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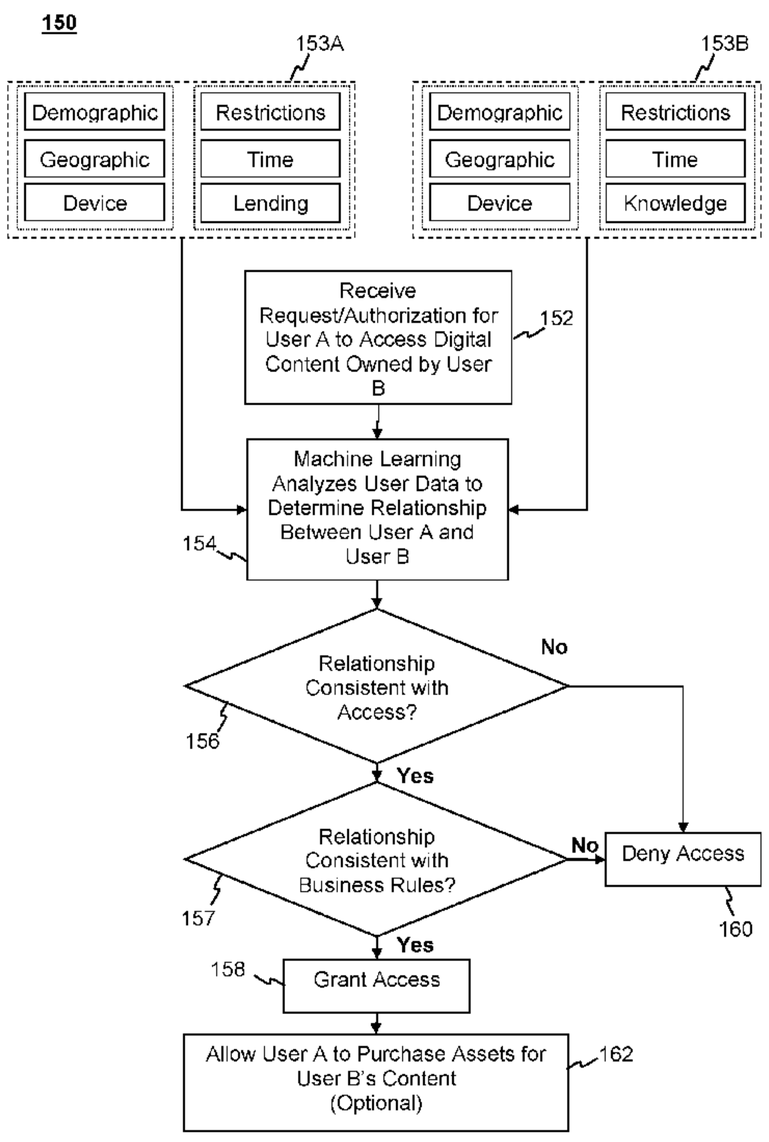


FIG. 1B

(57) Abstract: In a server configured to operate on a network, secured access to shared digital content may be implemented in response to a request from a first user to access one or more content items belonging to a second user. Information about the first and second users is analyzed with a machine learning algorithm to determine a relationship between the first user and the second user. The first user is granted or denied access to the one or more content items based on the determined relationship.

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WO 2021/112972 A1

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SECURE ACCESS TO SHARED DIGITAL CONTENT

FIELD OF THE DISCLOSURE

The present disclosure relates to sharing of digital content. In particular, aspects of the present disclosure relate to systems and methods for secure access to digital content by different users entitled to access the content.

BACKGROUND OF THE DISCLOSURE

Many computer applications, particularly video games, are often shared among multiple users. With the increasing prevalence of entirely digital application stores and the reliance on digital rights management (DRM) protection, the ability of a given user to access applications via multiple devices on-demand has greatly increased. However, if a user wishes to share access to an application with a family member this is often only possible by lending the user's device or to take action necessary to give the family member access. This is often impractical.

Many software applications are sold with a "site license" that allows a given application to be installed on certain number of computers. This is practical for business-related software as most users have their own devices but it is impractical in household situations.

In many households different members of the same family may have access to different applications associated with a common platform, such as a video game console or online store associated with a network. Access to these applications is often restricted to their respective "owners" who, though they may be members of the same family, are different individuals. There is a need in the art for a way to allow users of computer applications to both share and restrict access to those applications.

It is within this context that aspects of the present disclosure arise.

BRIEF DESCRIPTION OF THE DRAWINGS

The teachings of the present disclosure can be readily understood by considering the following detailed description in conjunction with the accompanying drawings, in which:

FIG. 1A is a schematic diagram of a system that allows secure access to shared digital content according to aspects of the present disclosure.

FIG. 1B is a flow diagram of a system that allows secure access to shared digital content according to aspects of the present disclosure.

FIG. 2A is a simplified node diagram of a recurrent neural network for use in secure access to shared digital content according to aspects of the present disclosure.

FIG. 2B is a simplified node diagram of an unfolded recurrent neural network for use in secure access to shared digital content according to aspects of the present disclosure.

FIG. 2C is a simplified diagram of a convolutional neural network for use in secure access to shared digital content according to aspects of the present disclosure.

FIG. 2D is a block diagram of a method for training a neural network in secure access to shared digital content according to aspects of the present disclosure.

FIG. 3 is a flow diagram of a method for acquiring virtual assets in a borrowed application according to an embodiment of the present invention.

FIG. 4A is a screen shot illustrating an example of a filtered listing of applications for which purchasable virtual assets are available presented to a user in accordance with aspects of the present disclosure.

FIG. 4B is a screen shot illustrating an example of a filtered catalog of purchasable virtual assets that are available to a user for the selected application presented to a user in accordance with aspects of the present disclosure.

FIG. 5 is a flow diagram of a method for acquiring virtual assets in a borrowed application according to an embodiment of the present invention.

DESCRIPTION OF THE SPECIFIC EMBODIMENTS

Although the following detailed description contains many specific details for the purposes of illustration, anyone of ordinary skill in the art will appreciate that many variations and alterations to the following details are within the scope of the invention. Accordingly, the exemplary embodiments of the invention described below are set forth without any loss of generality to, and without imposing limitations upon, the claimed invention.

Introduction

Some gaming consoles are associated with individual persons who are, in turn, associated with corresponding accounts. In some such cases, account holders are able to set a given

device as their primary console. The term "primary console", as used herein, refers to a device on which a user can always access the content regardless of network/internet connectivity. An account holder can allow others to play content on the primary console through the account holder's access pipe. It would be desirable in some circumstances for different user's accounts to be configured to freely share content associated with that account. This may include content downloaded onto a given user's device as well as that which is not loaded on the device. Such implementations are often useful among people, who are related in some way, e.g., as members of a family or other close association of individuals.

Once a family relationship has been established, e.g., by entry of information attesting to a familial relationship, some systems allow any family member can access any content owned by any members of the family. In some cases this may be possible even if when the family member that owns the content is offline. The biggest technical hurdle to such systems is how to verify that a person requesting access to content is a "trusted" person with whom content can safely be shared. A root complexity is to associate a console not just with corresponding accounts – but with "people", i.e., to be able to attribute relationship status and gating based on characteristics of the "person owning the account".

According to aspects of the present disclosure, a machine learning system may analyze a user database to determine relationships between actors in a transaction involving access to shared content. Such a system could look at, e.g., social media profiles and geolocation information to see if two users are friends or family members or otherwise identify good actors versus bad actors for the purpose of granting or denying access to requested shared content.

According to additional aspects of the present disclosure, user acquisition of virtual assets for computer applications may be facilitated by an automated system that determines which applications are relevant to the user and which assets are available for those applications. This information may be filtered so that the relevant applications and available assets can be presented to the user in an organized way that reduces the amount of manual searching the user must do.

System

FIG. 1A depicts the system **100** configured to facilitate secure access to shared digital content according to aspects of the present disclosure. The system **100** may also facilitate acquisition of virtual assets associated with a user according to additional aspects of the present

disclosure. The system **100** may operate in conjunction with one or more user devices, e.g., a first user device **101** and a second user device **102**.

The system **100** may include one or more processor units **103**, which may be configured according to well-known architectures, such as, e.g., single-core, dual-core, quad-core, multi-core, processor-coprocessor, cell processor, and the like. The market place server may also include one or more memory units **104** (e.g., random access memory (RAM), dynamic random access memory (DRAM), read-only memory (ROM), and the like).

The processor unit **103** may execute one or more programs **117**, portions of which may be stored in the memory **104** and the processor **103** may be operatively coupled to the memory, e.g., by accessing the memory via a data bus **105**. The programs **117** may be configured to facilitate secure access to shared digital content according to the method **150** described below with respect to FIG. 1B. The programs **117** may also include programs configured to facilitate purchase of virtual assets for applications **108** according to the methods described below with respect to FIG. 3, FIG. 4, FIG. 5 and FIG. 6. Additionally the Memory **104** may contain information about connections **110** between the system and one or more client devices **101**, **102**. Such connection information may include, e.g., internet protocol (IP) addresses, network address translator (NAT) traversal information, and connection performance information, such as bandwidth and latency. In addition, the Memory **104** may contain user account information **119**, such as account identifiers, user profile information, and data indicating which applications are available to a given user. The Memory **104** may also contain data corresponding to virtual assets for the application **109**. Alternatively, the virtual may be included in application data **108** or in a separate database (not shown). The virtual assets, applications and connection information may also be stored as data **118** in the Mass Store **118**.

The system **100** may also include well-known support circuits, such as input/output (I/O) **107**, circuits, power supplies (P/S) **111**, a clock (CLK) **112**, and cache **113**, which may communicate with other components of the system, e.g., via the bus **105**. The computing device may include a network interface **114**. The processor unit **103** and network interface **114** may be configured to implement a local area network (LAN) or personal area network (PAN), via a suitable network protocol, e.g., Bluetooth, for a PAN. The computing device may optionally include a mass storage device **115** such as a disk drive, CD-ROM drive, tape drive, flash memory, or the like, and the mass storage device may store programs and/or data. The marketplace server may also include a user interface **116** to facilitate interaction between

the system and a user. The user interface may include a monitor, Television screen, speakers, headphones or other devices that communicate information to the user.

The system server **100** may include a network interface **114** to facilitate communication via an electronic communications network **120**. The network interface **114** may be configured to implement wired or wireless communication over local area networks and wide area networks such as the Internet. The device **100** may send and receive data and/or requests for files via one or more message packets over the network **120**. Message packets sent over the network **120** may temporarily be stored in a buffer in memory **104**.

Although for simplicity the application **108** is shown as being stored in memory **104** on the marketplace server **100** aspects of the present disclosure are not limited to such implementations. In alternative implementations, code and data for the application **108** may be stored on a separate application server that can be remotely accessed by the system **100** and the client devices **101**, **102**.

Method

FIG 1B depicts an example of a method **150** for secured access to shared digital content that may be implemented by a system such as that depicted in FIG. 1A. A first user (User A) requests access to one or more content items belonging to a second user (User B), as indicated at **152**, e.g., by accessing the system **100** of FIG. 1 through a device connected to the network **120**. It is noted that the request at **152** may be bi-directional. User B can push (i.e., attempt to authorize access) to the User A or User A can request/pull access from User B. It is further noted that the request **152** can be a request from User A to join a group that User B belongs to so that User A can access one or more content items belonging to the group. The content items may include, media presentations, computer programs, e.g., games, data relating to assets usable with programs, e.g., game add-ons, and the like.

The system analyzes information **153A** about User A and information **153B** about User B with a machine learning algorithm to determine a relationship between the User A and User B, as indicated at **154**. The system may select different information for the lending user **153A** and the borrowing user **153B** to perform this analysis, as will be discussed below. Once the relationship is determined, the system then determines whether the relationship is consistent with granting access, as indicated at **156**. Depending on whether the relationship is consistent with access and access is consistent with business rules at **157**, access is then either granted at **158** or denied at **160** according to the determination. In some implementations, once access

is granted, the system may optionally allow the first user to purchase assets (e.g., add-ons) for the User B's content. According to aspects of the present disclosure, the request and/or granting actions may be available to be initiated by either lender or borrower. For example, the lender could select a friend and a game to share with them. Alternatively, a borrower could select a friend's content and request to borrow it. Furthermore, a grant of access that includes a grant of a request to join a group may include a grant of access to content items that belong to the group.

The information **153A**, **153B** may include information relating to interactions between the first and second user with each other. If the first user interacts with the second user frequently and regularly, they are more likely to be in some trusted relationship, e.g., as a friendship or familial relationship. In some cases, the information **153A**, **153B** may include information relating to interactions between the first or second user and one or more other users. For example, frequent and regular interaction between both users and a third user may support an inference that the first and second users are friends or family members, though it might not be dispositive.

In some implementations, the information **153A**, **153B** may include one or more user-defined data inputs. Two different user's having the same or similar user defined data inputs could support an inference that the two users are friends or family members.

In some implementations, the information **153A**, **153B** may relate to the identity of the one or more content items, which may include the identity of the content items, ownership of the content items and a history of use of the content items. Such information can be useful in determining a relationship if, e.g., the first user has previously been granted access to a content item owned by the second user.

In some implementations, the information **153A**, **153B** may relate to one or more familial relationships involving the first and/or second user, e.g., having the same last name, combined with a shared residence address. It is noted that the two users may be related, e.g., as siblings or spouses (or ex-spouses), but might not trust one another sufficiently to share access to content. The existence of a familial relationship, though useful, is not always dispositive.

In some implementations, the information **153A**, **153B** may relate to a device associated with the one or more items of digital content, the first user, or the second user. For example, the

first user might have access to the second user's device, which would support an inference of a trusted relationship.

In some implementations, the information **153A**, **153B** may relate to location data relating to the first user, the second user, or a device associated with the one or more items of digital content, the first user, or the second user. If the first and second user's share the same address they could be in a familial relationship or other relationship involving trust. This may also be relevant whether to grant access. For example, in parental oversight situations, e.g., where the first user could be a child of the second user and the child could be located at school. The parent could deny access to shared content under such circumstances.

The information **153A**, **153B** could relate to an amount of time spent interacting with the one or more items of digital content. This is sometimes useful when a content provider (e.g., game provider) places a restriction on sharing depending on the amount of time content is used. Lastly, the information **153A**, **153B** may relate to an account associated with the one or more items of digital content. In some circumstances, there may be restrictions upon whether an account can be accessed by anyone other than the account holder.

The foregoing examples of the information **153A**, **153B** are not limiting. Those of skill in the art will be able to devise other types of information that could be used to determine a relationship or to determine whether to grant or deny access.

Once a relationship is established, there a number of ways to determine whether to grant or deny access based on the determined relationship at **156**.

By way of example, and not by way of limitation, the first user may be granted access to the second user's content according to one or more restrictions based on a category analysis, e.g. when it is determined that the first user and second user have previously played other games together, or it is determined that the first user and second user have communicated via the platform for n months previously. Access may also be granted or denied according to whether the first user can demonstrate possession of shared knowledge between the first and second user that is not user defined. By way of example, the system **100** may ask the first user a challenge question like, "what game do you and the first user play most often?" The system may be able to determine this from data regarding both users' patterns of game play in the information **153A**, **153B**. A correct answer to this question would demonstrate shared knowledge.

Once a relationship has been established, the system may then consider business rules at **156** to determine whether granting access is consistent with such rules. Business rules may depend on a number of various restrictions, i.e. number of times content has been shared, or number of users accessing the shared content etc. These restrictions may be included in the information **153A**, **153B**.

In some circumstances, access may also be granted or denied according to a time of day. Some games may restrict access to children during school hours, for example. In some implementations, granting or denying access may depend on a number of users currently accessing the one or more content items. Some applications, e.g., video games, place restrictions on the number of users who can be granted concurrent access. Other content items may have restrictions on a number of times the one or more content items have been accessed. This latter restriction could be based on a variety of dynamics, e.g., the borrower has accessed borrowed content too many times, or the lender has shared content too many times, or specific to the game/content, that game has been shared by the lender too many times etc. Still other content items may have restrictions on how many times they may be accessed by anyone other than their owner and may particularly limit the number of times they may be accessed by the first user. Alternatively, the system **100** may limit access according to a number of other users to whom the second user is currently granting access to content items belonging to the second user.

Machine Learning

The machine learning program that determines relatedness of two users may be implemented using one or more trained Neural Networks (NNs). Generally, neural networks may include one or more of several different types of neural networks and may have many different layers. By way of example and not by way of limitation the classification neural network may consist of one or multiple convolutional neural networks (CNN), recurrent neural networks (RNN) and/or dynamic neural networks (DNN).

By way of example, and not by way of limitation, FIG. 2A depicts the basic form of an RNN having a layer of nodes **220**, each of which is characterized by an activation function **S**, one input weight **U**, a recurrent hidden node transition weight **W**, and an output transition weight **V.** The activation function **S** may be any non-linear function known in the art and is not limited to the (hyperbolic tangent (tanh) function. For example, the activation function **S** may be a Sigmoid or ReLu function. Unlike other types of neural networks, RNNs have one

set of activation functions and weights for the entire layer. As shown in FIG. 2B, the RNN may be considered as a series of nodes **220** having the same activation function moving through time **T** and **T+1**. Thus, the RNN maintains historical information by feeding the result from a previous time **T** to a current time **T+1**.

In some embodiments, a convolutional RNN may be used. Another type of RNN that may be used is a Long Short-Term Memory (LSTM) Neural Network which adds a memory block in a RNN node with input gate activation function, output gate activation function and forget gate activation function resulting in a gating memory that allows the network to retain some information for a longer period of time as described by Hochreiter & Schmidhuber "Long Short-term memory" Neural Computation 9(8):1735-1780 (1997), which is incorporated herein by reference.

FIG. 2C depicts an example layout of a convolution neural network such as a CRNN according to aspects of the present disclosure. In this depiction, the convolution neural network is generated for training data in the form of an array **232**, e.g., with 4 rows and 4 columns giving a total of 16 elements. The depicted convolutional neural network has a filter **233** size of 2 rows by 2 columns with a skip value of 1 and a channel **236** of size 9. For clarity in FIG. 2C only the connections **234** between the first column of channels and their filter windows is depicted. Aspects of the present disclosure, however, are not limited to such implementations. According to aspects of the present disclosure, the convolutional neural network that implements the classification **229** may have any number of additional neural network node layers **231** and may include such layer types as additional convolutional layers, fully connected layers, pooling layers, max pooling layers, local contrast normalization layers, etc. of any size.

As seen in FIG. 2D Training a neural network (NN) begins with initialization of the weights of the NN **241**. In general, the initial weights should be distributed randomly. For example, an NN with a tanh activation function should have random values distributed between $-\frac{1}{\sqrt{n}}$ and $\frac{1}{\sqrt{n}}$ where n is the number of inputs to the node.

After initialization the activation function and optimizer is defined. The NN is then provided with a feature vector or input dataset **242**. Each of the different features vectors may be generated by the NN from inputs that have known labels. Similarly, the NN may be provided with feature vectors that correspond to inputs having known labeling or

classification. The NN then predicts a label or classification for the feature or input **243**. The predicted label or class is compared to the known label or class (also known as ground truth) and a loss function measures the total error between the predictions and ground truth over all the training samples **244**. By way of example and not by way of limitation the loss function may be a cross entropy loss function, quadratic cost, triplet contrastive function, exponential cost, etc. Multiple different loss functions may be used depending on the purpose. By way of example and not by way of limitation, for training classifiers a cross entropy loss function may be used whereas for learning pre-trained embedding a triplet contrastive function may be employed. The NN is then optimized and trained, using the result of the loss function and using known methods of training for neural networks such as backpropagation with adaptive gradient descent etc. **245**. In each training epoch, the optimizer tries to choose the model parameters (i.e., weights) that minimize the training loss function (i.e. total error). Data is partitioned into training, validation, and test samples.

During training, the Optimizer minimizes the loss function on the training samples. After each training epoch, the mode is evaluated on the validation sample by computing the validation loss and accuracy. If there is no significant change, training can be stopped and the resulting trained model may be used to predict the labels of the test data.

Thus, the neural network may be trained from inputs having known labels or classifications to identify and classify those inputs.

Acquiring Virtual Assets in a Borrowed Application

As noted above, aspects of the present disclosure include implementations in which a user who has been granted access to shared, but un-owned, content may acquire virtual assets for use with that content. The flow diagram of FIG. 3 shows an example of a computer-implemented method **300** for facilitating acquisition of virtual assets for computer applications according to these additional aspects of the present disclosure. According to the illustrated method a computer system may obtain information about a user and information **303** about one or more computer applications associated with the user, as generally indicated at **302**. The information **303** generally includes user-related information **303A** and application-related information **303B**.

The user information **303A** may include, e.g., demographic information, geographic information, and device information. Demographic information generally includes things like the user's age, marital status, economic status, and other defining characteristics about

the user. Geographic information may include things like the user's current jurisdiction of residence, e.g., city, county, state, province, country or the user's current physical location. This can be determined, e.g., from a GPS or the Internet Protocol (IP) Geolocation or other location-sensing component of a device that the user uses to access the system. Device information may include information about one or more devices associated with the user. Such information may include, e.g., device ID, IP address, device capabilities, e.g., processor type, processor speed, memory space available, storage space (e.g., hard disk space) available, and the like.

The application information **303B** may include information identifying which applications the user owns, has borrowed, is otherwise associated with, e.g., applications the user has access to through a joint account with other users or through a device shared with other users. The application information may also include information identifying the corresponding producer, operating system, and/or version for such applications. In some implementations, the application information **303B** may include information identifying which application or applications are currently loaded on the device the user is using access the system through which the user attempts to acquire virtual assets for those applications.

The system may obtain the information in several different ways. By way of example, the system may be implemented locally on a device through which the user interacts with the applications. In some such cases the applications may be loaded onto the device, e.g., a computer, laptop, or gaming console, through some physical medium, such as a compact disc (CD) or universal serial bus (USB) drive, e.g., a flash drive. In such implementations, the user's device may keep track of every application loaded into the device. In other implementations, the user's device accesses the applications on a remote server via a network, such as the internet. The user's applications, i.e., those the user can access, may be associated with an account through which the user can access the applications and associated data. In such cases, either the user's device or the remote server may keep track of each application the user can access.

When the user navigates a device to a catalog screen for virtual assets for computer applications, as indicated at **304,** the system automatically presents to the user a filtered listing of applications for which virtual assets are available to the user, as indicated at **306**. The user may navigate to the catalog screen in any suitable manner, e.g., through a graphical

user interface if the system is local to the user's device or through a web browser if the system is on a server that is remote from the user's device.

The listing of applications that is automatically presented to the user is filtered according to the information about the user and/or the information about the applications associated with the user. These may include applications owned by the user, applications shared by the user with other users, applications borrowed from other users and applications to which the user otherwise has access. The list of applications to which the user has access may be filtered so that a few of the most relevant applications are presented most prominently. By way of example, and not by way of limitations, the system can filter the list of applications presented to the user so that those most recently used or most frequently appear more prominently, e.g., at the top of the list.

FIG. 4A depicts a screen shot showing an example of how such a filtered listing may be presented to the user. In the illustrated example, the screen **400** shows the user a list **402** showing icons representing 5 different applications. Applications 1, 2, and 5 are owned by the user. Application 3 is borrowed and application 4 is shared with other users. Here, the system shows only five application icons. The user may own additional applications but the system has presented the five most relevant applications as determined from the user information **403A** and/or application information **403B**. In this example, the user can view additional applications by clicking on the arrow **404** to the right of the icons using a cursor **4**.

In some implementations, the list **402** may be selectively limited to display only those applications that are owned or only those that are borrowed. In other implementations, the list **402** may display a listing of applications to which the user has opportunity to access through the user's association with other users. Such applications may include applications that are shared with others or those that are separately owned by others associated with the user, e.g., the user's friends, which the user may be able to borrow. There are a number of ways in which a system could determine which other users are associated with a given user. For example, and without limitation, other users could be associated with given user through social media. One or more other users could be associated with the given user through a multi-user online application, e.g., a multiplayer online game. The given user and another user could have gifted or lent each other applications or virtual assets in the past. The given user and another user could have communicated over voice chat feature of one or more applications. Information regarding associations between the given user and other users

could be included in the user information **403A**. Collection of such information is greatly facilitated where applications are accessed and used via a common networking system associated with the game that the given user and other users can access.

In some implementations the screen may present an interactive selector **407** that allows the user to select criteria upon which the list **402** that will be based. In the illustrated example, the selector **407** includes radio buttons that allows the user to select or de-select whether the list **402** is based on applications that are owned, borrowed, shared, or belong to friends. The user can select or de-select the appropriate radio buttons with the cursor **406**.

When the user selects an application on the filtered listing **402**, as indicated at **408,** the system automatically presents to the user a filtered catalog of purchasable virtual assets that are available to the user for the selected application, as indicated at **410**. The filtered catalog of purchasable virtual assets is filtered according to the information about the user and/or the information about one or more computer applications associated with the user.

There are a number of ways in which the system can filter the list of virtual assets for each application according to user information **403A**. For example, the catalog may be filtered according to the user demographic information, e.g., some add-ons might not be age-appropriate. The catalog presented could omit such virtual assets. The catalog may also be filtered according to the geographic information, e.g., certain virtual assets might not be available in certain areas. The catalog presented could omit such virtual assets. Furthermore, the catalog may be filtered according to device information, e.g., certain add-ons might not be available for use with certain machines. The catalog presented could omit such virtual assets. The filtering of the catalog of virtual assets could also be application context-dependent. For example, in the context of gaming applications, availability of some add-ons might be contingent upon the user accomplishing certain achievements within a game. The catalog presented could omit such virtual assets or indicate the nature of the contingency.

FIG. 4B depicts a screen shot showing an example of how such a catalog may be presented to the user. In the illustrated example, the screen **400** shows the user the list **402** with the icons representing the 4 different applications depicted in FIG. 4A. Here, the user has clicked on application 1 using the cursor **406** and the screen shows a catalog **408** with five virtual asset icons. In the illustrated example, each icon identifies the type of asset and a price to purchase the asset. Clicking on one of the asset icons may direct the user to a purchase page where the

user can complete a transaction to purchase the asset. The catalog **408** may contain additional virtual assets but, if screen space is limited, the system might present the five most relevant assets as determined from the user information **303A** and/or application information **303B**. In this example, the user can view additional assets by clicking on the arrow **402** to the right of the icons using the cursor **404**.

Referring again to FIG. 3, as noted above, the user may select a particular asset from the catalog for purchase. In such cases, the system may receive a purchase request from the user, as indicated at **312**. The system may then deliver the asset (or access to the asset) to the user, as indicated at **314**. In some implementations, the system may provide the user with an option to transfer the asset to another user, as indicated at **316**. If the user elects this option, the system may then transfer the asset (or access to the asset) to the other user identified by the user who purchased the asset, as indicated at **318**.

As discussed above, certain aspects of the present disclosure may apply to situations where a first user has lent a game to a second user who wishes to purchase add-ons for the borrowed game. According to aspects of the present disclosure, an application delivery service may allow for a user (the borrower) to borrow an application from another user (the lender) and purchase virtual assets that are available for use with the borrowed applications but which the borrower (or lender) does not own. Additionally, the application delivery service may present users with a catalog of one or more virtual assets for applications they don't currently own but may be interested in owning or trying. For example, a user may enjoy a game they borrowed and purchase a virtual asset on the expectation that they will purchase the game and the virtual asset will be available for them to use after the purchase. Alternatively, the user may purchase a virtual asset for a borrowed game as a gift for the lender.

FIG. 5 shows a method for lending a virtual asset from a first user to a second user wherein the second user can purchase assets for the borrowed application. A virtual marketplace running on a remote server may provide an interface that allows a first user of the virtual marketplace to purchase an application, as indicated at **501**. The application may be a video game, photo-editing program, music editing program, document-editing program, or the like. After purchasing the application the first user may be given the option to allow other users to borrow the application, as indicated at **502.** A second user may send a request to the virtual market place to borrow the application from the first user, as indicated at **503.**

Alternatively, the first user may simply send a message to the second user through the market place asking to borrow the application and the second user may send a message to the marketplace indicating that the first user is allowed to borrow the application. In this context borrowing, means that the application is, for a limited period of time, made unavailable to the first user, e.g., disabled or otherwise removed from the first user's device, and made available to the second user, e.g., downloaded, installed, or otherwise enabled on the second user's device. The "limited period of time" may be a fixed period of time, e.g., minutes, hours, days, weeks, months, or years, determined before or at the time the game is lent. Such a fixed period may be established by the first user, the second user, the virtual market place, or some mutual agreement among two or more of these entities. Alternatively, the duration of the "limited period of time" may be undetermined at the time the game is lent to the second user. For example, the application may be made available to the second user, e.g., downloaded, installed or otherwise enabled on the second user's device, until the first user requests that the application be returned.

In general, the borrowing of a game involves the assent of the first user before the game is lent to the second user. In some implementations, assent of a marketplace system may be required. After the request by the second user to borrow the application has been approved, the marketplace system transfers availability of the application from the first user to the second user, as indicated at **504**. The application may be transferred by way of example and not by way of limitation allowing the second user to download the application from a database in connection with the marketplace server or from a memory of the marketplace server or from a peer to peer connection with the first user. Additionally, before, during or after the transfer the Application is removed or disabled for the user. In some implementations, e.g., cloud-based gaming, the bulk of the application code and data may be stored on an application server that users can access on different devices via user accounts. In such implementations, transfer of availability may be handled by the application server disabling access to the application from the first user's account while enabling access to the application from the second user's account. Such implementations may further involve the marketplace system sending executable code (e.g., for a user interface) and or machine-readable data (e.g., encryption keys) to the second user's device so that second user can communicate.

While the second user is borrowing the application, a catalog of virtual assets for the application may be presented to the second user, as indicated at **505**. The marketplace may present the catalog to the second user, e.g., by directing the second user to a web page that the second user can access via a browser on the second user's device. In some implementations according to aspects of the present disclosure the catalog of purchasable virtual assets for the application may be presented to the second user before sending the request to borrow the application from the first user at **503**. By way of example and not by way limitation the virtual market place server may provide images of or lists of virtual assets for the application to the second user if the second user is friends with someone that owns the application or uses the application more than a threshold frequency, on a social media platform. In other embodiments the catalog of purchasable virtual assets may be presented to the second user if they recently clicked on an advertisement for the application or viewed a store page for the application.

The second user may purchase an asset for the application that the second user does not own, as indicated **506.** The purchase may occur before the second user borrows the application from the user and the virtual asset may be delivered to the user in the form of a receipt or some other proof of purchase which the second user may redeem for the virtual asset, as indicated at **507**. Alternatively, the second user may purchase the virtual asset after they have borrowed the application. In this case the virtual asset may be immediately delivered to the second user at **507**. By way of example, and not by way of limitation, the virtual asset may be delivered to the second user by downloading executable code and/or machine-readable data representing the virtual asset within the application. Alternatively, the virtual asset may be delivered to the second user by enabling use of the virtual asset within the Application, e.g., through change of an access code associated with the second user's account. In some embodiments the second user may receive at least one warning that they are buying a virtual asset for an application that they do not own. Additionally the second user may be given the option to purchase the application or ask to borrow the application from another user.

In some implementations, the marketplace system may determine whether the first user is a friend of the second user and, if so, may present the second user with a catalog of other purchasable virtual assets that are available in other applications owned by the first user. There are a number of ways in which friendship between the first and second users may be determined. For example, the marketplace may be associated with or otherwise have access

to data for a social media platform and the first and second users may indicate that they are friends on the social media platform. Alternatively, such friendship information may be directly associated with user accounts for both users on the application server.

After receiving the borrowed application from the first user the second user may use the application for a limited period of time. In some embodiments the limited period of time is chosen by the first user before the second user receives the application. In other embodiments the second user specifies the length of the borrowing period as part of the request to borrow the application from the first user. Alternatively, the first user may have the option to request the application be returned while the application is being borrowed by the second user. In some implementations, the marketplace system may determine or have a role in determining the limited period of time over which the application may be borrowed. In any case availability of the application is returned to the first user after the borrowing period has ended, as indicated at **508.** Similar to delivering availability of the application to the second user, the first user may receive the application by downloading the application again. Alternatively the application may have been disabled when the first user chose to lend the application to the second user and in which case the application may be re-enabled. In some implementations, the lending user may receive a warning when downloading a game or add-ons or updates for a game that has been lent out to another user that the game currently lent this game to the other user. Disabling and re-enabling the application may come in the form of encrypting and decrypting the application data respectively. The first user may receive a decryption key allowing decryption of the encrypted application after the borrowing period has ended. In other implementations, the marketplace system may simply enable access to the application from the first user's account and disable access to the application from the second user's account.

In some embodiments of the present disclosure the second user is provided the option to transfer the virtual asset to the first user after borrowing the application, as indicated at **109.** The second user may be provided this option before borrowing the application or after purchasing the virtual asset or after transferring the application back to the first user or any other period during which the second user owns the virtual asset. In some embodiments second user may choose to send the virtual asset as a gift to the first for allowing them to borrow the application and in which case there may be gift options for the presentation of the virtual asset to the first user.

While the above is a complete description of the preferred embodiment of the present invention, it is possible to use various alternatives, modifications and equivalents. Therefore, the scope of the present invention should be determined not with reference to the above description but should, instead, be determined with reference to the appended claims, along with their full scope of equivalents. Any feature described herein, whether preferred or not, may be combined with any other feature described herein, whether preferred or not. In the claims that follow, the indefinite article "A", or "An" refers to a quantity of one or more of the item following the article, except where expressly stated otherwise. The appended claims are not to be interpreted as including means-plus-function limitations, unless such a limitation is explicitly recited in a given claim using the phrase "means for."

WHAT IS CLAIMED IS:

1. In a server configured to operate on a network, a method for secured access to shared digital content, the method comprising:

in response to a request from a first user to access one or more content items belonging to a second user,

analyzing information about the first and second users with a machine learning algorithm to determine a relationship between the first user and the second user; and

granting or denying the first user access to the one or more content items belonging to the second user based on the determined relationship.

2. The method of claim 1, wherein the information about the first and second user includes information relating to interactions between the first and second user with each other.

3. The method of claim 1, wherein the information about the first and second user includes information relating to interactions between the first or second user and one or more other users.

4. The method of claim 1, wherein the information about the first and second user includes one or more user-defined data inputs.

5. The method of claim 1, wherein the information about the first and second user includes information relating to the identity of the one or more content items.

6. The method of claim 1, wherein the information about the first and second user includes information relating to the ownership of the one or more content items.

7. The method of claim 1, wherein the information about the first and second user includes information relating to one or more familial relationships involving the first and/or second user.

8. The method of claim 1, wherein the information about the first and second user includes information about a device associated with the one or more items of digital content, the first user, or the second user.

9. The method of claim 1, wherein the information about the first and second user includes location data relating to the first user, the second user, or a device associated with the one or more items of digital content, the first user, or the second user.

10. The method of claim 1, wherein the information about the first and second user includes information relating to an amount of time spent interacting with the one or more items of digital content.

11. The method of claim 1, wherein the information about the first and second user includes information regarding to an account associated with the one or more items of digital content.

12. The method of claim 1, wherein granting or denying the first user access to the one or more content items belonging to the second user based on the determined relationship includes determining whether to grant or deny access according to one or more restrictions based on a category analysis.

13. The method of claim 1, wherein granting or denying the first user access to the one or more content items belonging to the second user based on the determined relationship includes determining whether to grant or deny access according to whether the first user can demonstrate possession of shared knowledge between lender and borrower that is not user defined.

14. The method of claim 1, wherein granting or denying the first user access to the one or more content items belonging to the second user based on the determined relationship includes determining whether to grant or deny access according to a time of day.

15. The method of claim 1, wherein granting or denying the first user access to the one or more content items belonging to the second user based on the determined relationship includes determining whether to grant or deny access according to a number of users currently accessing the one or more content items.

16. The method of claim 1, wherein granting or denying the first user access to the one or more content items belonging to the second user based on the determined relationship includes determining whether to grant or deny access according to a number of times the one or more content items have been accessed.

17. The method of claim 1, wherein granting or denying the first user access to the one or more content items belonging to the second user based on the determined relationship includes determining whether to grant or deny access according to a number of times the one or more content items have been accessed by users other than the second user.

18. The method of claim 1, wherein granting or denying the first user access to the one or more content items belonging to the second user based on the determined relationship includes determining whether to grant or deny access according to a number of times the one or more content items have been accessed by the first user.

19. The method of claim 1, wherein granting or denying the first user access to the one or more content items belonging to the second user based on the determined relationship includes determining whether to grant or deny access according to a number of other users to whom the second user is currently granting access to content items belonging to the second user.

20. The method of claim 1, wherein the machine learning algorithm includes a trained neural network.

21. The method of claim 1, wherein the one or more content items include one or more computer applications , the method further comprising;

transferring availability of a computer application owned by the second user to the first user from the second user for a limited period of time before the first user navigates a device to a catalog screen for virtual assets for computer applications,

automatically presenting to the user a filtered catalog of purchasable virtual assets that are available to the user for the selected application, wherein the filtered catalog of purchasable virtual assets is filtered according to information about the first user and/or information about one or more computer applications associated with the first user

wherein the filtered listing of applications for which purchasable virtual assets includes the computer application owned by the second user

22. The method of claim 1, wherein the request is a request from the first user to join a group that the second user belongs to, wherein the one or more content items belong to the group.

23. An apparatus for secured access to shared digital content, comprising:

a memory;

a processor coupled to the memory;

computer readable instructions embodied in the memory and executable by the processor that, when executed by the processor, cause the apparatus to implement a method, the method comprising,

in response to a request from a first user to access one or more content items belonging to a second user,

analyzing information about the first and second users with a machine learning algorithm to determine a relationship between the first user and the second user, and

granting or denying the first user access to the one or more content items belonging to the second user based on the determined relationship.

24. A non-transitory computer readable medium having computer readable instructions embodied therein, the computer readable instructions being executable by a processor and configured such that, when executed by the processor, execution of the instructions causes the processor to implement a method, the method comprising,

in response to a request from a first user to access one or more content items belonging to a second user,

analyzing information about the first and second users with a machine learning algorithm to determine a relationship between the first user and the second user, and

granting or denying the first user access to the one or more content items belonging to the second user based on the determined relationship.

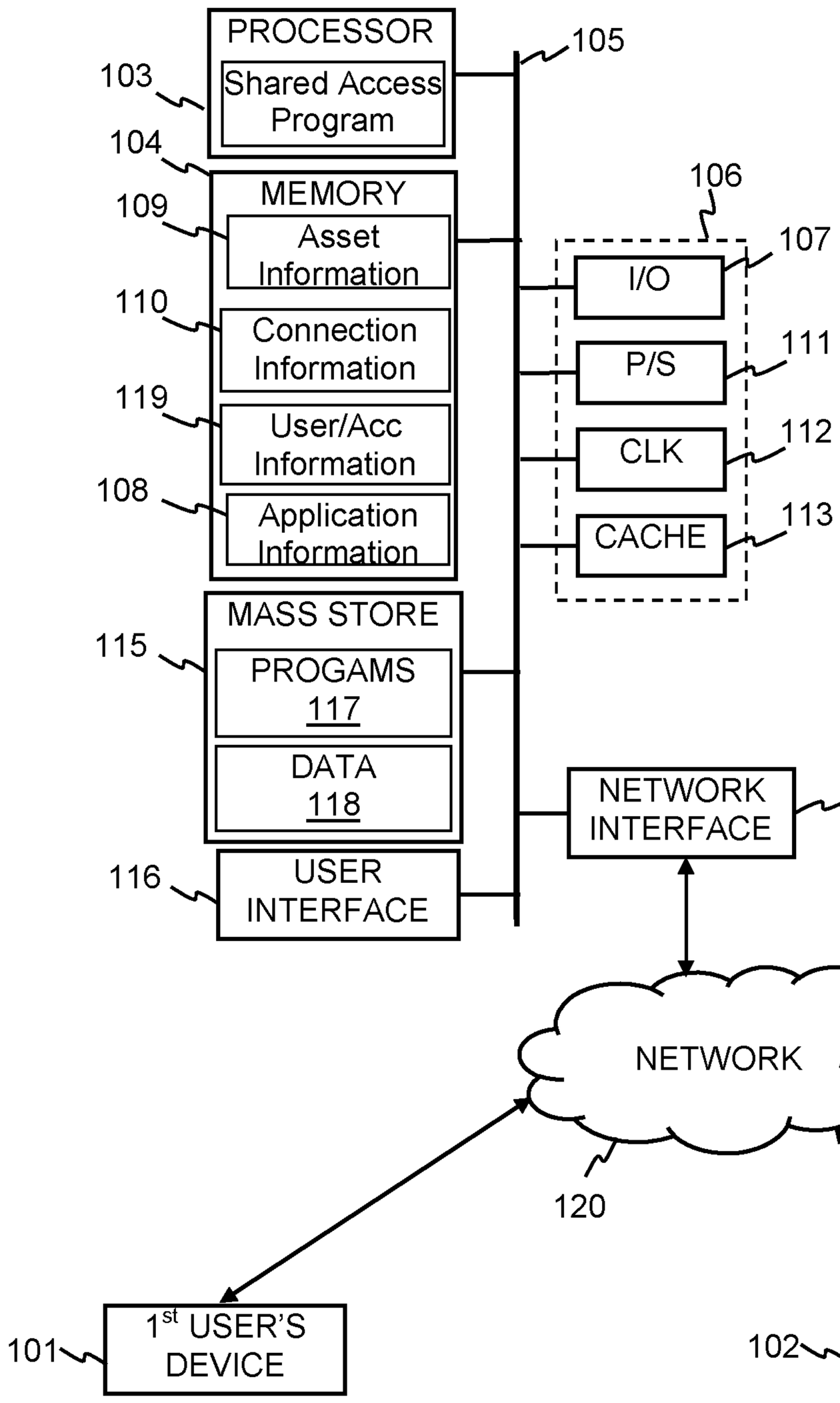

100
PROCESSOR
Shared Access Program
103
105
104
MEMORY
109
Asset Information
110
Connection Information
119
User/Acc Information
108
Application Information
106
107
I/O
111
P/S
112
CLK
113
CACHE
MASS STORE
115
PROGAMS 117
DATA 118
NETWORK INTERFACE
114
116
USER INTERFACE
NETWORK
120
1st USER'S DEVICE
101
2nd USER'S DEVICE
102

FIG. 1A

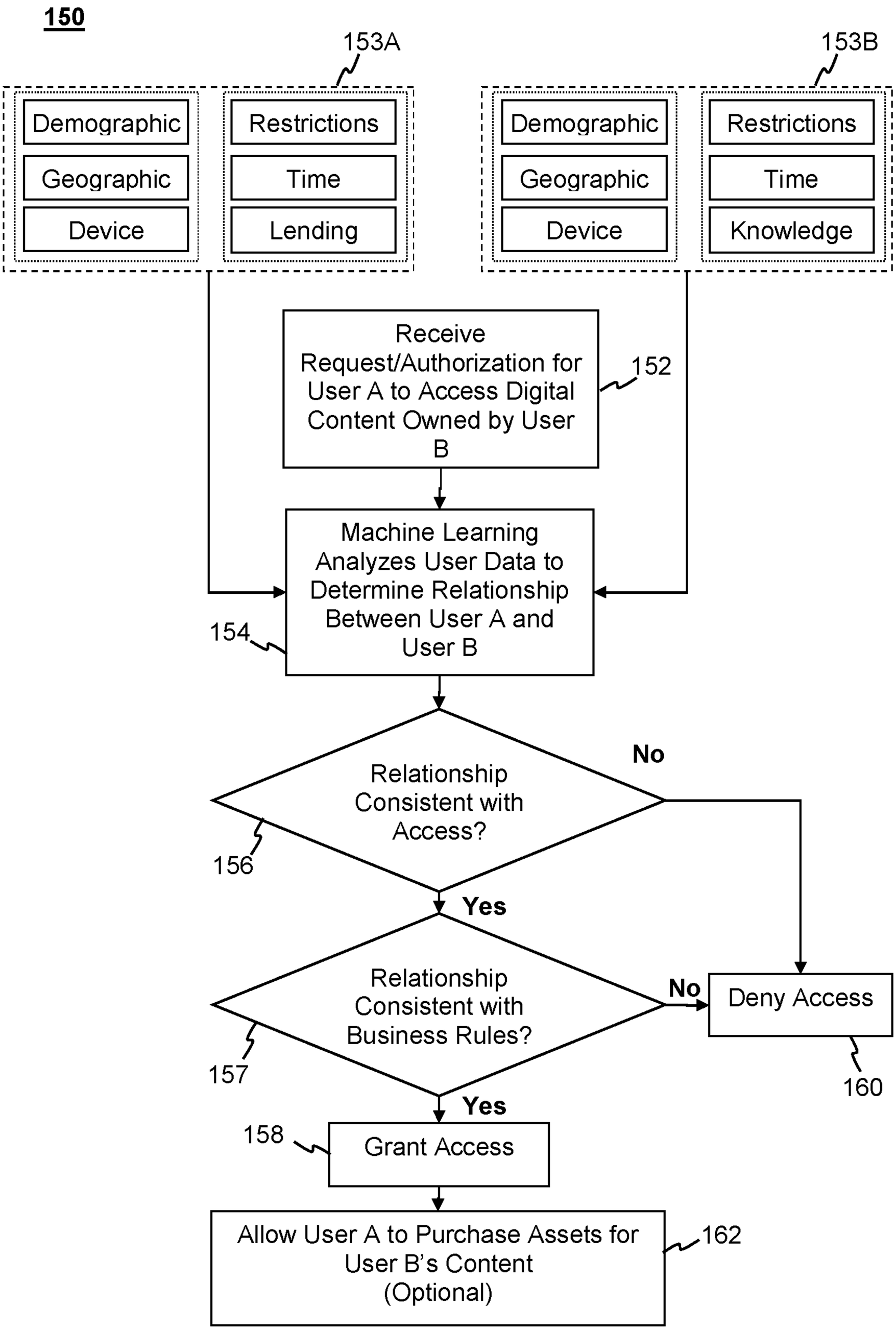

150
153A
Demographic
Geographic
Device
Restrictions
Time
Lending
153B
Demographic
Geographic
Device
Restrictions
Time
Knowledge
Receive Request/Authorization for User A to Access Digital Content Owned by User B
152
Machine Learning Analyzes User Data to Determine Relationship Between User A and User B
154
Relationship Consistent with Access?
156
No
Yes
Relationship Consistent with Business Rules?
157
No
Deny Access
160
Yes
158
Grant Access
Allow User A to Purchase Assets for User B's Content (Optional)
162

FIG. 1B

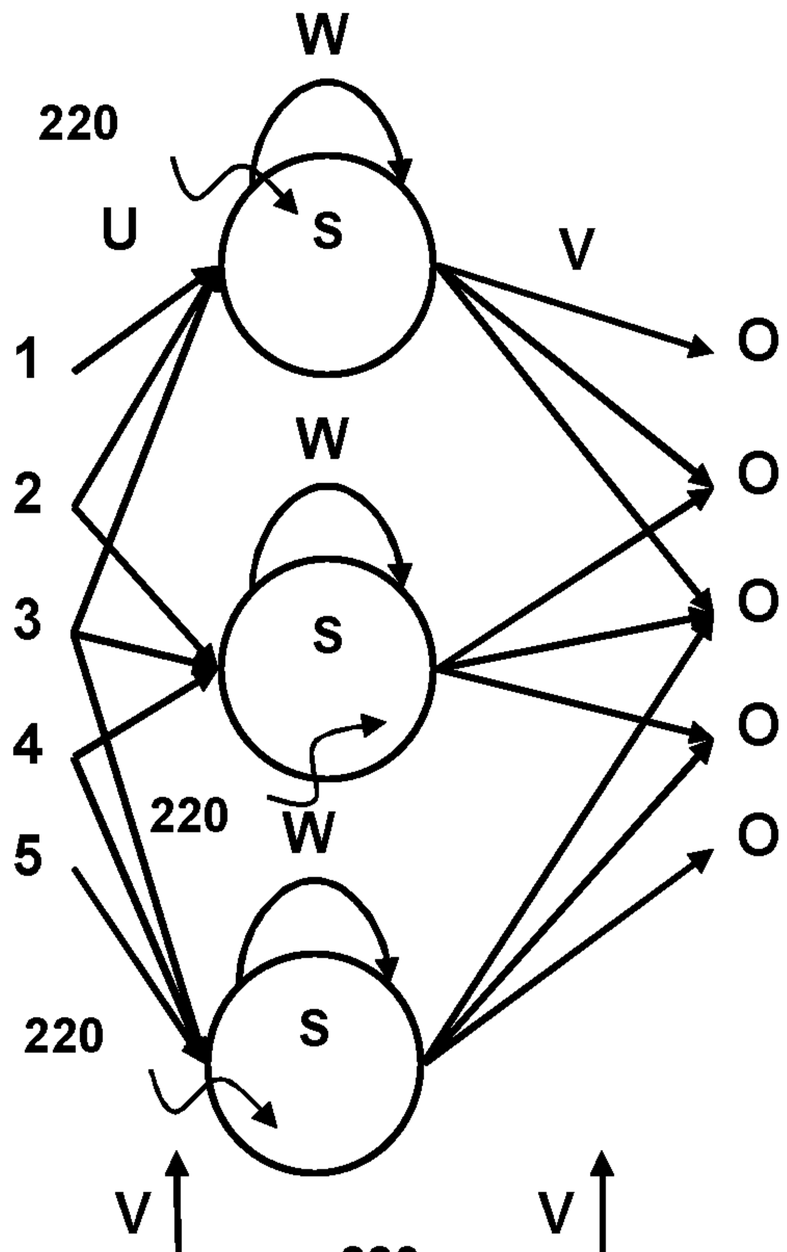


FIG. 2A

FIG. 2B

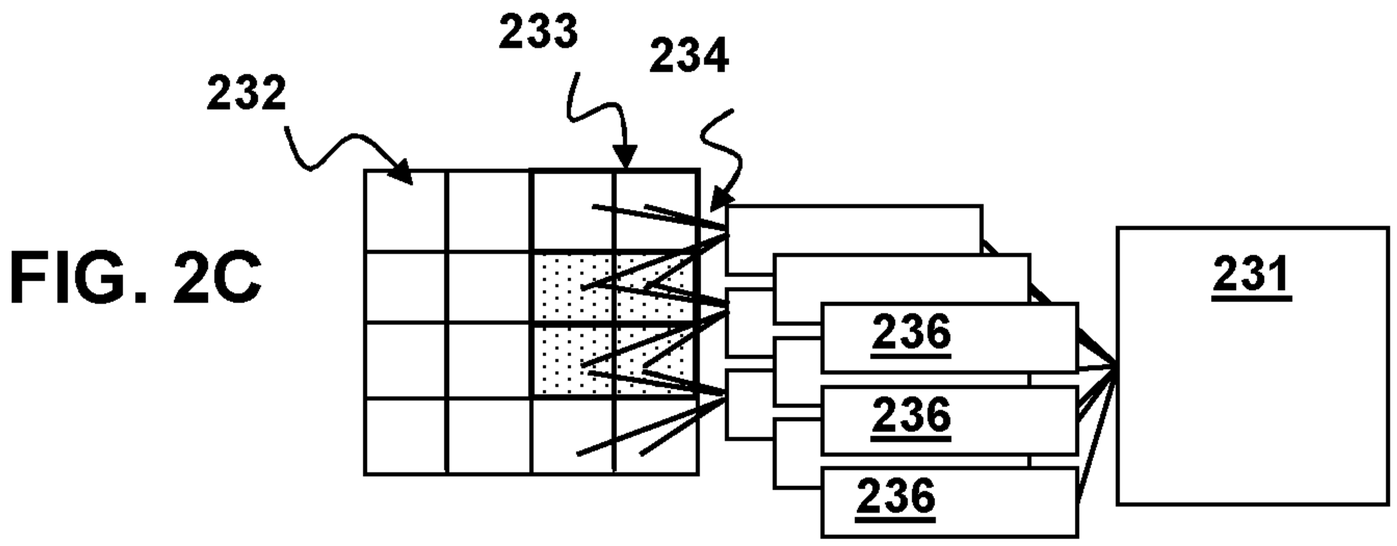


FIG. 2C

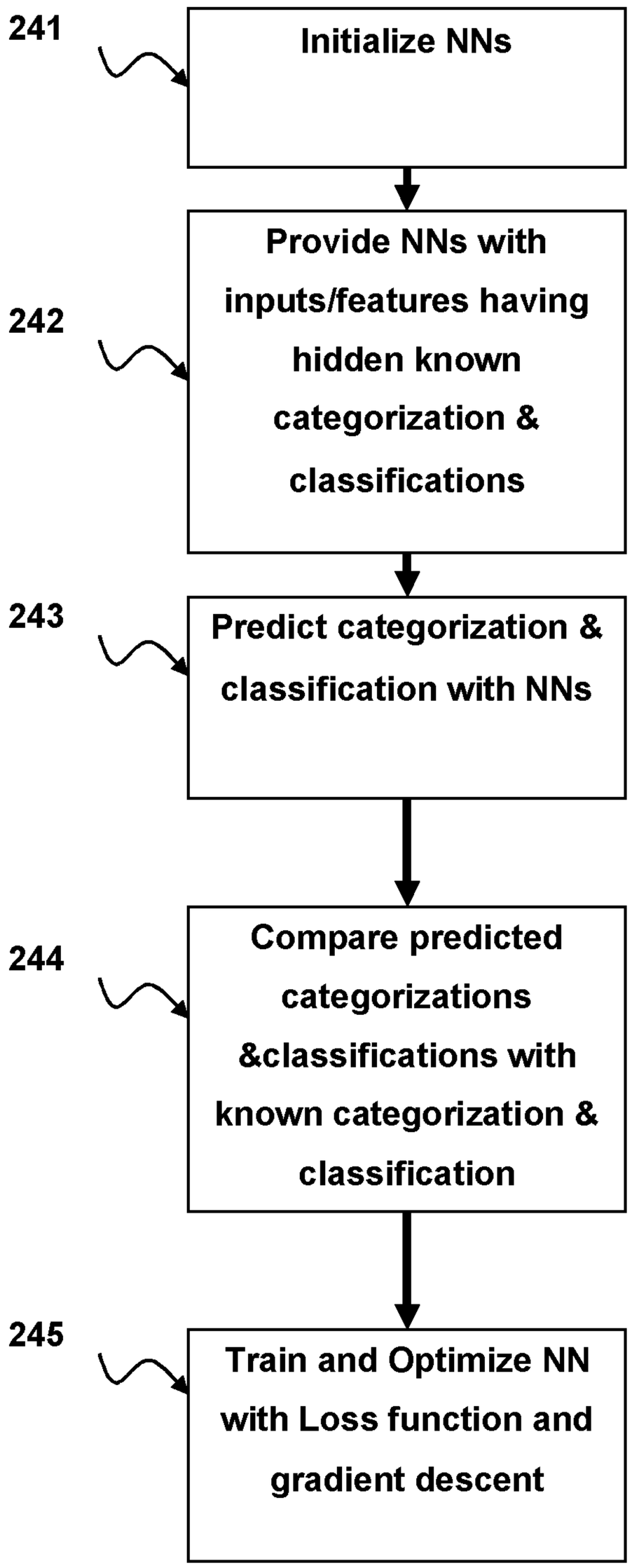

241
Initialize NNs
242
Provide NNs with inputs/features having hidden known categorization & classifications
243
Predict categorization & classification with NNs
244
Compare predicted categorizations &classifications with known categorization & classification
245
Train and Optimize NN with Loss function and gradient descent

FIG. 2D

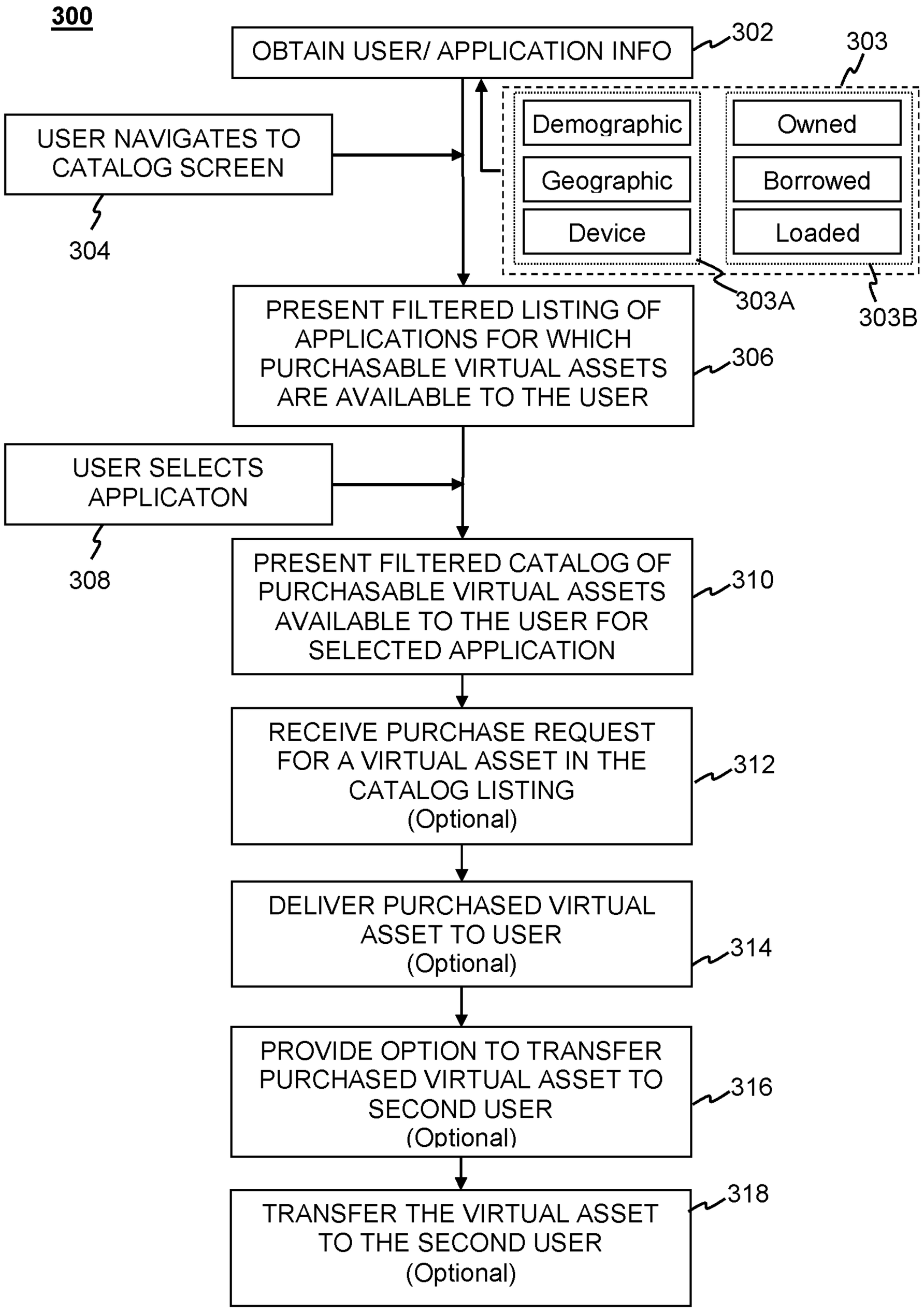

300
OBTAIN USER/ APPLICATION INFO
302
303
Demographic
Geographic
Device
Owned
Borrowed
Loaded
303A
303B
USER NAVIGATES TO CATALOG SCREEN
304
PRESENT FILTERED LISTING OF APPLICATIONS FOR WHICH PURCHASABLE VIRTUAL ASSETS ARE AVAILABLE TO THE USER
306
USER SELECTS APPLICATON
308
PRESENT FILTERED CATALOG OF PURCHASABLE VIRTUAL ASSETS AVAILABLE TO THE USER FOR SELECTED APPLICATION
310
RECEIVE PURCHASE REQUEST FOR A VIRTUAL ASSET IN THE CATALOG LISTING (Optional)
312
DELIVER PURCHASED VIRTUAL ASSET TO USER (Optional)
314
PROVIDE OPTION TO TRANSFER PURCHASED VIRTUAL ASSET TO SECOND USER (Optional)
316
TRANSFER THE VIRTUAL ASSET TO THE SECOND USER (Optional)
318

FIG. 3

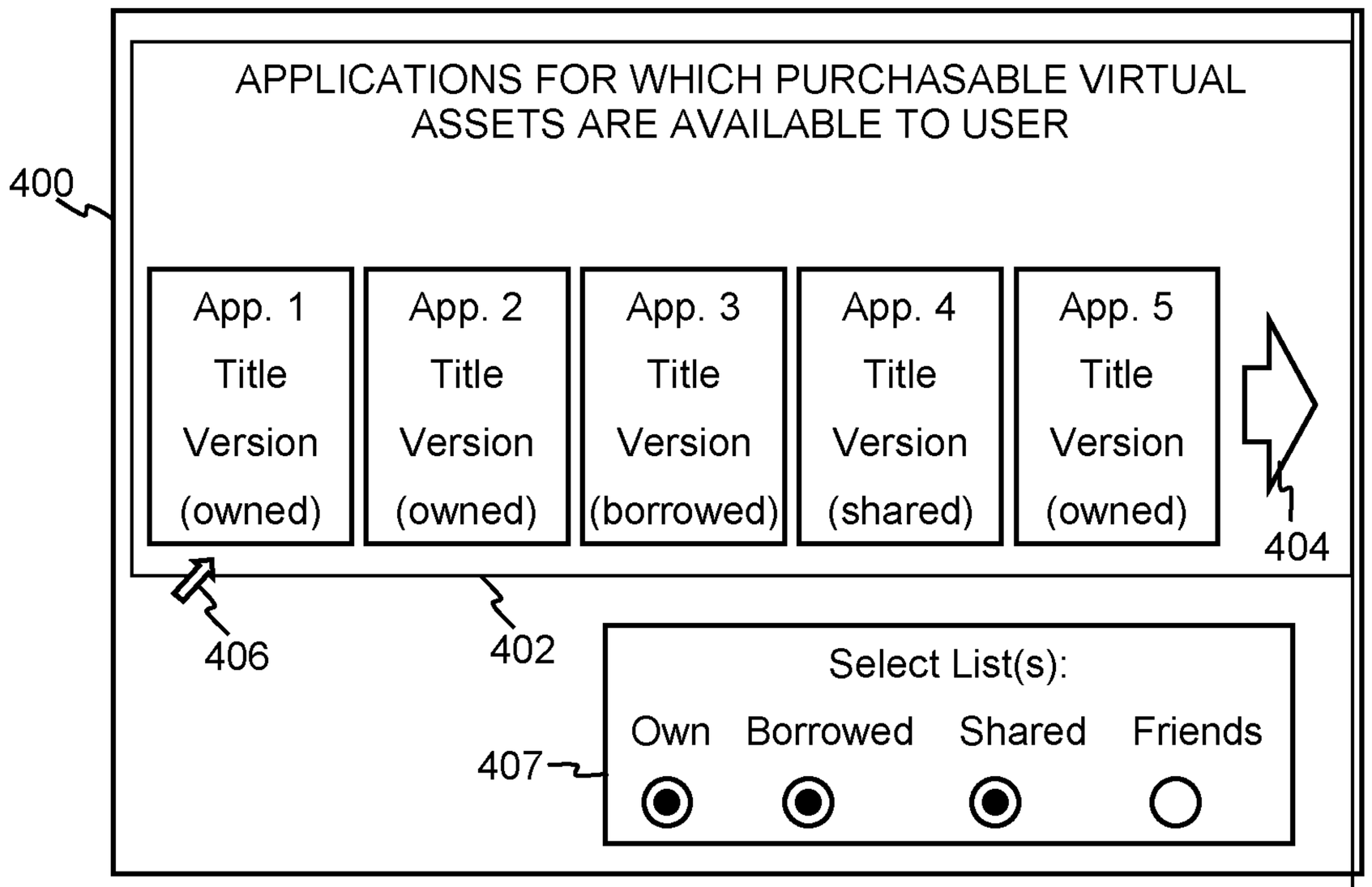

400
APPLICATIONS FOR WHICH PURCHASABLE VIRTUAL ASSETS ARE AVAILABLE TO USER
App. 1 Title Version (owned)
App. 2 Title Version (owned)
App. 3 Title Version (borrowed)
App. 4 Title Version (shared)
App. 5 Title Version (owned)
404
406
402
Select List(s):
Own
Borrowed
Shared
Friends
407

FIG. 4A

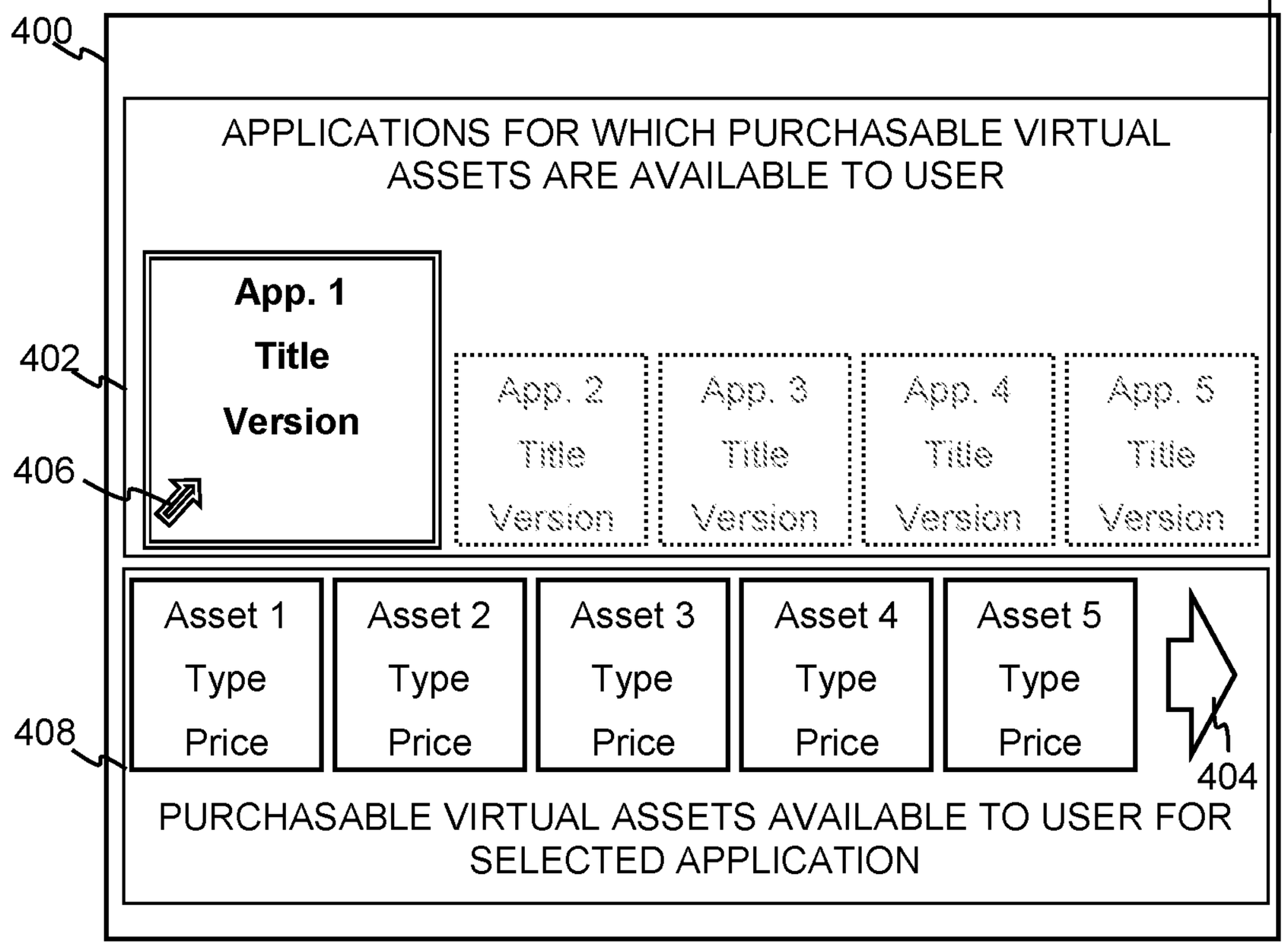

400
APPLICATIONS FOR WHICH PURCHASABLE VIRTUAL ASSETS ARE AVAILABLE TO USER
App. 1 Title Version
402
406
App. 2 Title Version
App. 3 Title Version
App. 4 Title Version
App. 5 Title Version
Asset 1 Type Price
Asset 2 Type Price
Asset 3 Type Price
Asset 4 Type Price
Asset 5 Type Price
408
404
PURCHASABLE VIRTUAL ASSETS AVAILABLE TO USER FOR SELECTED APPLICATION

FIG. 4B

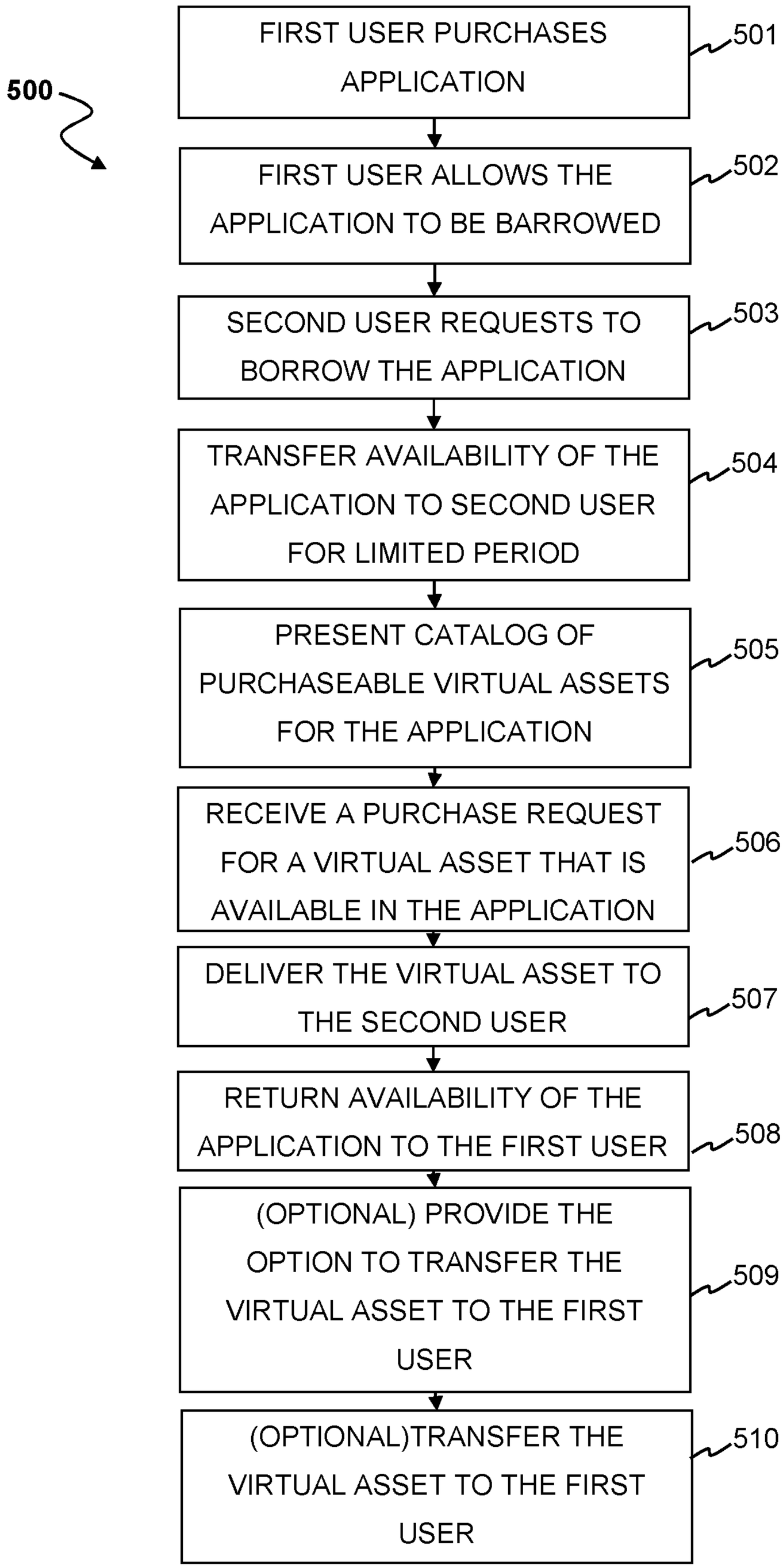

500
FIRST USER PURCHASES APPLICATION
501
FIRST USER ALLOWS THE APPLICATION TO BE BARROWED
502
SECOND USER REQUESTS TO BORROW THE APPLICATION
503
TRANSFER AVAILABILITY OF THE APPLICATION TO SECOND USER FOR LIMITED PERIOD
504
PRESENT CATALOG OF PURCHASEABLE VIRTUAL ASSETS FOR THE APPLICATION
505
RECEIVE A PURCHASE REQUEST FOR A VIRTUAL ASSET THAT IS AVAILABLE IN THE APPLICATION
506
DELIVER THE VIRTUAL ASSET TO THE SECOND USER
507
RETURN AVAILABILITY OF THE APPLICATION TO THE FIRST USER
508
(OPTIONAL) PROVIDE THE OPTION TO TRANSFER THE VIRTUAL ASSET TO THE FIRST USER
509
(OPTIONAL)TRANSFER THE VIRTUAL ASSET TO THE FIRST USER
510

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2020/057526

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - G06F 21/10; G06F 21/62; G06N 20/00; G06N 99/00; H04L 29/06 (2020.01)
CPC - G06F 21/6209; G06F 21/10; G06F 21/12; H04L 2463/101; H04N 21/2541; H04N 21/4781; H04N 21/8173 (2020.08)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
see Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
see Search History document

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
see Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2019/0207946 A1 (GOOGLE INC.) 04 July 2019 (04.07.2019) entire document	1-9, 11, 12, 23, 24 --- 10, 13-20, 22
Y	US 2015/0020151 A1 (CONTENTRAVEN, LLC) 15 January 2015 (15.01.2015) entire document	10, 14-19
Y	US 2011/0113098 A1 (WALSH et al) 12 May 2011 (12.05.2011) entire document	13, 20
Y	US 2009/0216859 A1 (DOLLING) 27 August 2009 (27.08.2009) entire document	22
A	US 10,089,611 B1 (AMAZON TECHNOLOGIES INC) 02 October 2018 (02.10.2018) entire document	1-24
A	US 2015/0101069 A1 (THE PLATFORM FOR MEDIA, INC.) 09 April 2015 (09.04.2015) entire document	1-24

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"D" document cited by the applicant in the international application
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 December 2020	22 JAN 2021
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450 Facsimile No. 571-273-8300	Authorized officer Blaine R. Copenheaver Telephone No. PCT Helpdesk: 571-272-4300