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(54) **SYSTEMS AND METHODS FOR TOKENIZING FINANCIAL INFORMATION**

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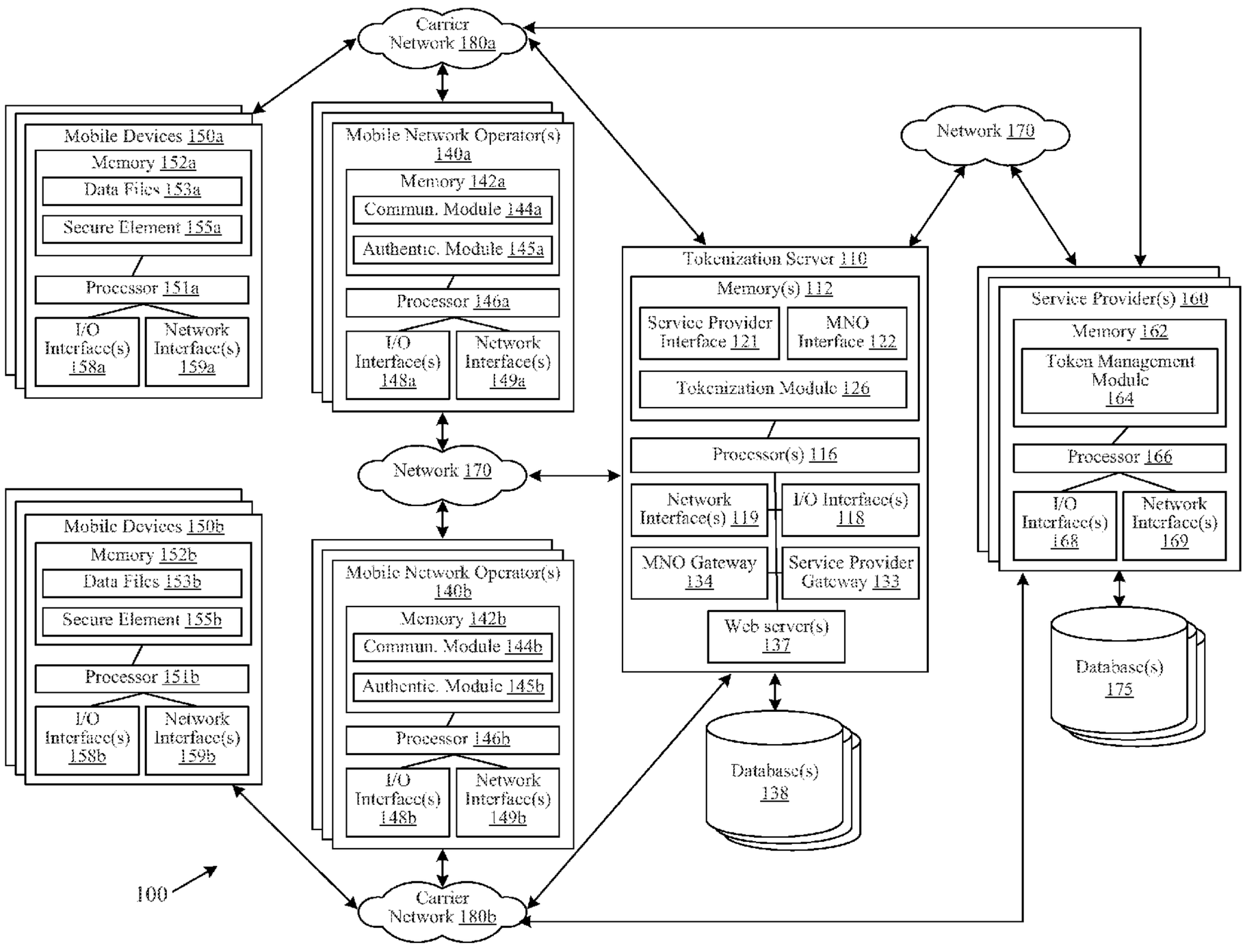
(57) **ABSTRACT**

Embodiments of the invention can provide systems and methods for tokenizing financial information associated with mobile device transactions. According to one example embodiment of the invention, a method for providing tokens to devices can be provided. The method can include receiving, from a device, a request for a token to represent financial information; identifying, in response to the request, token information associated with the token; providing at least a portion of the token information to the device; and providing the token to a third party entity, wherein the third party entity utilizes the received token to evaluate a second token subsequently received from one of the device or a user of the device.



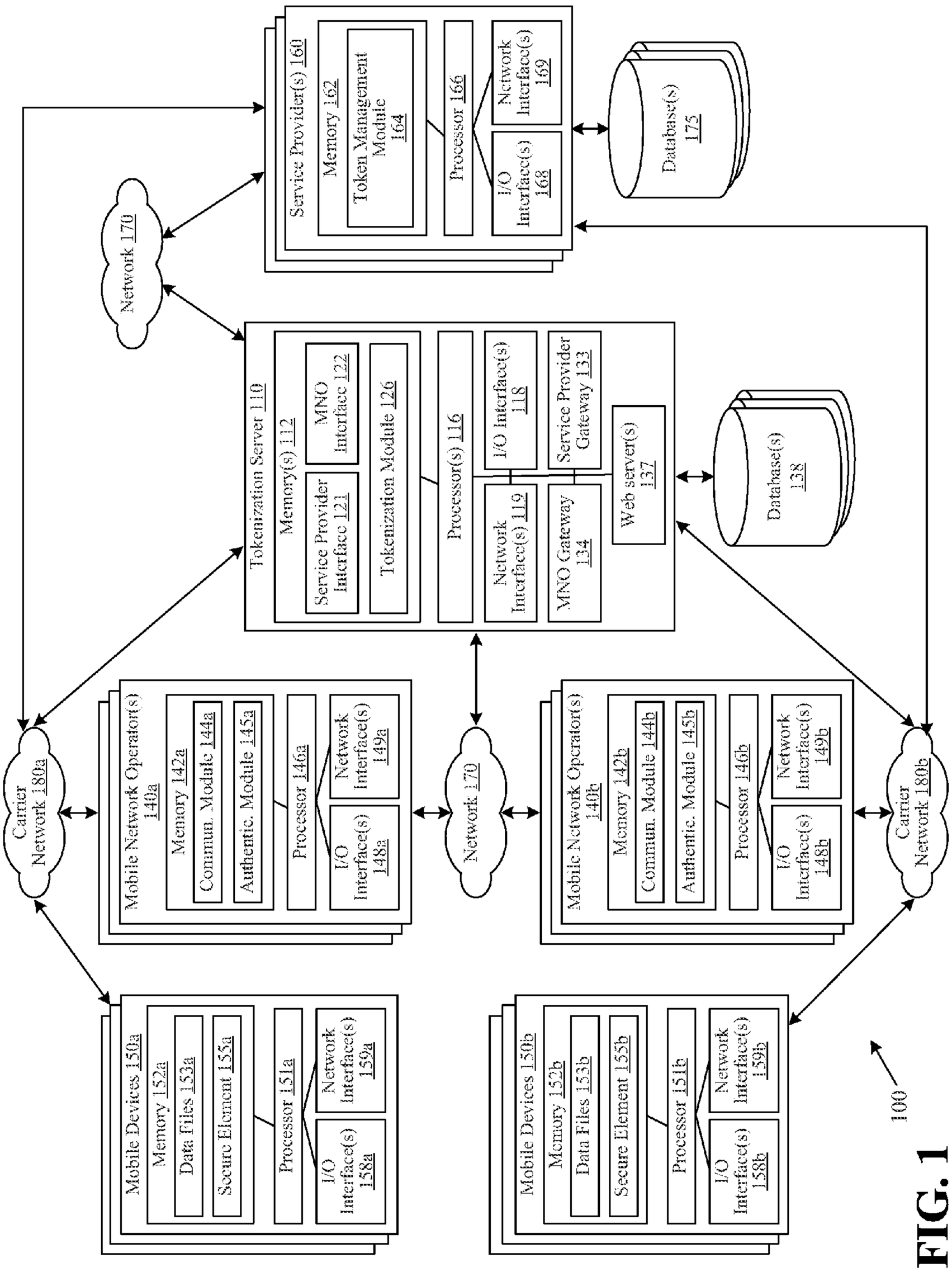

Service Provider(s) 160
Memory 162
Token Management Module 164
Processor 166
Network Interface(s) 169
I/O Interface(s) 168
Database(s) 175
Network 170
Tokenization Server 110
Memory(s) 112
Service Provider Interface 121
Tokenization Module 126
MNO Interface 122
Processor(s) 116
I/O Interface(s) 118
Network Interface(s) 119
MNO Gateway 134
Service Provider Gateway 133
Web server(s) 137
Database(s) 138
Carrier Network 180a
Mobile Network Operator(s) 140a
Memory 142a
Commun. Module 144a
Authentic. Module 145a
Processor 146a
I/O Interface(s) 148a
Network Interface(s) 149a
Network 170
Mobile Network Operator(s) 140b
Memory 142b
Commun. Module 144b
Authentic. Module 145b
Processor 146b
I/O Interface(s) 148b
Network Interface(s) 149b
Carrier Network 180b
Mobile Devices 150a
Memory 152a
Data Files 153a
Secure Element 155a
Processor 151a
I/O Interface(s) 158a
Network Interface(s) 159a
Mobile Devices 150b
Memory 152b
Data Files 153b
Secure Element 155b
Processor 151b
I/O Interface(s) 158b
Network Interface(s) 159b
100

FIG. 1

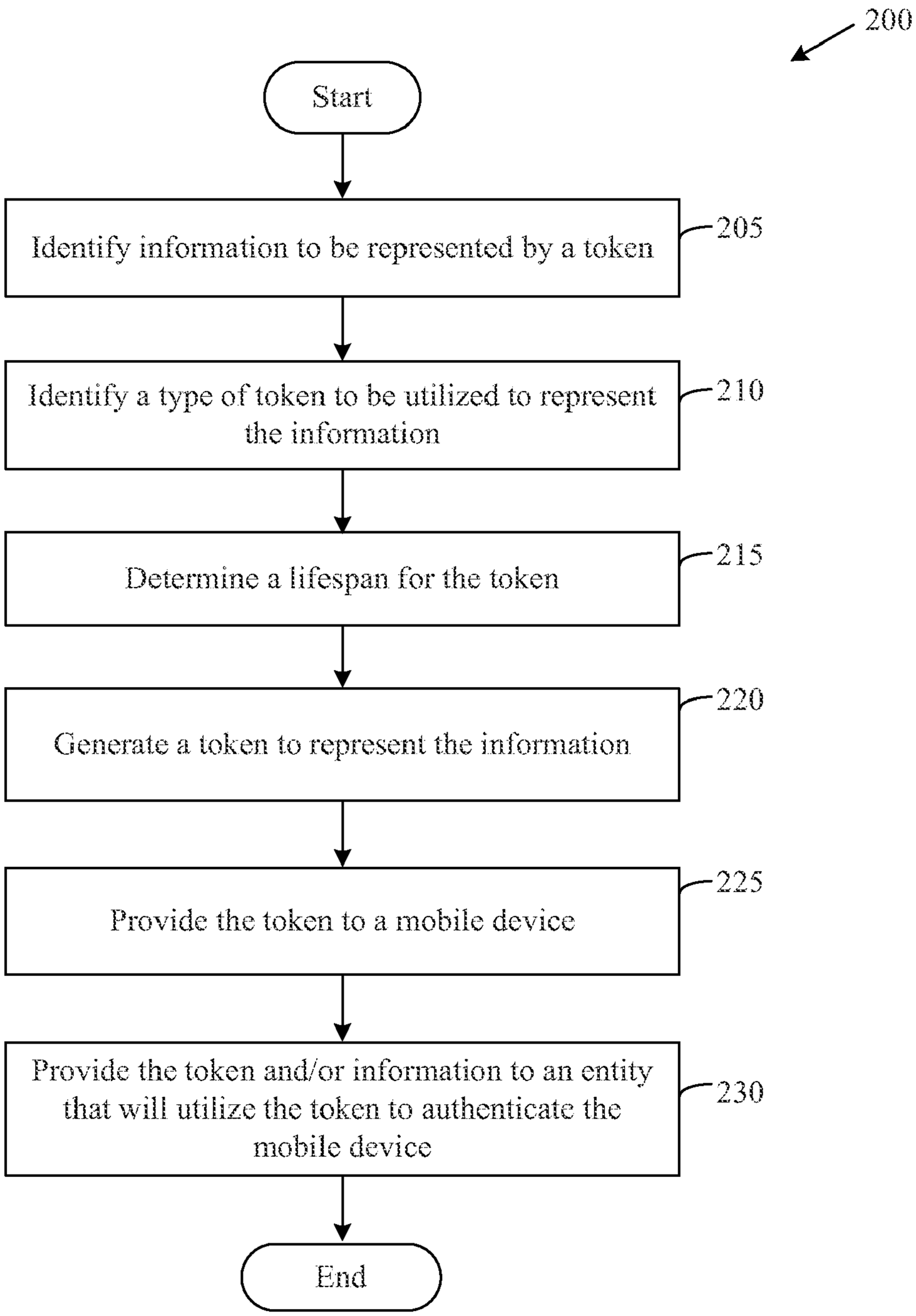

200
Start
Identify information to be represented by a token
205
Identify a type of token to be utilized to represent the information
210
Determine a lifespan for the token
215
Generate a token to represent the information
220
Provide the token to a mobile device
225
Provide the token and/or information to an entity that will utilize the token to authenticate the mobile device
230
End

FIG. 2

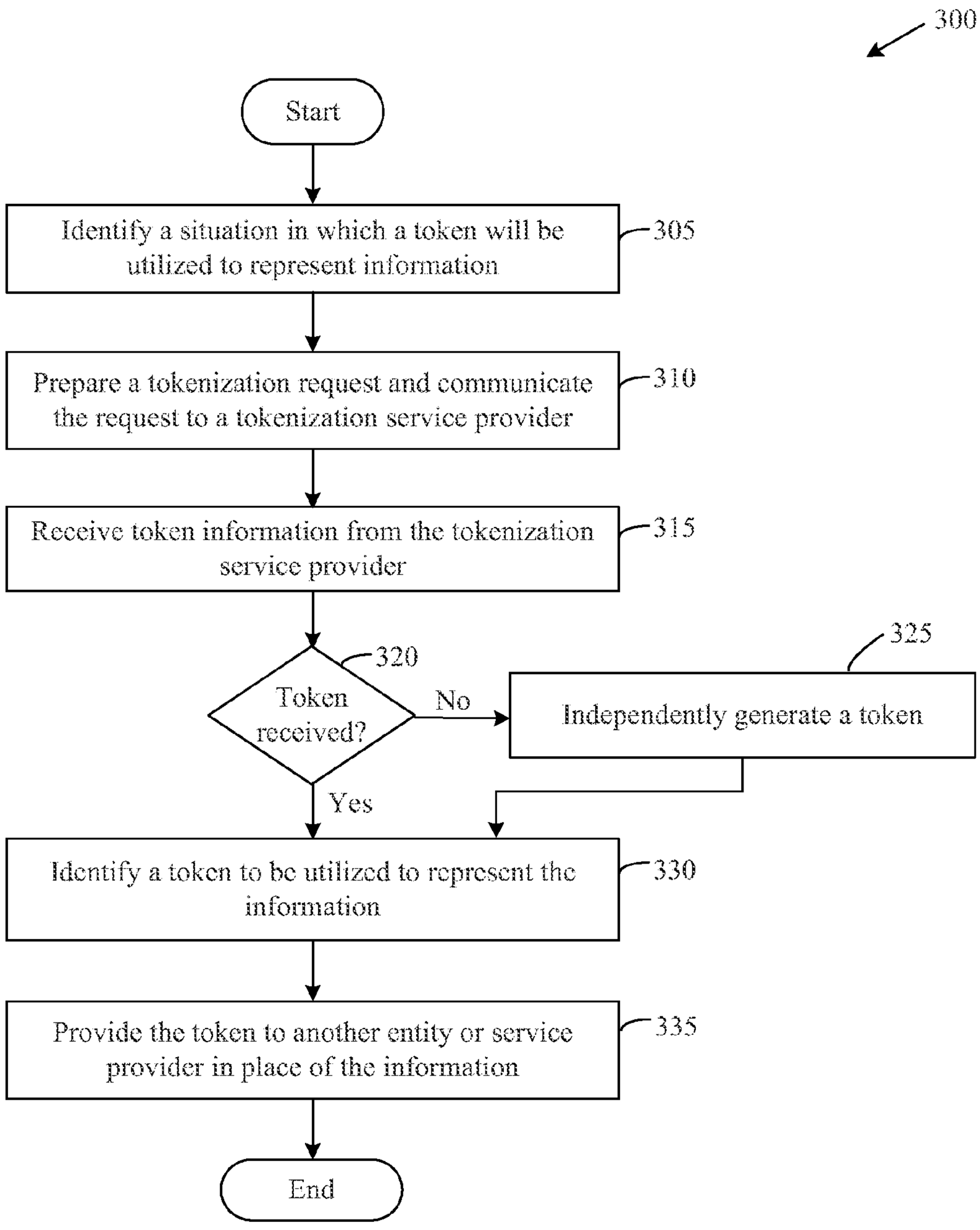

300
Start
Identify a situation in which a token will be utilized to represent information
305
Prepare a tokenization request and communicate the request to a tokenization service provider
310
Receive token information from the tokenization service provider
315
320
Token received?
No
325
Independently generate a token
Yes
Identify a token to be utilized to represent the information
330
Provide the token to another entity or service provider in place of the information
335
End

FIG. 3

SYSTEMS AND METHODS FOR TOKENIZING FINANCIAL INFORMATION

RELATED APPLICATION

[0001] This application claims priority to U.S. Ser. No. 61/490,501, titled "Trusted Service Manager," filed on May 26, 2011, the contents of which are incorporated herein by reference.

FIELD OF THE INVENTION

[0002] Embodiments of the invention relate generally to mobile device transactions, and more specifically to systems and methods for tokenizing financial information associated with mobile device transactions.

BACKGROUND OF THE INVENTION

[0003] Mobile devices, such as cell phones, personal digital assistants ("PDAs"), smart phones, and other similar devices, have increasingly been utilized to provide additional functionality beyond traditional voice communications. One component of enabling the mobile devices to support these additional functionalities includes installing software applications on the mobile devices. Mobile device applications can facilitate a variety of services performed by or with the mobile devices, including payment applications (e.g., prepaid, credit, debit, etc.), loyalty or incentive applications, transportation payment applications, access control applications, entertainment applications, and the like. Given the sensitive nature of data that may be utilized in association with these additional applications, mobile devices may make use of secure memory elements configured to store sensitive data, such as account information.

[0004] In many situations, a user of a mobile device may wish to provide sensitive data to a service provider for authentication purposes or other transaction purposes. For example, a user may wish to provide a credit card account number to a service provider during a service call. However, because the shared memory of the mobile device is inherently insecure, the sensitive data can be exposed to security attacks, such as side channel attacks, Trojan application, and/or input sniffers, if the sensitive data is moved to a shared memory of the mobile device or communicated to a service provider by the mobile device. Accordingly, there is an opportunity for improving the security of financial information and/or other sensitive data by tokenizing the data.

BRIEF DESCRIPTION OF THE INVENTION

[0005] Embodiments of the invention may provide systems and methods for tokenizing financial information associated with mobile device transactions. According to one example embodiment of the invention, a method for providing tokens to devices can be provided. The method can include receiving, from a device, a request for a token to represent financial information; identifying, in response to the request, token information associated with the token; providing at least a portion of the token information to the device; and providing the token to a third party entity, wherein the third party entity utilizes the received token to evaluate a second token subsequently received from one of the device or a user of the device. In certain embodiments, one or more operations can be performed by one or more computers associated with a service provider.

[0006] According to another embodiment, a system for providing tokens to devices can be provided. The system may include at least one memory and at least one processor. The at least one memory may be configured to store computer-executable instructions. The at least one processor may be configured to receive, from a device, a request for a token to represent financial information; identify, in response to the request, token information associated with the token; provide at least a portion of the token information to the device; and provide the token to a third party entity, wherein the third party entity utilizes the received token to evaluate a second token subsequently received from one of the device or a user of the device. In certain embodiments, one or more operations can be performed by one or more computers associated with a service provider.

[0007] According to yet another embodiment, a method can be provided. The method can include receiving, from a mobile device, a request for a token to represent financial information; identifying, in response to the request, token information associated with the token; providing at least a portion of the token information to the mobile device; and providing the token to a third party entity, wherein the third party entity utilizes the received token to evaluate a second token received from one of the mobile device or a user of the mobile device. In certain embodiments, one or more operations can be performed by one or more computers associated with a service provider.

[0008] According to another embodiment, a system for providing tokens to devices can be provided. The system may include at least one memory and at least one processor. The at least one memory may be configured to store computer-executable instructions. The at least one processor may be configured to receive, from a mobile device, a request for a token to represent financial information; identify, in response to the request, token information associated with the token; provide at least a portion of the token information to the mobile device; and provide the token to a third party entity, wherein the third party entity utilizes the received token to evaluate a second token received from one of the mobile device or a user of the mobile device. In certain embodiments, one or more operations can be performed by one or more computers associated with a service provider.

[0009] Additional systems, methods, apparatus, features, and aspects are realized through the techniques of various embodiments of the invention. Other embodiments and aspects of the invention are described in detail herein and are considered a part of the claimed invention. Other advantages and features can be understood with reference to the description and to the drawings.

BRIEF DESCRIPTION OF THE FIGURES

[0010] FIG. **1** illustrates a block diagram of an example tokenization system that may be utilized in accordance with various embodiments of the invention.

[0011] FIG. **2** illustrates a flow diagram of an example process for communicating a token to a mobile device, according to an example embodiment of the invention.

[0012] FIG. **3** illustrates a flow diagram of an example process for utilizing a token in conjunction with a mobile device, according to an example embodiment of the invention.

DETAILED DESCRIPTION

[0013] Various embodiments of the invention are directed to the tokenization of information in association with device

transactions. In other words, various embodiments of the invention are directed to the generation of tokens to represent sensitive data, such as financial account data and/or transaction data. Generated tokens may then be utilized by a device, such as a mobile device, in order to reference a transaction and/or authenticate the user. In one example embodiment of the invention, a device may identify a situation in which a token will be utilized to represent sensitive data. For example, a service call situation in which an account number is desired by a technician may be identified as a situation in which a token will be utilized to represent the account number. As other examples, a balance reporting situation or a transaction situation may be identified as situations in which tokens will be utilized. In certain embodiments, a situation may be identified by the device based upon the receipt of user input. For example, a user may request a service call. In other embodiments, a situation may be identified by the device based upon the processing of data, such as transaction data. For example, the device may identify a transaction error and automatically trigger a service call situation.

[0014] Once a desired tokenization situation has been identified, a tokenization request may be prepared or generated by the device, and the tokenization request may be communicated to a tokenization service provider. A wide variety of information may be included in the request, including but not limited to, a type associated with the desired situation (e.g., a service call, a balance reporting situation, a transaction, etc.), an identifier of information to be tokenized, and/or an identifier of a service provider or other party to which a token will be communicated. The tokenization service provider may process the request in order to generate token information, and the generated token information may be provided to the device. In certain embodiments, the tokenization service provider may generate a token that is returned to the requesting device. In other embodiments, the tokenization service provider may generate a token and determine information that may be utilized by the device to independent identify or generate a token. For example, the tokenization service provider may identify an algorithm that may be utilized by the device to generate a token utilizing a wide variety of information provided by the service provider and/or device information (e.g., an identifier of a mobile device secure element, card production life cycle information, etc.). As another example, the tokenization service provider may determine a token number or other identifier and provide the identifier to a device to facilitate a device selection of a token generated by the device (e.g., a first token, a fourth token, etc.). Indeed, a wide variety of token information may be prepared by the tokenization service provider and communicated to the requesting device in order to facilitate the identification of a token by the device.

[0015] In addition to returning token information to the requesting device, the tokenization service provider may additionally provide token information (e.g., a token, etc.) to another service provider or entity. For example, the tokenization service provider may provide token information to a service provider that handles technical service calls or to a transaction service provider. The recipient service provider may utilize the received token information in order to authenticate the device and/or to verify the identity of a mobile device user. For example, the recipient service provider may independently receive tokens from both the tokenization service provider and the device (or a user of the device), and the recipient service provider may compare the tokens in order to verify the identity of the device or device user. Additionally, in certain embodiments, the tokenization service provider may also communicate the sensitive data (e.g., financial account number, etc.) that is represented by the token to the recipient service provider. As desired, secure communications networks and/or other communications means may be utilized to communicate information to the recipient service provider. Once the two tokens have been matched by the recipient service provider, the received sensitive data may be utilized by the recipient service provider. As a result of the use of tokens, the storage of sensitive data on a shared or general memory of the device may be reduced and/or avoided. In this regard, security risks associated with the data may be reduced.

[0016] Various embodiments of the invention utilize trusted service management functionality, which may be implemented by the tokenization service provider, to facilitate integration between multiple service providers and multiple mobile devices operating on any number of carrier networks, each operated by a different mobile network operator ("MNO"). In certain embodiments, a tokenization service provider may be a third party entity strategically positioned to provide tokenization services.

[0017] Embodiments of the invention now will be described more fully hereinafter with reference to the accompanying drawings, in which embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout.

[0018] FIG. **1** represents a block diagram of an example system **100** for providing tokenization services, according to one embodiment of the invention. As shown in FIG. **1**, a tokenization service provider ("TSP") computer **110**; multiple mobile network operator ("MNO") computers **140***a*, **140***b*; multiple mobile devices **150***a*, **150***b*; and multiple service provider computers **160** may be in communication via any number of networks **170** and/or multiple carrier networks **180***a*, **180***b*, each of the carrier networks **180***a*, **180***b* being associated with a respective MNO computer **140***a*, **140***b*. Each of these components will now be discussed in further detail.

[0019] First, the TSP computer **110** may include any number of processor-driven devices, including but not limited to, a server computer, a mainframe computer, one or more networked computers, a desktop computer, a personal computer, a laptop computer, a mobile computer, or any other processor-based device. In addition to having one or more processors **116**, the TSP computer **110** may further include one or more memory devices **112**, input/output ("I/O") interface(s) **118**, and network interface(s) **119**. The memory **112** may be any computer-readable medium, coupled to the processor(s) **116**, such as RAM, ROM, and/or a removable storage device for storing data files and a database management system ("DBMS") to facilitate management of data files and other data stored in the memory **112** and/or stored in one or more separate databases **138**. The memory **112** may also store various program modules, such as an operating system ("OS"), a service provider interface **121**, a mobile network operator interface **122**, and a tokenization module **126**. The OS may be, but is not limited to, Microsoft Windows®, Apple

OSX™, Unix, a mainframe computer operating system (e.g., IBM z/OS, MVS, OS/390, etc.), or a specially designed operating system. Each of the interfaces and modules **121**, **122**, **126** may comprise computer-executable program instructions or software, including a dedicated program, for receiving, storing, extracting, managing, processing, and analyzing communications associated with tokenization via any number of suitable networks, such as networks **170** and/or carrier networks **180***a*, **180***b*.

[0020] The tokenization module **126** may include any number of suitable software modules and/or applications that facilitate the provisioning and processing of tokenization requests. In one example operation, a tokenization request may be received from a mobile device **150***a*, **150***b* via a suitable interface or gateway, and the tokenization request may be provided to the tokenization module **126**. The tokenization module **126** may process the received request in order to identify, determine, and/or generate token information (e.g., a token, a token life cycle, etc.), and the tokenization module **126** may direct the communication of at least a portion of the token information to the mobile device **150***a*, **150***b*. Additionally, the tokenization module **126** may direct provision of token information and, as desired, data represented by the token information to a service provider **160** via one or more suitable interfaces and/or gateways. In this regard, a wide variety of data (e.g., financial account data, other sensitive data, etc.) may be represented by tokens, and the tokens may be utilized by the mobile devices **150***a*, **150***b* and the service providers **160** to identify and/or access the data.

[0021] One example of the operations that may be performed by the tokenization module **126** is described in greater detail below with reference to FIG. **2**.

[0022] An MNO gateway **134** and associated MNO interface **122** are operable for providing a common point of integration between the tokenization server computer **110** and the multiple MNO computers **140**. According to one embodiment, the MNO interface **122** is configured to communicate with each MNO according to the same common MNO message standard, as described further herein. Moreover, according to various embodiments, the MNO gateway **134** and associated MNO interface **122** are further operable to permit the tokenization server computer **110** to communicate with mobile devices **150** via a respective carrier network operated by each MNO. In a similar manner, a service provider gateway **133** and associated service provider interface **121** are operable for providing a common point of integration between the tokenization server computer **110** and the multiple service provider computers **160**.

[0023] Still referring to the TSP computer **110**, the I/O interface(s) **118** may facilitate communication between the processor **116** and various I/O devices, such as a keyboard, mouse, printer, microphone, speaker, monitor, bar code reader/scanner, RFID reader, contactless reader, or Hardware Security Modules ("HSMs") which facilitate secure key management (e.g., test key management for a variety of testing environments, etc.) and the like. The network interface(s) **119** may take any of a number of forms, such as, but not limited to, a network interface card, a modem, a wireless network card, a cellular network card, or any other means operable for facilitating communications with one or more carrier networks **180***a*, **180***b* and/or other networks **170**. Indeed, the TSP computer **110** can communicate directly with mobile devices **150***a*, **150***b* via the carrier networks **180***a*, **180***b*, respectively, via network interface(s) **119** and/or via one or more of suitable Web servers **137** or the mobile network operator gateway **134**. It will be appreciated that the TSP computer **110** may be implemented on a particular machine, which may include a computer that is designed, customized, configured, or programmed to perform at least one or more functions of the interfaces and modules, according to an example embodiment of the invention.

[0024] Second, the MNO computers **140***a*, **140***b* may include any number of processor-driven devices, including but not limited to, a server computer, a mainframe computer, one or more networked computers, a desktop computer, a personal computer, a laptop computer, a mobile computer, or any other processor-based device. In addition to having one or more processors **146***a*, **146***b*, each of the MNO computers **140***a*, **140***b* may further include one or more memory devices **142***a*, **142***b*, input/output ("I/O") interface(s) **148***a*, **148***b*, and network interface(s) **149***a*, **149***b*. The memory **142***a*, **142***b* may be any computer-readable medium, coupled to the processor(s) **146**, such as RAM, ROM, and/or a removable storage device for storing data files and a DBMS to facilitate management of data files and other data stored in the memory **142***a*, **142***b* and/or stored in one or more separate databases. The memory **142***a*, **142***b* may also store various program modules, such as an operating system ("OS"), a communications module **144***a*, **144***b*, and an authentication module **145***a*, **145***b*. The OS may be, but is not limited to, Microsoft Windows®, Apple OSX™, Unix, a mainframe computer operating system (e.g., IBM z/OS, MVS, OS/390, etc.), or a specially designed operating system. The communications module **144***a*, **144***b* may comprise computer-executable program instructions or software, including a dedicated program, for facilitating communications with multiple mobile devices **150***a*, **150***b* operating on the respective carrier networks **180***a*, **180***b*, and for facilitating mobile device application provisioning and management via a common MNO messaging standard as implemented by the TSP computer **110**. The authentication module **145***a*, **145***b* may comprise computer-executable program instructions or software, including a dedicated program, for facilitating the authentication of mobile devices **150***a*, **150***b* and/or the establishment of secure communications channels with mobile devices **150***a*, **150***b*. A wide variety of authentication procedures may be utilized as desired by an authentication module **145***a*, **145***b*.

[0025] Still referring to each MNO computer **140***a*, **140***b*, the I/O interface(s) **148***a*, **148***b* may facilitate communication between the processors **146***a*, **146***b* and various I/O devices, such as a keyboard, mouse, printer, microphone, speaker, monitor, bar code reader/scanner, RFID reader, and the like. The network interface(s) **149***a*, **149***b* may take any of a number of forms, such as, but not limited to, a network interface card, a modem, a wireless network card, a cellular network card, or any other means operable for facilitating communications with one or more carrier networks **180***a*, **180***b* and/or other network **170**. It will be appreciated that the MNO computers **140***a*, **140***b* may be implemented on a particular machine, which may include a computer that is designed, customized, configured, or programmed to perform at least one or more functions of the communications module **144***a*, **144***b*, according to an example embodiment of the invention.

[0026] Third, the mobile devices **150***a*, **150***b* may be any mobile processor-driven device, such as a mobile phone, radio, pager, laptop computer, handheld computer, PDA, and the like, or any other processor-based mobile device for facilitating communications over one or more carrier networks

180*a*, **180***b*. For example, each mobile device **150***a*, **150***b* may be registered with a specific MNO computer **140***a*, **140***b* for communicating via the respective carrier network **180***a*, **180***b*. In addition to having one or more processors **156***a*, **156***b*, each of the mobile devices **150***a*, **150***b* may further include one or more memory devices **152***a*, **152***b*, input/output ("I/O") interface(s) **158***a*, **158***b*, and network interface (s) **159***a*, **159***b*. The memory **152***a*, **152***b* may be any computer-readable medium, coupled to the processor(s) **156**, such as RAM, ROM, and/or a removable storage device for storing data files. The memory **152***a*, **152***b* may include any number of shared or general memories (e.g., memories that may be accessed by a wide variety of applications such as a mobile wallet) and/or any number of secure elements **155***a*, **155***b* configured to maintain mobile device applications and confidential data. In certain embodiments, a secure element **155***a*, **155***b* may be configured to store key information, as well as certain identification information for the mobile device and the secure element **155***a*, **155***b* (e.g., card production life cycle ("CPLC") information, etc.). In certain embodiments, a secure element **155***a*, **155***b* may store an authentication module or program utilized by a mobile device **150***a*, **150***b* to tag an/or encrypt communications output by the mobile device **150***a*, **150***b* and/or to decrypt communications received by the mobile device **150***a*, **150***b*. As desired, the authentication module or an application stored on shared memory may be configured to generate tokenization requests and receive token information as described in greater detail below with reference to FIG. **2**.

[0027] The memory **152***a*, **152***b* may also store any number of data files **153***a*, **153***b* and/or various program modules, such as an operating system ("OS"), end user interface module(s), and a provisioning module. The OS may be any mobile operating system, including proprietary operating systems by a mobile device manufacturer or mobile network operator, or third party software vendor mobile operating system, such as, but not limited to, Microsoft Windows CE®, Microsoft Windows Mobile®, Symbian OS™, Apple iPhone™ OS, RIM BlackBerry® OS, Palm OS® by ACCESS, or Google Android™. The provisioning module may comprise computer-executable program instructions or software, including a dedicated program, for facilitating mobile device application provisioning on general memory and/or on the secure elements **155***a*, **155***b*. According to various embodiments, the secure elements **155***a*, **155***b* may refer to any computer-readable storage in the memory **152** and/or may refer to any securitized medium having memory, such as a Universal Integrated Circuit Card ("UICC"), Subscriber Identity Module ("SIM"), and the like. In one example, the secure elements **155***a*, **155***b* may be operable with a RFID device or other NFC device associated with the mobile devices **150***a*, **150***b*. It is also appreciated that the secure elements **155***a*, **155***b* may be a separate embedded secure element (e.g., smart card chip) or a separate element (e.g., removable memory card, a key fob; connected via Bluetooth, etc.). For example, a secure element chip may be embedded in a mobile device **150***a*, **150***b* separately from a general operation chip utilized by the mobile device **150***a*, **150***b*. In certain embodiments, the secure elements **155***a*, **155***b* may include any suitable hardware and/or software, such as memory, processing components, and communications components. In certain embodiments, the secure elements **155***a*, **155***b* may be configured to communicate with other elements of the mobile devices **150***a*, **150***b*, such as a general or shared memory chip associated with the mobile devices **150***a*, **150***b*. For example, a mobile wallet may be stored in shared memory, and a secure element **155***a*, **155***b* may be accessed to encrypt and/or decrypt transactions generated by and/or received by the mobile wallet.

[0028] In certain embodiments, a mobile device **150***a*, **150***b* may be configured to generate tokenization requests that are provided to the TSP computer **110**. For example, a dedicated tokenization application may be stored on a shared memory and/or the secure element **155***a*, **155***b*. As another example, the authentication application or other provisioned application may also be configured to perform tokenization functions. In operation, a tokenization situation or information to be tokenized may be identified, and a tokenization request may be prepared and communicated to the TSP computer **110**. In response to the tokenization request, token information may be received from the TSP computer **110**, and the token information may be utilized to identify a token to be utilized in place of information represented by the token. The token may then be utilized by the mobile device **150***a*, **150***b* or a user of the mobile device **150***a*, **150***b* to contact a service provider **160** and verify the identity of the device and/or user. In this regard, the security of the information represented by the token may be enhanced.

[0029] One example of the operations that may be performed by a mobile device **150***a*, **150***b* to facilitate tokenization is described in greater detail below with reference to FIG. **3**.

[0030] Still referring to each mobile device **150***a*, **150***b*, the I/O interface(s) **158***a*, **158***b* may facilitate communication between the processors **156***a*, **156***b* and various I/O devices, such as a keypad, touch screen, keyboard, mouse, printer, microphone, speaker, screen display, RFID device, NFC device, and the like. The network interface(s) **159***a*, **159***b* may take any of a number of forms to permit wireless communications according to various communications standards, such as, but not limited to, Code Division Multiple Access ("CDMA"), Global System for Mobile Communication ("GSM"), Universal Wireless Communications ("UWC"), Universal Mobile Telecommunications System ("UMTS"), or General Packet Radio Service ("GPRS") communication standards as may be implemented by one or more carrier networks **180***a*, **180***b*. The network interfaces(s) **159***a*, **159***b* may further permit access to other networks **170**, such as via one or more carrier networks **180***a*, **180***b* providing Internet or other network access, or via Wi-Fi communications onto a Wi-Fi network. It will be appreciated that the mobile devices **150***a*, **150***b* may be implemented on a particular machine, which may include a computer that is designed, customized, configured, or programmed to perform at least one or more functions of the provisioning module **154***a*, **154***b* and other mobile communications, including voice communications, data communications, short message service ("SMS"), wireless application protocol ("WAP"), multimedia message service ("MMS"), Internet communications, other wireless communications, and the like, according to an example embodiment of the invention.

[0031] Although mobile devices **150***a*, **150***b* are illustrated in FIG. **1**, embodiments of the invention may be utilized in conjunction with a wide variety of other devices configured to communicate via the networks **170** and/or carrier networks **180***a*, **180***b*, such as personal computers and/or tablet computers. Indeed, embodiments of the invention are applicable to any operating environment in which sensitive data may be represented by tokens.

[0032] Fourth, the service provider computers **160** may include any number of processor-driven devices, including but not limited to, a server computer, a mainframe computer, one or more networked computers, a desktop computer, a personal computer, a laptop computer, a mobile computer, or any other processor-based device. A service provider computer **160** may be configured to provide a wide variety of services to a mobile device user, such as technical services and/or financial reporting services. In addition to having one or more processors **166**, each of the service provider computers **160** may further include one or more memory devices **162**, input/output ("I/O") interface(s) **168**, and network interface (s) **169**. The memory **162** may be any computer-readable medium, coupled to the processor(s) **166**, such as RAM, ROM, and/or a removable storage device for storing data files and a DBMS to facilitate management of data files and other data stored in the memory **162** and/or stored in one or more separate databases **175** (e.g., a database of received token information, etc.). The memory **162** may also store various program modules, such as an operating system ("OS") and a token management module **164**. The OS may be, but is not limited to, Microsoft Windows®, Apple OSX™, Unix, a mainframe computer operating system (e.g., IBM z/OS, MVS, OS/390, etc.), or a specially designed operating system. The token management module **164** may comprise computer-executable program instructions or software, including a dedicated program, for managing tokens and/or token information received from the TSP computer **110**, managing information represented by tokens, managing associations between tokens and other information, processing tokens received from mobile devices **150***a,* **150***b* in order to access stored information represented by the tokens, and/or verifying identity and/or authenticating the mobile devices **150***a,* **150***b* and/or mobile device users.

[0033] Still referring to each service provider computer **160** the I/O interface(s) **168** may facilitate communication between the processors **166** and various I/O devices, such as a keyboard, mouse, printer, microphone, speaker, monitor, bar code reader/scanner, RFID reader, and the like. The network interface(s) **169** may take any of a number of forms, such as, but not limited to, a network interface card, a modem, a wireless network card, a cellular network card, or any other means operable for facilitating communications with the network **170**. It will be appreciated that the service provider computer **160** may be implemented on a particular machine, which may include a computer that is designed, customized, configured, or programmed to perform at least one or more functions of token verification and/or provide other functions to a mobile device or mobile device user (e.g., technical support functions, etc.).

[0034] The network **170** may include any telecommunication and/or data network, whether public, private, or a combination thereof, including a local area network, a wide area network, an intranet, an internet, the Internet, intermediate handheld data transfer devices, a publicly switched telephone network ("PSTN"), a cellular network, and/or any combination thereof and may be wired and/or wireless. The network **170** may also allow for real time, near real time, off-line, and/or batch transactions to be transmitted between or among the TSP computer **110**, the MNO computer(s) **140***a,* **140***b,* the mobile devices **150***a,* **150***b,* and the service provider computers **160**. Due to network connectivity, various methodologies as described herein may be practiced in the context of distributed computing environments. It will also be appreciated that the network **170** may include a plurality of networks, each with devices such as gateways and routers for providing connectivity between or among networks **170**. Instead of, or in addition to, a network **170**, dedicated communication links may be used to connect the various devices in accordance with an example embodiment.

[0035] The mobile carrier networks **180***a,* **180***b* may include any cellular telecommunication network, each operated by a respective mobile network operator. The mobile carrier networks may be implemented to operate according to one or more wireless technology formats, including, but not limited to, CDMA, GSM, UWC, UMTS, GPRS, and/or any "generation" or version thereof. Accordingly, in one embodiment, each mobile device **150***a,* **150***b* is configured to operate primarily on a certain carrier network **180***a,* **180***b* as operated by the mobile network operator with which the mobile device end user has an agreement and with which the mobile device is registered. It is appreciated, however, that, according to various embodiments, mobile devices **150***a,* **150***b* and carrier networks **180***a,* **180***b* may be configured to permit interoperability of mobile devices on non-registered carrier networks **180***a,* **180***b.*

[0036] Generally, each of the memories and data storage devices, such as the memories **112**, **142***a,* **142***b,* **152***a,* **152***b,* **162** and the databases **138**, **175** and/or any other memory and data storage device, can store data and information for subsequent retrieval. In this manner, the system **100** can store various received or collected information in memory or a database associated with one or more of the TSP computer(s) **110**, the MNO computer(s) **140***a,* **140***b,* the mobile devices **150***a,* **150***b,* and/or the service provider computer(s) **160**. The memories and databases can be in communication with each other and/or other databases, such as a centralized database, or other types of data storage devices. When needed, data or information stored in a memory or a database may be transmitted to a centralized database capable of receiving data, information, or data records from more than one database or other data storage devices. In other embodiments, the databases shown can be integrated or distributed into any number of databases or other data storage devices.

[0037] Suitable processors, such as the processors **116**, **146***a,* **146***b,* **151***a,* **151***b,* **166**, may comprise a microprocessor, an application-specific integrated circuit ("ASIC"), and/or state machine. Example processors can be those provided by Intel Corporation (Santa Clara, Calif.), AMD Corporation (Sunnyvale, Calif.), and Motorola Corporation (Schaumburg, Ill.). According to various embodiments, one or more of the computers can be configured as a multi-processor computer having multiple processors **116**, **146***a,* **146***b,* **151***a,* **151***b,* **166** providing parallel and/or redundant processing capabilities. Such processors comprise, or may be in communication with, media, for example, computer-readable media, which stores instructions that, when executed by the processor, cause the processor to perform the elements described herein. Embodiments of computer-readable media include, but are not limited to, an electronic, optical, magnetic, or other storage or transmission device capable of providing a processor with computer-readable instructions. Other examples of suitable media include, but are not limited to, a floppy disk, pen drive, CD-ROM, DVD, magnetic disk, memory chip, ROM, RAM, EPROM, EEPROM, a configured processor, all optical media, all magnetic tape or other magnetic media, or any other medium from which a computer processor can read instructions. Also, various other forms of computer-readable

media may transmit or carry instructions to a computer, including a router, gateway, private or public network, or other transmission device or channel, both wired and wireless. The instructions may comprise code from any computer-programming language, including but not limited to, assembly, C, C++, C#, Visual Basic, Java, Python, Perl, JavaScript, GPSS, LISP, SAS, Parlay, JAIN, or Open Mobile Architecture.

[0038] The system **100** shown in and described with respect to FIG. **1** is provided by way of example only. Numerous other operating environments, system architectures, and device configurations are possible. Other system embodiments can include fewer or greater numbers of components and may incorporate some or all of the functionality described with respect to the system components shown in FIG. **1**. Accordingly, embodiments of the invention should not be construed as being limited to any particular operating environment, system architecture, or device configuration.

[0039] According to an aspect of the invention, methods for representing data or information by tokens may be provided. In this regard, the security of sensitive data may be enhanced while tokens that represent the data are communicated. FIG. **2** illustrates a flow diagram of an example method **200** for communicating a token to a mobile device, according to an example embodiment of the invention. The method **400** may be performed by a suitable tokenization system, such as the system **100** illustrated in FIG. **1**. The method **200** may begin at block **205**.

[0040] At block **205**, information to be represented by a token may be identified. For example, a tokenization request may be received from a mobile device, such as one of the mobile devices **150***a*, **150***b* illustrated in FIG. **1**. The received tokenization request may be evaluated or analyzed in order to determine a type of tokenization situation, such as a customer support situation, a balance reporting situation, or a transaction situation, and the information to be represented by the token (e.g., financial account information, etc.) may be identified based at least in part upon the determined type of tokenization situation. As another example, an indicator of the information to be represented by a token may be included in a received tokenization request.

[0041] At block **210**, a type of token for representing the information may be identified. A wide variety of different types of tokens may be utilized as desired in various embodiments of the invention. In certain embodiments, a type of token to be utilized may be determined based at least in part upon the information to be tokenized, the tokenization situation, preferences of a service provider to whom the token will be communicated, and/or preferences associated with the mobile device and/or a mobile device user. Additionally, a wide variety of suitable techniques may be utilized as desired to generate a token. For example, a token may be simply identified as a next unused sequential number. As another example, a token may be derived based upon a wide variety of combinations of base level information and/or other information, such as information associated with the mobile device (e.g., a device identifier, etc.) and/or a secure element associated with the mobile device (e.g., CPLC data, etc.).

[0042] At block **215**, which may be optional in certain embodiments of the invention, a lifespan for a token may be determined. In this regard, an amount of time during which the token may be utilized and/or presented to a service provider may be limited. In certain embodiments, the type of token or tokenization situation may be taken into account when determining a token lifespan. For example, a relatively short (e.g., ten minutes, etc.) lifespan may be utilized for a transaction token while a relatively longer (e.g., one hour, one day, etc.) lifespan is utilized for a technical support process.

[0043] At block **220**, a token may be generated or identified. The token may be representative of the information to be tokenized. As set forth above, a wide variety of different types of tokens and/or token generation techniques may be utilized to generate or identify a token. Once the token has been generated or identified, the token may be provided to the mobile device at block **225** in response to the tokenization request. As an alternative to communicating the token to the mobile device, base level information and/or instructions for independently identifying or generating the token may be communicated to the mobile device. For example, a base level number and/or an instruction for deriving a token utilizing the base level number and device identifying information may be communicated to the mobile device. As another example, an identifier of one of a series of tokens stored on the mobile device may be communicated.

[0044] At block **230**, the token and/or the information represented by the token may be provided to another entity, such as one of the service provider computers **160** illustrated in FIG. **1**. In this regard, the token and/or information represented by the token may be stored by a service provider and utilized to facilitate a subsequent authentication and/or validation of the mobile device and/or mobile device user. For example, the token may be stored for a subsequent comparison to a token received from the mobile device or mobile device user.

[0045] The method **200** may end following block **230**.

[0046] FIG. **3** illustrates a flow diagram of an example method **400** for utilizing a token in conjunction with a mobile device (or other device), according to an example embodiment of the invention. The method **300** may be performed by a suitable mobile device, such as one of the mobile devices **150***a*, **150***b* illustrated in FIG. **1**. The method **300** may begin at block **305**.

[0047] At block **305**, a situation in which a token will be utilized to represent information (e.g., sensitive data, etc.) may be identified. In certain embodiments, a tokenization situation may be identified based upon the receipt of user input. For example, a user may request the initiation of a transaction, and a tokenization situation may be identified based upon the received request. In other embodiments, a tokenization situation may be automatically identified by a mobile device based upon the triggering of any number of predetermined criteria or conditions. For example, an error may be identified by the mobile device, and a service request tokenization situation may be identified.

[0048] Once a tokenization situation has been identified, operations may continue at block **310**, and a tokenization request may be prepare or generated. The tokenization request may then be communicated to a suitable tokenization service provider, such as the TSP computer **110** illustrated in FIG. **1**. A wide variety of information may be included in the tokenization request as desired in various embodiments of the invention, including but not limited to, an identifier of a type of tokenization situation, identification information for the mobile device and/or mobile device secure element, and/or any number of user preferences for generating a token or token information. The tokenization request may be processed by the TSP computer **110**, and token information may be returned to the mobile device. The token information may

be received at block **315**. As desired, the token information may include a wide variety of different types of information. For example, the token information may include a generated token. As another example, the token information may include an identifier of a token to be utilized by the mobile device, such as a numerical identifier of a stored token to be utilized. As yet another example, the token information may include data and/or instructions (e.g., base level data and/or algorithms, etc.) for generating or deriving a token by the mobile device.

[0049] At block **320**, a determination may be made as to whether a token was received from the TSP computer **110**. If it is determined at block **320** that a token has been received, then operations may continue at block **330**, and the received token may be identified as a token to be utilized to represent the information. If, however, it is determined at block **320** that a token has not been received, then operations may continue at block **325**, and the mobile device may independently identify, generate, or derive a token to be utilized. For example, received token information may be processed in order to derive or identify a token. Operations may then continue at block **330** and the identified or derived token may be identified as a token to be utilized to represent the information.

[0050] At block **335**, the token may be provided to another entity or service provider in place of the information represented by the token. In this regard, the security of the represented information may be enhanced. A wide variety of suitable techniques may be utilized to provide the token to a service provider. For example, the mobile device may provide the token via a suitable network connection and/or via any number of suitable Web sites or graphical user interfaces hosted by the service provider. As another example, a mobile device user may provide the token to the service provider via a telephone voice connection, by entering the token via touch tone dialing or voice recognition, and/or by entering the token via a suitable Web form provided by the service provider.

[0051] Once the token has been provided by the mobile device or mobile device user to the service provider, the service provider may compare the received token to a token previously received from the TSP computer **110**. In this regard, the service provider may verify the identity of the mobile device and/or user. Additionally, based upon a successful match, the service provider may access the information represented by the token (e.g., account information, etc.) without the information being communicated from the mobile device or stored one a shared memory of the mobile device. As desired, the service provider may request additional information from the mobile device or mobile device user in order to further authenticate the mobile device or mobile device user. For example, during a service call, a mobile device user may provide a service token to a service provider representative in order to facilitate the service provider representative accessing account information for the mobile device user. The service provider representative may then request additional information from the user, such as name, address, and/or security question information, in order to authenticate the user.

[0052] The method **300** may end following block **335**.

[0053] The operations described and shown in the methods **200** and **300** of FIGS. **2-3** may be carried out or performed in any suitable order as desired in various embodiments of the invention. Additionally, in certain embodiments, at least a portion of the operations may be carried out in parallel. Furthermore, in certain embodiments, less than or more than the operations described in FIGS. **2-3** may be performed.

[0054] The invention is described above with reference to block and flow diagrams of systems, methods, apparatuses, and/or computer program products according to example embodiments of the invention. It will be understood that one or more blocks of the block diagrams and flow diagrams, and combinations of blocks in the block diagrams and the flow diagrams, respectively, can be implemented by computer-executable program instructions. Likewise, some blocks of the block diagrams and flow diagrams may not necessarily need to be performed in the order presented, or may not necessarily need to be performed at all, according to some embodiments of the invention.

[0055] Various block and/or flow diagrams of systems, methods, apparatus, and/or computer program products according to example embodiments of the invention are described above. It will be understood that one or more blocks of the block diagrams and flow diagrams, and combinations of blocks in the block diagrams and flow diagrams, respectively, can be implemented by computer-executable program instructions. Likewise, some blocks of the block diagrams and flow diagrams may not necessarily need to be performed in the order presented, or may not necessarily need to be performed at all, according to some embodiments of the invention.

[0056] These computer-executable program instructions may be loaded onto a special purpose computer or other particular machine, a processor, or other programmable data processing apparatus to produce a particular machine, such that the instructions that execute on the computer, processor, or other programmable data processing apparatus create means for implementing one or more functions specified in the flow diagram block or blocks. These computer program instructions may also be stored in a computer-readable memory that can direct a computer or other programmable data processing apparatus to function in a particular manner, such that the instructions stored in the computer-readable memory produce an article of manufacture including instruction means that implement one or more functions specified in the flow diagram block or blocks. As an example, embodiments of the invention may provide for a computer program product, comprising a computer-usable medium having a computer-readable program code or program instructions embodied therein, said computer-readable program code adapted to be executed to implement one or more functions specified in the flow diagram block or blocks. The computer program instructions may also be loaded onto a computer or other programmable data processing apparatus to cause a series of operational elements or steps to be performed on the computer or other programmable apparatus to produce a computer-implemented process such that the instructions that execute on the computer or other programmable apparatus provide elements or steps for implementing the functions specified in the flow diagram block or blocks.

[0057] Accordingly, blocks of the block diagrams and flow diagrams support combinations of means for performing the specified functions, combinations of elements or steps for performing the specified functions and program instruction means for performing the specified functions. It will also be understood that each block of the block diagrams and flow diagrams, and combinations of blocks in the block diagrams and flow diagrams, can be implemented by special purpose, hardware-based computer systems that perform the specified

functions, elements or steps, or combinations of special purpose hardware and computer instructions.

[0058] Many modifications and other embodiments of the invention set forth herein will be apparent having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the invention is not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

The claimed invention is:

1. A computer-implemented method for providing tokens to devices, the method comprising:

receiving, from a device, a request for a token to represent financial information;

identifying, in response to the request, token information associated with the token;

providing at least a portion of the token information to the device; and

providing the token to a third party entity, wherein the third party entity utilizes the received token to evaluate a second token subsequently received from one of the device or a user of the device,

wherein the above operations are performed by one or more computers associated with a tokenization service provider.

2. The computer-implemented method of claim **1**, wherein the token information comprises the token.

3. The computer-implemented method of claim **1**, wherein the token information comprises information that may be utilized by the device to identify or derive the token.

4. The computer-implemented method of claim **1**, wherein receiving a request for a token comprises receiving a request for a token to represent a financial account number.

5. The computer-implemented method of claim **1**, further comprising:

identifying a tokenization situation associated with the request; and

identifying the token information based at least in part upon the identified tokenization situation.

6. A system for providing tokens to devices, the system comprising:

at least one memory configured to store computer-executable instructions; and

at least one processor configured to access the at least one memory and execute the computer-executable instructions to:

receive, from a device, a request for a token to represent financial information;

identify, in response to the request, token information associated with the token;

provide at least a portion of the token information to the device; and

provide the token to a third party entity, wherein the third party entity utilizes the received token to evaluate a second token subsequently received from one of the device or a user of the device,

wherein the above operations are performed by one or more computers associated with a tokenization service provider.

7. The system of claim **6**, wherein the token information comprises the token.

8. The system of claim **6**, wherein the token information comprises information that may be utilized by the device to identify or derive the token.

9. The system of claim **6**, wherein the computer-executable instructions to receive a request for a token comprise instructions to receive a request for a token to represent a financial account number.

10. The system of claim **6**, wherein the at least one processor is further configured to execute the computer-executable instructions to:

identify a tokenization situation associated with the request; and

identify the token information based at least in part upon the identified tokenization situation.

11. A method comprising:

receiving, from a mobile device, a request for a token to represent financial information;

identifying, in response to the request, token information associated with the token;

providing at least a portion of the token information to the mobile device; and

providing the token to a third party entity, wherein the third party entity utilizes the received token to evaluate a second token received from one of the mobile device or a user of the mobile device,

wherein the above operations are performed by one or more computers associated with a service provider.

12. The computer-implemented method of claim **11**, wherein the token information comprises the token.

13. The computer-implemented method of claim **11**, wherein the token information comprises information that may be utilized by the mobile device to identify or derive the token.

14. The computer-implemented method of claim **11**, wherein receiving a request for a token comprises receiving a request for a token to represent a financial account number.

15. The computer-implemented method of claim **11**, further comprising:

identifying a tokenization situation associated with the request; and

identifying the token information based at least in part upon the identified tokenization situation.

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