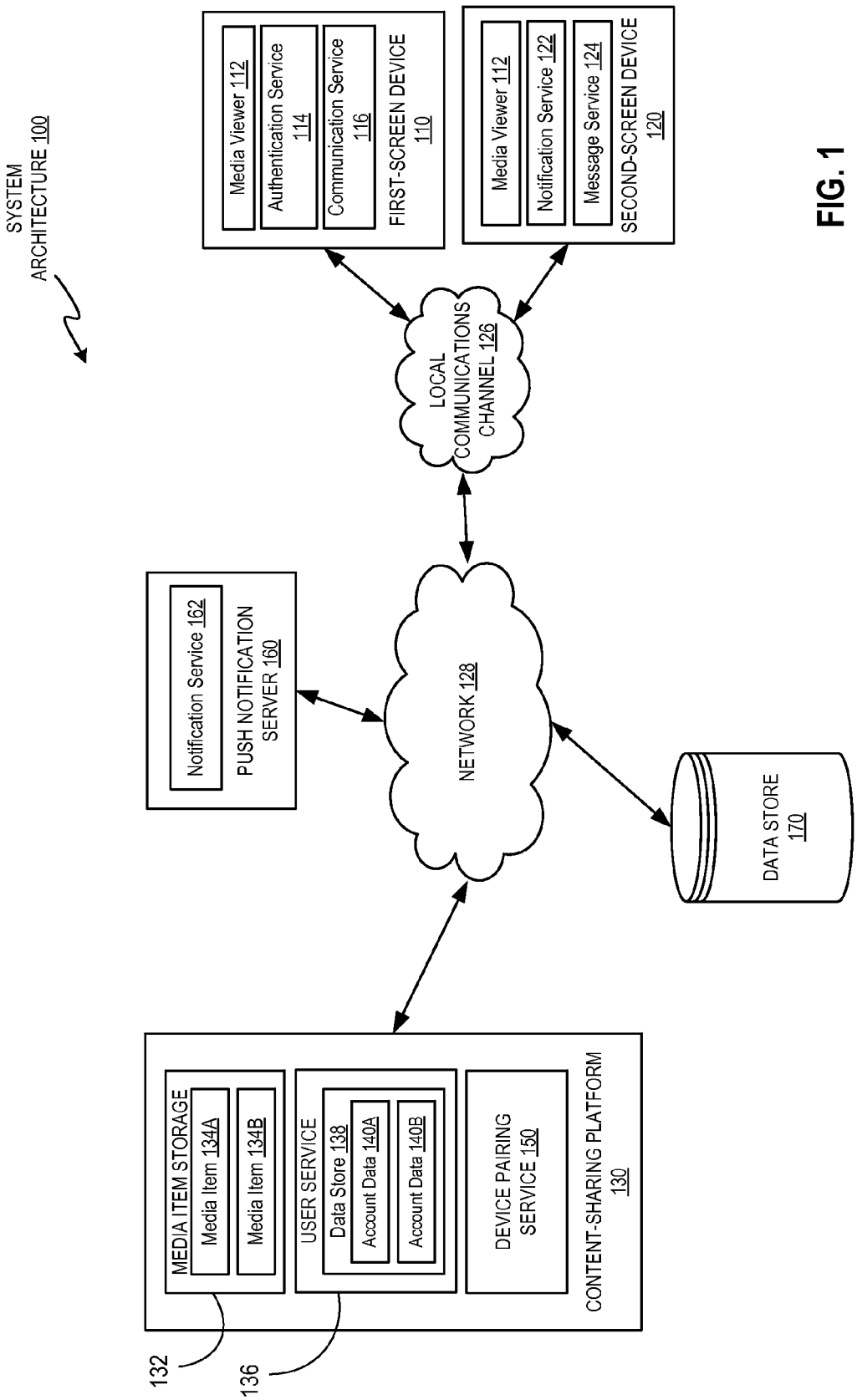

SYSTEM ARCHITECTURE 100
FIRST-SCREEN DEVICE 110
Media Viewer 112
Authentication Service 114
Communication Service 116
SECOND-SCREEN DEVICE 120
Media Viewer 112
Notification Service 122
Message Service 124
LOCAL COMMUNICATIONS CHANNEL 126
NETWORK 128
PUSH NOTIFICATION SERVER 160
Notification Service 162
DATA STORE 170
CONTENT-SHARING PLATFORM 130
MEDIA ITEM STORAGE
Media Item 134A
Media Item 134B
USER SERVICE
Data Store 138
Account Data 140A
Account Data 140B
DEVICE PAIRING SERVICE 150
132
136

FIG. 1

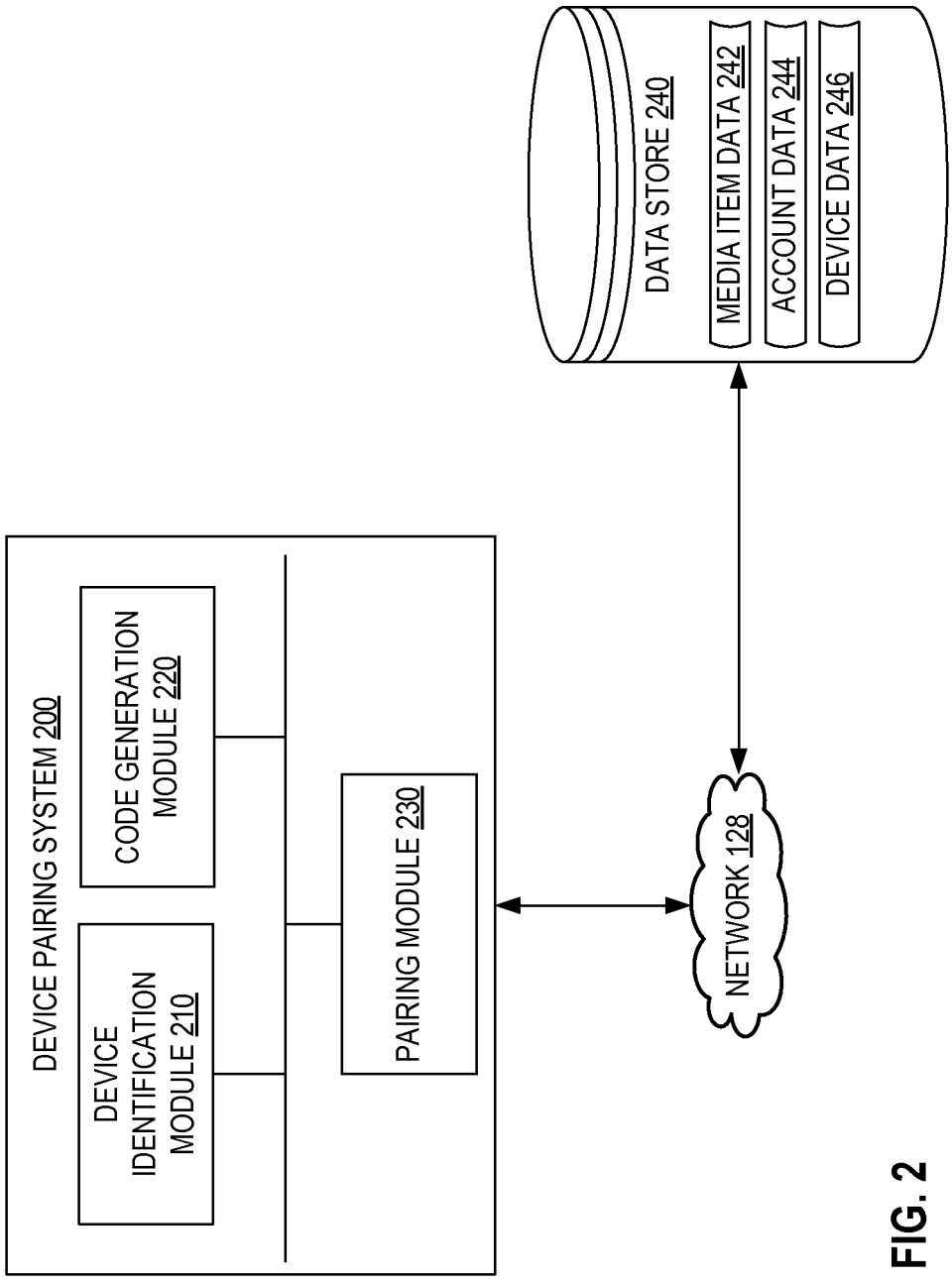

DEVICE PAIRING SYSTEM 200
DEVICE IDENTIFICATION MODULE 210
CODE GENERATION MODULE 220
PAIRING MODULE 230
NETWORK 128
DATA STORE 240
MEDIA ITEM DATA 242
ACCOUNT DATA 244
DEVICE DATA 246

FIG. 2

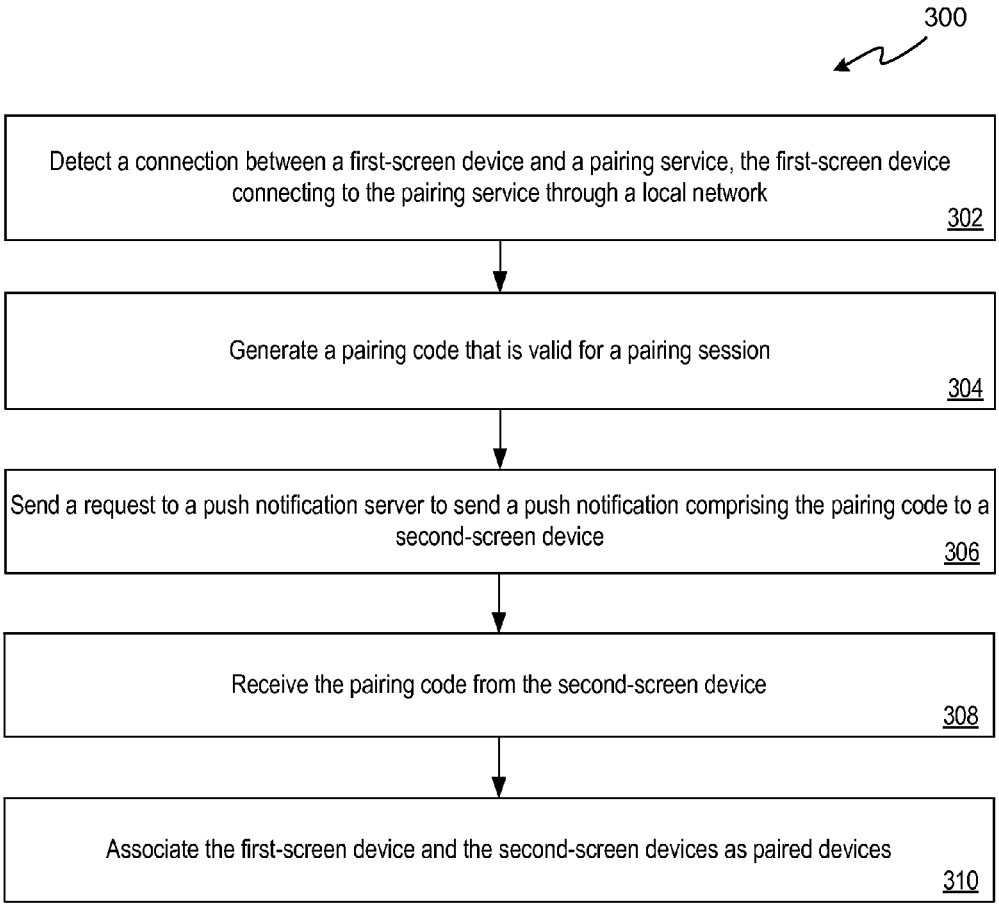

300
Detect a connection between a first-screen device and a pairing service, the first-screen device connecting to the pairing service through a local network
302
Generate a pairing code that is valid for a pairing session
304
Send a request to a push notification server to send a push notification comprising the pairing code to a second-screen device
306
Receive the pairing code from the second-screen device
308
Associate the first-screen device and the second-screen devices as paired devices
310

FIG. 3

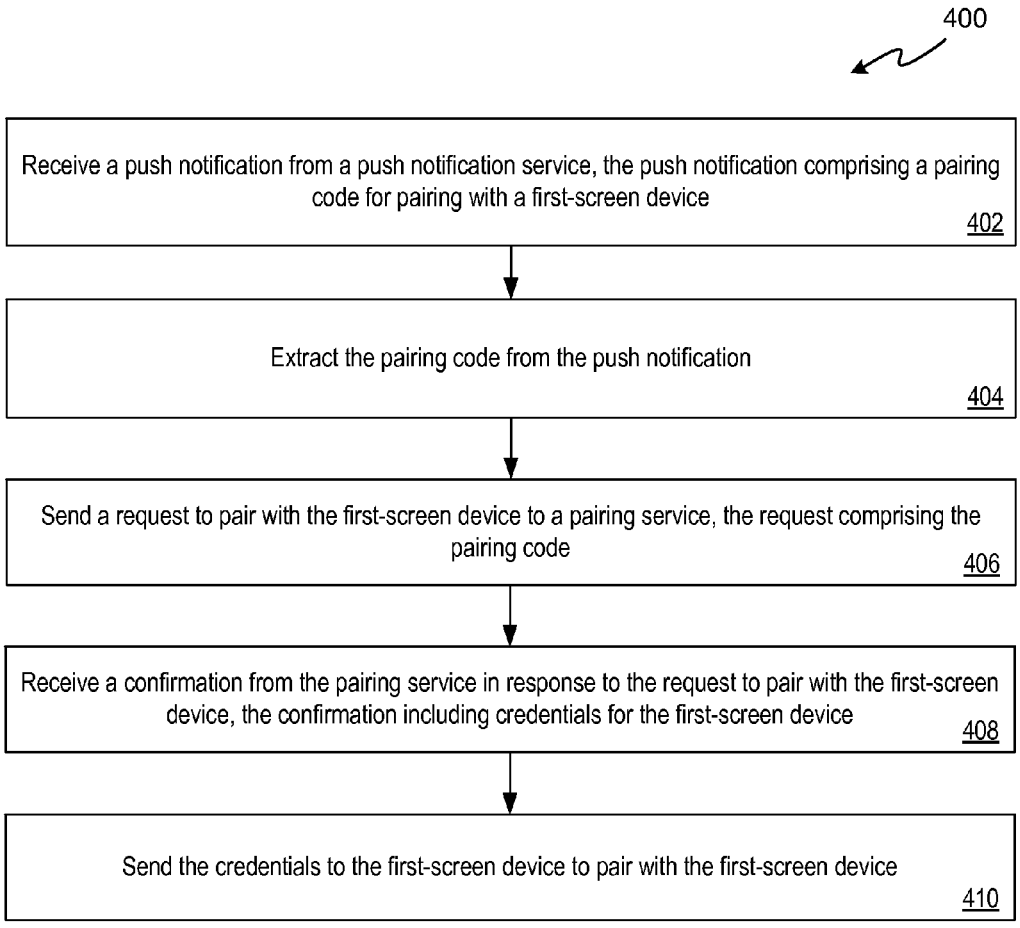

400
Receive a push notification from a push notification service, the push notification comprising a pairing code for pairing with a first-screen device
402
Extract the pairing code from the push notification
404
Send a request to pair with the first-screen device to a pairing service, the request comprising the pairing code
406
Receive a confirmation from the pairing service in response to the request to pair with the first-screen device, the confirmation including credentials for the first-screen device
408
Send the credentials to the first-screen device to pair with the first-screen device
410

FIG. 4

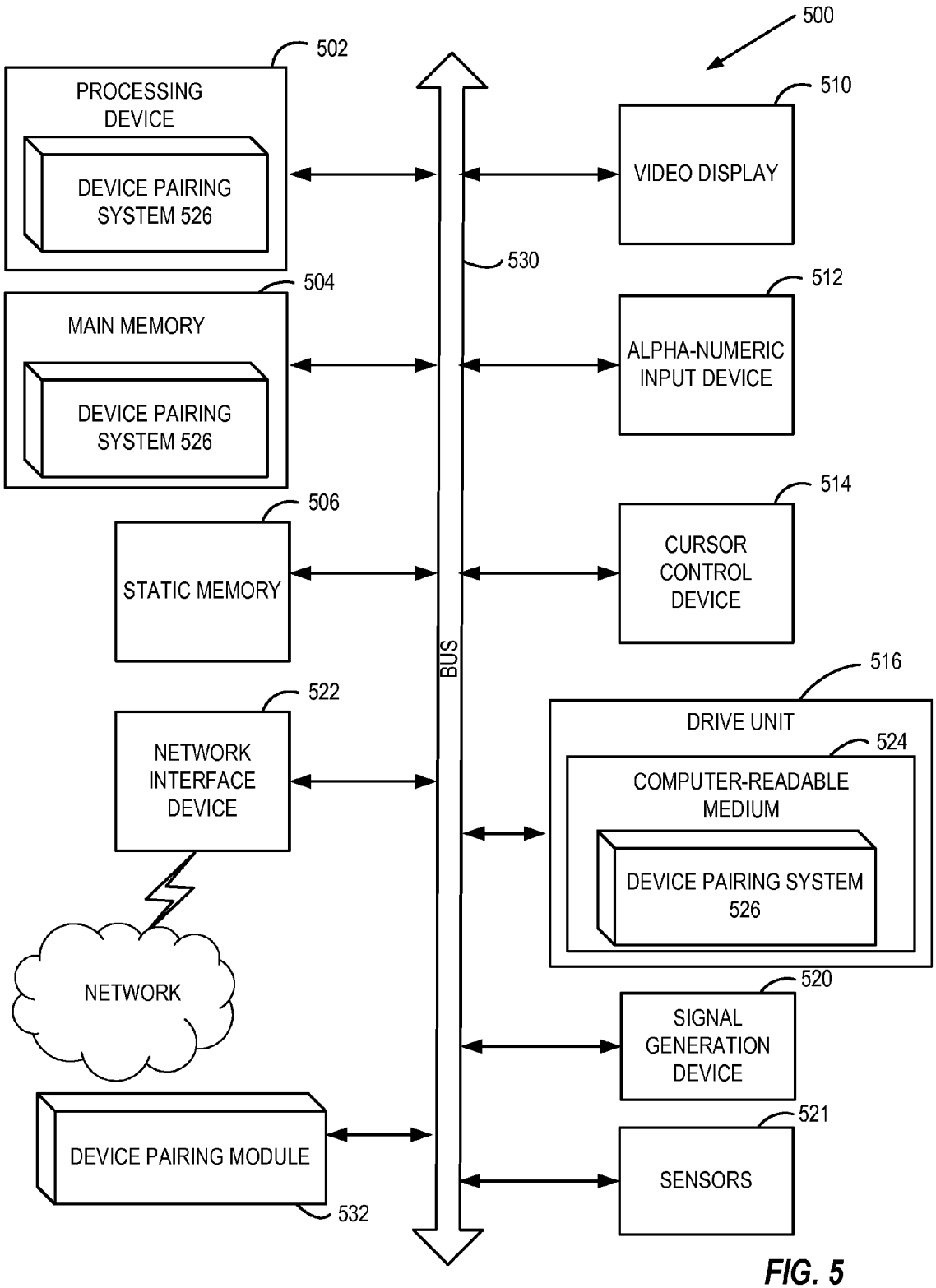

500
502
PROCESSING DEVICE
DEVICE PAIRING SYSTEM 526
504
MAIN MEMORY
DEVICE PAIRING SYSTEM 526
506
STATIC MEMORY
522
NETWORK INTERFACE DEVICE
NETWORK
DEVICE PAIRING MODULE
532
530
BUS
510
VIDEO DISPLAY
512
ALPHA-NUMERIC INPUT DEVICE
514
CURSOR CONTROL DEVICE
516
DRIVE UNIT
524
COMPUTER-READABLE MEDIUM
DEVICE PAIRING SYSTEM 526
520
SIGNAL GENERATION DEVICE
521
SENSORS

FIG. 5

SECOND-SCREEN CONTROL AUTOMATIC PAIRING USING PUSH NOTIFICATIONS

TECHNICAL FIELD

[0001] This disclosure relates to the field of content-sharing platforms and, in particular, to methods and systems for pairing multimedia devices.

BACKGROUND

[0002] As mobile devices, include smartphones, tablets, mobile gaming devices, etc., have become more prevalent, more media is consumed on such devices. Users are increasingly comfortable with the navigation and control of such devices for access media items. Coinciding with the rise in such "small-screen" devices there has been a rise in the size of television sets and monitors. Technologies have improved the resolution of such "big-screen" devices and their refresh rates as well, offering a richer experience.

[0003] Some technologies enable consumers with both large-screen and small-screen devices to connect the two, enabling one to be used to control the other. Different approaches have been taken to enable the pairing and cooperation of these types of devices. However, current pairing approaches have not been entirely satisfactory. For example, one current pairing approach uses a protocol known as DIAL (Discovery and Launch) that can discover and launch applications on the same WiFi network. However, this technology requires that a large-screen device explicitly support DIAL on a network level, which significantly reduces the number of applicable large screen devices.

SUMMARY

[0004] The following is a simplified summary of the disclosure in order to provide a basic understanding of some aspects of the disclosure. This summary is not an extensive overview of the disclosure. It is intended to neither identify key or critical elements of the disclosure nor delineate any scope of the particular embodiments of the disclosure or any scope of the claims. Its sole purpose is to present some concepts of the disclosure in a simplified form as a prelude to the more detailed description that is presented later.

[0005] A computer-implemented method for pairing a first-screen device with a second-screen device is provided herein. Embodiments of the method include operations of detecting a connection between a first-screen device and a pairing service, the first-screen device connecting to the pairing service through a local network, and generating a pairing code that is valid for a pairing session. The operations further include sending a request to a push notification server to send a push notification comprising the pairing code to a second-screen device, receiving the pairing code from the second-screen device, and associating the first-screen device and the second-screen devices as paired devices.

[0006] In additional implementations or embodiments, computing devices for performing the operations of the above-described implementations are also disclosed. Systems with a processing device and a memory including instructions that when executed by the processing devices cause the processing device to perform operations corresponding to the disclosed methods are also provided. Additionally, in some implementations of the present disclosure, a non-transitory computer-readable storage medium stores instructions for performing the operations of the above-described implementations.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Aspects of the present disclosure are illustrated, by way of example and not by way of limitation, in the figures of the accompanying drawings.

[0008] FIG. **1** illustrates an exemplary system architecture for pairing multimedia devices, in accordance with an embodiment of the disclosure.

[0009] FIG. **2** is a block diagram of a pairing system, in accordance with some embodiments of the disclosure.

[0010] FIG. **3** is a flow diagram of a method of pairing multimedia devices, in accordance with some embodiments of the disclosure.

[0011] FIG. **4** is a flow diagram of another method of pairing multimedia devices, in accordance with some embodiments of the disclosure.

[0012] FIG. **5** is a block diagram illustrating an exemplary system architecture, according to some embodiments.

[0013] These drawings may be better understood when observed in connection with the following Detailed Description.

DETAILED DESCRIPTION

[0014] Implementations are described for pairing two multimedia devices together such that a user of both devices may use one device to control the other over a network connection, such as a wireless network connection. People consume media items, such as movies, television, videos, music, photography, and text on a variety of different devices. The devices include televisions with over-the-air signals and/or cable or satellite signals (including, for example, television sets and smart TVs), personal computers, laptops, tablets, smartphones, gaming consoles, set-top box (STBs), wearable computers, etc. Each of these devices may provide a different interface, with different advantages and disadvantages. The devices may be controlled in a variety of ways. For example, users of these devices may control the devices with a dedicated controller (e.g., a remote control), touch-based inputs, audio-inputs, motion-sensing controllers, or other types of controls used to navigate different types of user interfaces. The devices may include or be coupled to displays ranging from about 3 inches to more than 70 inches.

[0015] Given the range of devices, users may seek to combine the strengths of devices by using one to control another. For example, a user may want to control the user's television with the user's phone. In order for this to occur, the television and the phone may need to communicate directly or indirectly. Problems may occur if a neighbor of the user is able to control the user's television with the neighbor's phone, without the permission of the user. Thus, it may be desirable to allow users to pair their devices, such as pairing a television or a set-top box connected with the television and a smartphone, while preventing unauthorized pairing.

[0016] In some embodiments, a pairing service may be provided to communicate with both the television and the smartphone to establish a pairing relationship or association between them such that commands entered by a user using one device may be registered and enacted by another device.

[0017] For example, this pairing service may detect a connection between a user's television and the pairing service.

The television may connect to the pairing service through a local network that in turn connects to a larger network. The pairing service may obtain some information about the local network, such as an Internet Protocol (IP) address. In response to a request from the television, the pairing service may generate a pairing code. In some embodiments, the pairing code may be valid only for a single pairing session. After generating the pairing code, the pairing service may send a request to a push notification server to send a push notification, including the pairing code, to the user's smartphone, and any other devices associated with the user as indicated by a user account accessible to the pairing service. The push notification server may be a third-party push notification server. The push notification may be received by the user's smartphone, which may extract the pairing code from the push notification. This may be performed by the smartphone without an affirmative user command being entered contemporaneously with the receipt of the notification or without express knowledge of the user.

[0018] After the push notification is sent to the user's smartphone, the smartphone may communicate the pairing code to the pairing service by sending a request to pair with the television, thereby confirming to the pairing service the request of the user to pair the devices. The devices may be associated in a database of the pairing service or in another user database as being paired devices and the pairing service may send a confirmation to the smartphone. This confirmation may provide a message to the user indicating that the pairing service has allowed for the two devices to be paired. The confirmation may also include credentials for use in the pairing of the two devices. For example, the smartphone may use the credentials to authenticate itself to or otherwise pair with the television. The smartphone may send the credentials to the television over the local network or over another communication channel. The television may thereafter receive commands, files, and/or other data from the smartphone such that the smartphone is able to control the television. For example, the smartphone may be able to issue commands to the television, such as to change a channel, change the volume, modify settings, etc. Additionally, the smartphone may be able to communicate data, such as a streaming media file, to the television or to instruct the television to request and play such a streaming media file.

[0019] These and other aspects of the present disclosure may improve the process for pairing two multimedia devices, such as simplifying the pairing process and decreasing user actions. Aspects of the present disclosure also permit devices to be paired with less specialized device features than may be conventionally employed (e.g., without requiring a device to support a specific protocol such as the DIAL protocol or the like). As such, embodiments of the present disclosure may enable more devices to be paired in a simple manner than by conventional pairing technologies.

[0020] FIG. **1** illustrates an exemplary system architecture **100** for the pairing of multimedia devices, in accordance with an embodiment of the disclosure. For ease of explanation, the illustrated embodiment includes a pairing service as part of a content-sharing platform. This done solely for clarity in explanation. The scope of the present disclosure extends well beyond the specific embodiments presented herein.

[0021] The system architecture **100** includes a plurality of client devices, illustrated as a first-screen device **110** and a second-screen device **120**. The system architecture **100** further includes a local communications channel **126**, which may be a local network, such as a wireless network (e.g., Wi-Fi, Bluetooth®, etc.) or a wired network (e.g., an Ethernet network). The first-screen device first-screen device **110** and second-screen device **120** may communicate directly with each other via the local communications channel **126** in some embodiments. Additionally, the first-screen device **110** and the second-screen device **120** may exchange communication less directly through the local communications channel **126** and the network **128**, in some embodiments. The devices first-screen device **110** and/or second-screen device **120** may communicate with a content-sharing platform **130**, a push notification server **160**, and a data store **170** over the network **128**.

[0022] In one embodiment, network **128** may be a public network (e.g., the Internet), a private network (e.g., a local area network (LAN) or wide area network (WAN)), a wired network (e.g., Ethernet network), a wireless network (e.g., an 802.11 network or a Wi-Fi network), or a cellular network (e.g., a Long Term Evolution (LTE) network), having routers, hubs, switches, servers, and/or a combination thereof. In one embodiment, the data store **170** includes a memory (e.g., random access memory), a cache, a drive (e.g., a hard drive), a flash drive, a database system, a storage area network (SAN), or another type of component or device capable of storing data. The data store **170** may also include multiple storage components (e.g., multiple drives or multiple databases) that may also span multiple computing devices (e.g., multiple server computers) and storage devices such as may be present in a data center. Thus, in some embodiments, the data store **170** may be a data center.

[0023] The devices **110** and **120** may include computing devices such as personal computers (PCs), laptops, smartphones, tablet computers, wearable computing devices, set-top boxes (STBs), televisions, etc. The devices **110** and **120** may be referred to as "multimedia devices", as these devices are able to receive, process, and/or play media items. For ease of explanation, the first-screen device first-screen device **110** may be a television and the second-screen device **120** may be a smartphone in many of the examples provided herein. devices **110** and **120** may be used to consume (e.g., view, hear, etc.) content from the content-sharing platform **130** or from other sources, such as over-the-air television transmitters, cable and satellite television transmitters, the Internet, etc.

[0024] As illustrated, both the devices **110** and **120** include a media viewer **112**. In one embodiment, the media viewers **112** may be applications that allow users to receive media items including visible content, such as images, videos, web pages, text, documents, etc., and/or audio content from one or more sources. For example, the media viewer **112** may be a web browser that can access, retrieve, present, and/or navigate content (e.g., web pages such as Hyper Text Markup Language (HTML) pages, digital media items, etc.) served by a web server. The content may be received as a set of instructions or data. If the first screen device **110** is a television, the media viewer **112** of the first-screen device **110** may be a combination of hardware and software on the television to render signals for presentation. The media viewer **112** may render, display, and/or present the content (e.g., a web page, a media viewer) from the received instructions on the client device to a user consuming the content. The media viewer **112** may also display an embedded media player (e.g., a Flash® player or an HTML5 player) that is embedded in a web page (e.g., a web page that may provide information about a product sold by an online merchant, a content-sharing platform

such as a social network with social posts and comments). The media viewer **112** may also render or present audio components of the content on a sound system of a client device.

[0025] In another example, the media viewer **112** may be a standalone application, such as smartphone application or "app," that allows users to consume digital media items (e.g., digital videos, digital images, electronic books, shared text, etc.) as part of the content-sharing platform **130**. Additionally, the media viewer **112** may provide a user interface, or receive instructions or data including a user interface from the content-sharing platform **130** to enable users to upload and manage content.

[0026] The first-screen device **110** may further include an authentication service **114** which may receive credentials from a device, such as the second-screen device **120**, to authorize that device to exercise a degree of control over the first-screen device **110**. The credentials may be at least one of a username, a password, or a token, etc. For example, if the second-screen device **120** provides the appropriate credentials to the first-screen device **110**, the second-screen device **120** may be able to control certain features of the first-screen device **110**, such as changing the channel or instructing the first-screen device **110** to request content from the content-sharing platform **130** for presentation on a display of the first-screen device **110**. The first-screen device **110** may include a communication service **116** to enable the first-screen device **110** to communicate with the second-screen device **120**, the content-sharing platform **130**, and other sources as described herein.

[0027] The second-screen device **120** may include a media viewer **112** as described above, and may further include a notification service **122** and a message service **124**. The notification service **122** may receive messages from the push notification server **160** over the network **128**. Such messages may be referred to herein as "push notifications" or "cloud-to-device notifications." The message service **124** may allow local messages to be displayed to a user of the second-screen device **120**. For example, the message service **124** may receive a message from an application or "app" running in the background of the second-screen device **120** and present it as a message, alert, pop-up, etc., to the user of the device second-screen device **120**. Both the messages handled by the message service **124** and the notifications received by the notification service **122** may include text that is rendered on a display of the second-screen device **120** and information or data that is not rendered on the display. In some embodiments, the notification service **122** may receive and process one or more notifications from the push notification server **160** and not display the notification to the user of the second-screen device **120**. Such notifications may be processed in the background of the second-screen device **120**.

[0028] As illustrated in FIG. **1**, the devices **110** and **120** may communication with the content-sharing platform **130** over the network **128**.

[0029] In some embodiments, the content-sharing platform **130** may include one or more computing devices (such as a rack-mount server, a router computer, a server computer, a personal computer, a mainframe computer, a laptop computer, a tablet computer, a desktop computer, etc.), data stores (e.g., hard disks, memories, databases), networks, software components, and/or hardware components that may be used to provide a user with access to media items and/or provide the media items to the user. For example, the content-sharing platform **130** may allow a user to consume, upload, search for, approve of ("like"), dislike, share, and/or comment on media items. The content-sharing platform **130** may also include a website (e.g., a web page) and/or a mobile computing application or STB application (e.g., an "app") that may be used to provide a user with access to the media items.

[0030] The content-sharing platform **130** may include a media item storage **132** that includes a plurality of media items, such as exemplary media items **134**A and **134**B. Examples of media items **134**A and **134**B can include, and are not limited to, digital video, digital movies, digital photos, digital music, website content, social media updates, electronic books (ebooks), electronic magazines, digital newspapers, digital audio books, electronic journals, blogs, real simple syndication (RSS) feeds, electronic comic books, software applications, text-based messages, social posts, etc. As used herein, "media," media item," "online media item," "digital media," "digital media item," "content," and "content item" can include and refer to an electronic file that can be executed, loaded, or played using software, firmware, or hardware configured to present the digital media item to a viewing user of the content-sharing platform **130**.

[0031] The content-sharing platform **130** may further include a user service **136**. The user service **136** may include a data store **138** that stores account data. As shown in FIG. **1**, the data store **138** stores account data **140**A and account data **140**B. The account data **140**A and **140**B may include databases and/or table of information about or associated with accounts of users of the content-sharing platform, individually and/or collectively. The data store **138** may include multiple user accounts. For example, the account data **140**A may be a user account for a user that owns the first-screen device **110** and the second-screen device **120**. In order to access the content-sharing platform **130** from the devices **110** and **120**, the user may log into the content-sharing platform **130** from both of the devices **110** and **120**. The account data **140**A may include information identifying both of the devices **110** and **120** such as identifiers that may be used to identify and facilitate communication with multiple devices with which the user has logged into the content-sharing platform **130**.

[0032] The information from the user service **136** may be used by a device pairing service **150**. In some embodiments, the device pairing service **150** may be provided separately from and independent of the content-sharing platform **130**. In such instances, the device pairing service **150** may include or have access to the user service **136** or a comparable user service. The device pairing service **150** may receive a request from the user to pair devices associated with the user. In some embodiments, when the first-screen device **110** connects to the pairing service **150**, the pairing service **150** may automatically initiate a pairing process to enable the first-screen device **110** to be paired with any other devices associated with the user in the account data **140**A. As illustrated in FIG. **1**, a pairing process may be initiated to enable the pairing of the first-screen device **110** and second-screen device **120**.

[0033] As part of the pairing process, the device pairing service **150** may generate a pairing code and send a request to the push notification service **160**. A notification service **162** operating on the push notification server **160** may include the pairing code in a push notification. The pairing service **150** may request that such notifications be sent to all devices listed in the account data **140**A that are capable of pairing with the first-screen device **110**. In some embodiments, the pairing service **150** may request that such notifications be sent to the

devices that are associated with the user, as indicated by the user data **140**A, and are currently logged into the content-sharing platform **130**. Thus, notifications may be sent by the notification service **162** to the second-screen device **120** and other devices. In some embodiments, the pairing process may be initiated automatically, but with certain limits. For example, in some embodiments, the pairing process may only be initiated a certain number of times within a certain period, such as three times in a month or five times in a year.

[0034] The pairing code may be sent by the push notification server **160** to the second-screen device **120** over the network **128** or another network. The pairing code may be a temporary, custom-generate code and may be valid for a particular pairing session. The pairing code may be associated with session information and may include information identifying the first-screen device **110** and information requesting the location of the first-screen device **110**.

[0035] When the second-screen device **120** receives the notification, the notification is processed by the notification service **122**. In some embodiments, the notification service **122** may provide an alert to the user of the second-screen device **120**. In other embodiments, the notification service **122** does not provide an indication to the user that the notification has been received. The notification service **122** may extract the pairing code from the notification. The second-screen device **120** then sends a request, including the pairing code, to the pairing service **150** to pair with the first-screen device **110**. This request to pair with the first-screen device **110** may be a request for credentials in order to pair with the first-screen device **110**.

[0036] The pairing service **150** may receive the request containing the pairing code from the second-screen device **120** and confirm that the pairing code matches the pairing code that was sent to the notification server **160**. The pairing service **150** may also perform a check to determine whether the first-screen device **110** is still on-line and able to pair with the second-screen device **120**. The pairing service **150** may also perform a check to determine whether the first-screen device **110** and the second-screen device **120** are located near each other or proximate to each other. This may be done by determining whether the devices **110** and **120** are connected to the content-sharing platform **130** and/or the pairing service **150** via the same network, i.e., the local communication channel **126**. Some geographical information may be gathered from other sources, such as GPS coordinates provided by the first-screen device **110** and/or second-screen device **120**.

[0037] If the pairing code matches, the first-screen device **110** is available, and the devices **110** and **120** pass the location check, the pairing service **150** may respond to the second-screen device **120** with a confirmation. The confirmation may include credentials and a text-based message. The confirmation may indicate to the user that the pairing service **150** has associated the devices **110** and **120** as paired devices in in the user's account data, i.e. user data **140**A. The confirmation may be received by the second-screen device **120**. The confirmation may be presented to the user by the message service **124**. The message service **124** may present the message of the confirmation as an alert, a banner, a pop-up, etc., such that the message is presented to the user regardless of which app is (or apps are) running in a foreground of the device second-screen device **120**.

[0038] The message presented to the user of the second-screen device **120** by the message service **124** may further include interface elements for receiving a request from the user to finalize the pairing of the devices **110** and **120**. For example, the message may state "Do you want to pair this phone with your television?" and provide buttons or other elements for the user to indicate "yes" or "no." If the user indicates "yes", the user thereby requests to send the credentials received in the confirmation to the device first-screen device **110**. The credentials may be sent over the local communications channel **126**. The first-screen device **110** may store the credentials on a data store of the first-screen device **110** or the credentials may be stored in the user's account data **140**A. The first-screen device **110** may then authenticate the credentials and use them to finalize the pairing process. After the pairing process is finalized, the user may use the second-screen device **120** to control the first-screen device **110**. For example, the user may be able to select the media item **134**A on the content-sharing platform **130** via the second-screen device **120**, which may cause the first-screen device **110** to request the media item **134**A from the content-sharing platform **130**. The media item **134**A may then be played on the first-screen device **110**. In this way, the pairing device **150** may facilitate the pairing of the devices **110** and **120**.

[0039] Referring to FIG. **2**, shown therein is a block diagram of a device pairing system **200**, such as the device pairing service **150** of FIG. **1**, as described above. The device pairing system **200** may include several modules that provide the different functions that may be called upon in pairing devices, such as devices **110** and **120**. As illustrated, the pairing system **200** includes a device identification module **210**, a code generation module **220**, and a pairing module **230**. These modules **210**, **220**, **230** may be in communication with each other and with a data store **240** via the network **128**. The modules **210**, **220**, and **230** may work in cooperation to pair multimedia devices.

[0040] The device identification module **210** may identify one or more devices in many different ways. For example, the device identification module **210** may retrieve information from data communications between one or more devices and the device pairing system **200** and/or may retrieve information from the account data **244** stored on the data store **240**. For example, the account data **244** may include one or more user accounts. A user account may include a listing of all of the devices that have been logged into the account along with sufficient information to enable communication with these devices. The device identification module **210** may also determine which devices are online. For example, when the first-screen device **110** comes online and is connected to the content-sharing platform **130**, the device identification module **210** may set a flag to indicate that the first-screen device **110** is available to the pairing system **200**.

[0041] The code generation module **220** may respond to a request to initiate a device pairing process by generating a pair code as described above. The request may be automatically issued by the device identification module **210** upon identifying that the first-screen device **110** is online and available to pair with one or more devices associated with the user's account. If all devices that can be paired with the first-screen device **110** have already been paired as indicated by the user data **244**, then the device identification module **210** may forego initiating a pairing process. After the code generation module **220** generates the pairing code, the code generation module **220** may send the pairing code to a push notification service, such as the notification service **162** operating on the push notification server **160** as shown in FIG. **1**. The push notification service enables the distributed handling

and delivery of "cloud-to-device" messages. The notification service may receive the pairing code from the code generation module **220** and then include the pairing code in a notification sent to one or more devices associated with the user's account.

[0042] The receiving device or devices, such as the second-screen device **120**, may respond to receipt of the notification by sending the notification to the pairing system **200** as part of a request for pairing credentials. The pairing code may be sent automatically by the receiving device, without requiring or receiving a responsive, affirmative user request in response to the receipt of the pairing code contemporaneously with the receipt of the pairing code by the second-screen device **120**. The pairing module **230** may receive the pairing code and confirm that the pairing code received from the second-screen device **120** corresponds to the pairing code sent to the notification service **162**. In response, the pairing module **230** may access or generate credentials for use by the second-screen device **120** in pairing with the first-screen device **110**, and then send those credentials to the device second-screen device **120**. The credentials may be sent with a confirmation message that indicates to the user of the first-screen device **110** that the pairing system **200** has associated the devices **110** and **120** as being paired. This information may be stored in the user data **244** and/or device data **246** by the device identification module **210**.

[0043] After receiving the credentials and the confirmation, the second-screen device **120** may use the credentials to pair with the first-screen device **110** over the local communication channel **126**. Thereafter, the second-screen device **120** may be controlled by the user to control the first-screen device **110**.

[0044] FIG. **3** is a flow diagram of a method **300** of pairing multimedia devices such that one device may be used to control the other, according to some aspects of the present disclosure. The method **300**, and other methods described herein, may be performed by processing logic that comprises hardware (e.g., circuitry, dedicated logic, programmable logic, microcode, etc.), software (e.g., instructions run on a processing device to perform hardware simulation), or a combination thereof. For example, the method **300** may be performed by the device pairing service **150** of FIG. **1** or by the device pairing system **200** of FIG. **2**, both of which are described above.

[0045] For simplicity of explanation, the method **300** is depicted and described as a series of acts. However, acts in accordance with this disclosure can occur in various orders and/or concurrently, and with other acts not presented and described herein. Furthermore, not all illustrated acts may be required to implement the methods in accordance with the disclosed subject matter. In addition, those skilled in the art will understand and appreciate that the methods could alternatively be represented as a series of interrelated states via a state diagram or events. Additionally, it should be appreciated that the methods disclosed in this specification are capable of being stored on an article of manufacture to facilitate transporting and transferring such methods to computing devices. The term "article of manufacture," as used herein, is intended to encompass a computer program, including a set of instructions, accessible from any non-transitory, tangible computer-readable device or storage medium.

[0046] Embodiments of the method **300** may begin at block **302** in which processing logic detects a connection between a first-screen device and a pairing service, the first-screen device connecting to the pairing service through a network. For example, when the first-screen device **110** connects to the content-sharing platform **130** over the network **128**, the device identification module **210** may detect that the first-screen device **110** is connected to the pairing service **150** as well. Additionally, the device identification module **210** may determine that the first-screen device **110** is associated with a particular user account, and may identify other devices, such as the second-screen device **120**, that are associated with the same account. At block **304**, the processing logic generates a pairing code. The pairing code may be valid for a pairing session. For example, the code generation module **220** of the device pairing system **200** may generate a pairing code. The pairing code may be temporary, valid only for a current session, and associated with the session information including the identifier of the first-screen device and the location of the first-screen device determined as described herein.

[0047] At block **306**, the processing logic may send a request to a push notification server to send a push notification comprising the pairing code to a second-screen device. For example, the pairing module **230** may send a request to the push notification server **160**, with the pairing code, and request that the server **160** send a notification including the pairing code to the second-screen device **120**. Where multiple devices are identified by the device identification module **210** for possible pairing with the first-screen device **110** (e.g., devices associated with the same user name), the request to the server **160** may be a request to send the notification to each of these devices, or to each of the devices that are able to receive the notification from the server **160**. The user may be signed into his or her content sharing platform account either both on the first-screen device **110** and the second-screen device **120** or on the first-screen device **110** but not the second-screen device **120**.

[0048] At block **308**, the processing logic receives the pairing code from the second-screen device. For example, after receiving the notification from the push notification server **160**, the second-screen device **120** may respond by sending the pairing code to the pairing system **200** as part of a request to pair with the first-screen device **110**. The pairing code may be received and processed by the pairing module **230**, which may then determine whether the pairing code is valid (e.g., using the session information associated with the pairing code). The pairing module **230** may perform multiple checks before sending pairing credentials to the second-screen device **120**. For example, the pairing module **230** may check with the device identification module **210** to determine whether the first-screen device **110** is still online and available for pairing. Additionally, the pairing module **230** may receive information from the device identification module **210** to determine whether the first-screen device **110** and the second-screen device **120** are suitable for pairing. This may be done by determining that the devices **110** and **120** are in proximity to each other. The GPS information provided by the devices **110** and **120** when they are accessing the pairing system **200** and/or the content-sharing platform **130** or IP addresses by which the devices **110** and **120** are accessing the pairing system **200** and/or the content-sharing platform **130** may be compared to determine this proximity.

[0049] Upon receiving the pairing code from the second-screen device **120**, the pairing module **230** may send credentials and a confirmation message to the second-screen device **120**. The credentials may be used by the second-screen device **120** in finalizing the pairing with the first-screen device **110**.

[0050] At block **310**, the processing logic may associate the first-screen device and the second-screen devices as paired devices. For example, the device identification module **210** or the pairing module **230** may include an entry in the user data **244** and/or the device data **246** that indicates that the devices **110** and **120** are have been paired or that the credentials have been sent to the second-screen device **120** to enable it to pair with the first-screen device **110**, and thus, that the portions of pairing for which the pairing system **200** is responsible have been completed.

[0051] FIG. **4** is a flow diagram of a method **400** of pairing multimedia devices such that one device may be used to control the other, according to some aspects of the present disclosure. Some embodiments of the method **400** may be performed by the second-screen device **120** as included in FIG. **1** and as described herein. Embodiments of the method **400** may begin at block **402**, at which processing logic receives a notification from a push notification service. The notification includes a pairing code for pairing with a first-screen device. For example, the notification service **122** operating on the second-screen device **120** may receive the notification from the notification service **162**. The notification service **122** may also extract the pairing code from the notification, at block **404** at which the processing logic extracts the pairing code from the push notification. In some embodiments, the notification service **122** may check a permission setting prior to extracting the pairing code. This may be done without affirmative action on the part of the user in response to the particular notification. If the user has requested that such notifications are not to be processed, for example by specifying that notification sent at the request of the content-sharing platform **130** should not be automatically handled, the pairing code may not be extracted and the method **400** may end without completing the pairing process.

[0052] At block **406**, the processing logic may send a request to pair with the first-screen device to a pairing service, the request comprising the pairing code. For example, the second-screen device **120** may send the pairing code to the device pairing service **150**, and/or the pairing system **200**, over the network **128**. The pairing service **150** may process the request by verifying the validity of the pairing code and performing one or more checks. For example, the pairing service **150** may determine whether the first-screen device **110** is still online and available for pairing and whether the devices **110** and **120** are located in proximity to each other. For example, the pairing service **150** may use IP addresses of both the first-screen device **110** and the second-screen device **120** to determine that both devices **110** and **120** are coupled to the network **128** by the local communications channel **126**, which may be a home network.

[0053] At block **408**, the processing logic may receive a confirmation from the pairing service in response to the request to pair with the first-screen device. The confirmation may include or be sent in association with credentials for the first-screen device. For example, the pairing service **150** may send the confirmation and credentials to the second-screen device **120**. The second-screen device **120** may receive the confirmation and the message service **124** may cause a message from the confirmation to appear to the user of the second-screen device **120**. The message service **124** may cause the message to appear in a display of the second-screen device **120** even if the media viewer **112**, or another app communicating with the pairing service **150**, is operating in a background of the second-screen device **120**. At block **410**, the processing logic may send the credentials to the first-screen device to pair with the first-screen device. The second-screen device **120** may send the credentials to the first-screen device **110** over the local communications channel **126** to request that the first-screen device **110** pair with the second-screen device **120**.

[0054] After the first-screen device **110** receives the credentials, the first-screen device **110** may finalize the pairing with the second-screen device **120** such that the second-screen device **120** may control at least some aspects and features of the first-screen device **110**. For example, after the pairing is finalizes, the second-screen device **120** may be used by the user to make a selection of the media item **134**A, made accessible by the content-sharing platform **130**, to play on the first-screen device **110**. The first-screen device **110** may receive the request from the second-screen device **110** and then request the media item **134**A from the content-sharing platform **130**, and play the media item **134**A on a display of the first-screen device **110** or a display coupled thereto in embodiments in which the first-screen device **110** does not include a display (e.g., embodiments in which the first-screen device **110** is a game console, an STB, or a similar device).

[0055] FIG. **5** illustrates a diagrammatic representation of a machine in the exemplary form of a computing system **500**. Embodiments of the computing system **500** may provide the first-screen device **110**, the second-screen device **120**, content-sharing platform **130**, or the pairing system **200** as described herein. Within the computing system **500** is a set of instructions for causing the machine to perform any one or more of the methodologies discussed herein. In alternative embodiments, the machine may be connected (e.g., networked) to other machines in a LAN, an intranet, an extranet, or the Internet. The machine may operate in the capacity of a server or a client machine in a client-server network environment, or as a peer machine in a peer-to-peer (or distributed) network environment. The machine may be a PC, a tablet PC, a set-top-box (STB), a personal data assistant (PDA), a cellular telephone, a web appliance, a server, a gaming console, a network router, switch or bridge, or any machine capable of executing a set of instructions (sequential or otherwise) that specify actions to be taken by that machine. Further, while only a single machine is illustrated, the term "machine" shall also be taken to include any collection of machines that individually or jointly execute a set (or multiple sets) of instructions to perform any one or more of the methodologies discussed herein for pairing multimedia devices (e.g., a first-screen device and a second-screen device), such as embodiments of the methods **300** and **400** as described above. In one embodiment, the computing system **500** represents various components that may be implemented in the pairing system **200**, the second-screen device **120**, or the content-sharing platform **130** as described above. Alternatively, the server computing system **104** may include more or less components as illustrated in the computing system **500**.

[0056] The exemplary computing system **500** includes a processing device **502**, a main memory **504** (e.g., read-only memory (ROM), flash memory, dynamic random access memory (DRAM) such as synchronous DRAM (SDRAM), etc.), a static memory **506** (e.g., flash memory, static random access memory (SRAM), etc.), and a data storage device **516**, each of which communicate with each other via a bus **530**.

[0057] Processing device **502** represents one or more general-purpose processing devices such as a microprocessor, central processing unit, or the like. More particularly, the

processing device **502** may be a complex instruction set computing (CISC) microprocessor, reduced instruction set computing (RISC) microprocessor, very long instruction word (VLIW) microprocessor, or a processor implementing other instruction sets or processors implementing a combination of instruction sets. The processing device **502** may also be one or more special-purpose processing devices such as an application specific integrated circuit (ASIC), a field programmable gate array (FPGA), a digital signal processor (DSP), network processor, or the like. The processing device **502** is configured to execute the processing logic (e.g., device pairing system **526**, instructions for the message service **124** or the notification service **122**, etc.) for performing the operations and steps discussed herein.

[0058] The computing system **500** may further include a network interface device **522**. The computing system **500** also may include a video display unit **510** (e.g., a liquid crystal display (LCD) or a cathode ray tube (CRT)), an alphanumeric input device **512** (e.g., a keyboard), a cursor control device **514** (e.g., a mouse), and a signal generation device **520** (e.g., a speaker), and one or more sensors **521**.

[0059] The data storage device **516** may include a computer-readable storage medium **524** on which is stored one or more sets of instructions (e.g., device pairing system **526**) embodying any one or more of the methodologies or functions described herein. The device pairing system **526** may also reside, completely or at least partially, within the main memory **504** and/or within the processing device **502** during execution thereof by the computing system **500**, the main memory **504** and the processing device **502** also constituting computer-readable storage media. The device pairing system **526** may further be transmitted or received over a network via the network interface device **522**.

[0060] While the computer-readable storage medium **524** is shown in an exemplary embodiment to be a single medium, the term "computer-readable storage medium" should be taken to include a single medium or multiple media (e.g., a centralized or distributed database, and/or associated caches and servers) that store the one or more sets of instructions. The term "computer-readable storage medium" shall also be taken to include any medium that is capable of storing a set of instructions for execution by the machine and that causes the machine to perform any one or more of the methodologies of the present embodiments. The term "computer-readable storage medium" shall accordingly be taken to include, but not be limited to, solid-state memories, optical media, magnetic media or other types of mediums for storing the instructions. The term "computer-readable transmission medium" shall be taken to include any medium that is capable of transmitting a set of instructions for execution by the machine to cause the machine to perform any one or more of the methodologies of the present embodiments.

[0061] The device pairing system, components, and other features described herein can be implemented as discrete hardware components or integrated in the functionality of hardware components such as ASICS, FPGAs, DSPs, or similar devices. The device pairing module **532** may implement operations of device pairing as described herein. In addition, the device pairing module **532** can be implemented as firmware or functional circuitry within hardware devices. Further, the device pairing module **532** can be implemented in any combination hardware devices and software components.

[0062] In the foregoing description, numerous details are set forth. It will be apparent, however, to one of ordinary skill in the art having the benefit of this disclosure, that the present disclosure may be practiced without these specific details. In some instances, well-known structures and devices are shown in block diagram form, rather than in detail, in order to avoid obscuring the present disclosure.

[0063] Some portions of the detailed description have been presented in terms of algorithms and symbolic representations of operations on data bits within a computer memory. These algorithmic descriptions and representations are the means used by those skilled in the data processing arts to most effectively convey the substance of their work to others skilled in the art. An algorithm is here, and generally, conceived to be a self-consistent sequence of steps leading to a desired result. The steps are those requiring physical manipulations of physical quantities. Usually, though not necessarily, these quantities take the form of electrical or magnetic signals capable of being stored, transferred, combined, compared, and otherwise manipulated. It has proven convenient at times, principally for reasons of common usage, to refer to these signals as bits, values, elements, symbols, characters, terms, numbers, or the like.

[0064] It should be borne in mind, however, that all of these and similar terms are to be associated with the appropriate physical quantities and are merely convenient labels applied to these quantities. Unless specifically stated otherwise as apparent from the following discussion, it is appreciated that throughout the description, discussions utilizing terms such as "providing", "modifying", "determining", "receiving", "identifying", "generating", "maintaining", "transmitting" or the like, refer to the actions and processes of a computer system, or similar electronic computing device, that manipulates and transforms data represented as physical (e.g., electronic) quantities within the computer system's registers and memories into other data similarly represented as physical quantities within the computer system memories or registers or other such information storage, transmission or display devices.

[0065] The disclosure also relates to a system for performing the operations herein. This system may be specially constructed for the required purposes, or it may include a general purpose computer selectively activated or reconfigured by a computer program stored in the computer. Such a computer program may be stored in a computer readable storage medium, such as, but not limited to, any type of disk including floppy disks, optical disks, CD-ROMs, and magnetic-optical disks, read-only memories (ROMs), random access memories (RAMs), EPROMs, EEPROMs, magnetic or optical cards, or any type of media suitable for storing electronic instructions.

[0066] The words "example" or "exemplary" are used herein to mean serving as an example, instance, or illustration. Any aspect or design described herein as "example' or "exemplary" is not necessarily to be construed as preferred or advantageous over other aspects or designs. Rather, use of the words "example" or "exemplary" is intended to present concepts in a concrete fashion. As used in this application, the term "or" is intended to mean an inclusive "or" rather than an exclusive "or". That is, unless specified otherwise, or clear from context, "X includes A or B" is intended to mean any of the natural inclusive permutations. That is, if X includes A; X includes B; or X includes both A and B, then "X includes A or B" is satisfied under any of the foregoing instances. In addition, the articles "a" and "an" as used in this application and the appended claims should generally be construed to mean

"one or more" unless specified otherwise or clear from context to be directed to a singular form. Moreover, use of the term "an embodiment" or "one embodiment" or "an embodiment" or "one embodiment" throughout is not intended to mean the same embodiment or embodiment unless described as such.

[0067] Reference throughout this specification to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment. Thus, the appearances of the phrase "in some embodiments" or "in an embodiment" in various places throughout this specification are not necessarily all referring to the same embodiment. In addition, the term "or" is intended to mean an inclusive "or" rather than an exclusive "or."

[0068] It is to be understood that the above description is intended to be illustrative, and not restrictive. Many other embodiments will be apparent to those of skill in the art upon reading and understanding the above description. The scope of the disclosure should, therefore, be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled.

What is claimed is:

1. A computer-implemented method comprising:
- detecting a connection between a first-screen device and a pairing service, the first-screen device connecting to the pairing service through a network;
- generating, by a processing device, a pairing code that is valid for a pairing session;
- sending a request to a push notification server to send a push notification comprising the pairing code to a second-screen device;
- receiving, by the processing device, the pairing code from the second-screen device; and
- associating the first-screen device and the second-screen devices as paired devices.

2. The method of claim **1**, further comprising:
- determining that the first-screen device is associated with a user account: and
- identifying a plurality of devices associated with the user account, and
- wherein sending the request to send the push notification to the second-screen device comprises sending a request to send the push notification to each of the plurality of devices associated with the user account other than the first-screen device.

3. The method of claim **1**, further comprising:
- determining whether the first-screen device remains in communication with the pairing service over the connection; and
- determining whether the first-screen device is located proximate to the second-screen device.

4. The method of claim **3**, wherein determining whether the first-screen device is located proximate to the second-screen device comprises comparing an internet protocol (IP) address associated with the first-screen device with an IP address associated with the second-screen device.

5. The method of claim **1**, further comprising sending a confirmation to the second-screen device to permit the second-screen device to present a message to a user regarding the association of the first-screen device and the second-screen devices as paired devices, the confirmation including credentials for the first-screen device.

6. The method of claim **5**, wherein the message is to be presented to the user of the second-screen device outside of an application user interface associated with the pairing service.

7. The method of claim **1**, wherein the pairing code is generated for the pairing session and wherein session information is associated with the pairing code, the session information comprising an identifier of the first-screen device.

8. A system comprising:
- a memory to store instructions thereon; and
- a processing device communicably coupled to the memory, the processing device to execute the instructions to:
  - detect a connection between a first-screen device and a pairing service, the first-screen device connecting to the pairing service through a local network;
  - generate, by a processing device, a pairing code that is valid for a pairing session;
  - send a request to a push notification server to send a push notification comprising the pairing code to a second-screen device;
  - receive, by the processing device, the pairing code from the second-screen device; and
  - associate the first-screen device and the second-screen devices as paired devices.

9. The system of claim **8**, wherein the processing device is to further execute the instructions to:
- determine that the first-screen device is associated with a user account: and
- identify a plurality of devices associated with the user account, and
- wherein sending the request to send the push notification to the second-screen device comprises sending a request to send the push notification to each of the plurality of devices associated with the user account other than the first-screen device.

10. The system of claim **8**, wherein the processing device is to further execute the instructions to:
- determine whether the first-screen device remains in communication with the pairing service over the connection; and
- determine whether the first-screen device is located proximate to the second-screen device.

11. The system of claim **10**, wherein the determining whether the first-screen device is located proximate to the second-screen device comprises comparing an internet protocol (IP) address associated with the first-screen device with an IP address associated with the second-screen device.

12. The system of claim **8**, wherein the processing device is to further execute the instructions to send a confirmation to the second-screen device to permit the second-screen device to present a message to the a regarding the association of the first-screen device and the second-screen devices as paired devices, the confirmation including credentials for the first-screen device.

13. The system of claim **12**, wherein the message is to be presented to a user of the second-screen device outside of an application user interface associated with the pairing service.

14. The system of claim **8**, wherein the pairing code is generated for the pairing session and wherein session information is associated with the pairing code, the session information comprising an identifier of the first-screen device.

15. A computer-implemented method comprising:
- receiving a push notification from a push notification service, the push notification comprising a pairing code for pairing with a first-screen device;

extracting the pairing code from the push notification;

sending a request to pair with the first-screen device to a pairing service, the request comprising the pairing code; and

receiving a confirmation from the pairing service in response to the request to pair with the first-screen device, the confirmation including credentials for the first-screen device.

16. The method of claim **15**, further comprising sending the credentials to the first-screen device to finalize pairing with the first-screen device.

17. The method of claim **15**, further comprising checking a permission setting before extracting the pairing code from the push notification and before sending the request to pair with the first-screen device.

18. The method of claim **15**, further comprising:

presenting a message regarding the confirmation on a display; and

receiving input from a user, the input comprising a request to pair with the first-screen device.

19. The method of claim **15**, further comprising:

receiving a selection of a media item provided on a content-sharing platform, the selection received on a second-screen device; and

sending a command to the first-screen device to request the media item from the content-sharing platform.

20. The method of claim **15**, wherein extracting the pairing code from the push notification and sending the request to pair with the first-screen device to the pairing service are performed without contemporaneous user action.

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