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Maeng

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(54) **DIRECT PAYMENT AUTHORIZATION PATH**

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(51) **Int. Cl.**

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G06Q 20/32	(2012.01)
G06Q 20/38	(2012.01)
G06Q 20/40	(2012.01)

(52) **U.S. Cl.**
CPC ***G06Q 20/36*** (2013.01); ***G06Q 20/202*** (2013.01); ***G06Q 20/32*** (2013.01); ***G06Q 20/3829*** (2013.01); ***G06Q 20/387*** (2013.01); ***G06Q 20/405*** (2013.01)

(58) **Field of Classification Search**
CPC G06Q 20/36; G06Q 20/202; G06Q 20/32; G06Q 20/3829; G06Q 20/387; G06Q 20/405
See application file for complete search history.

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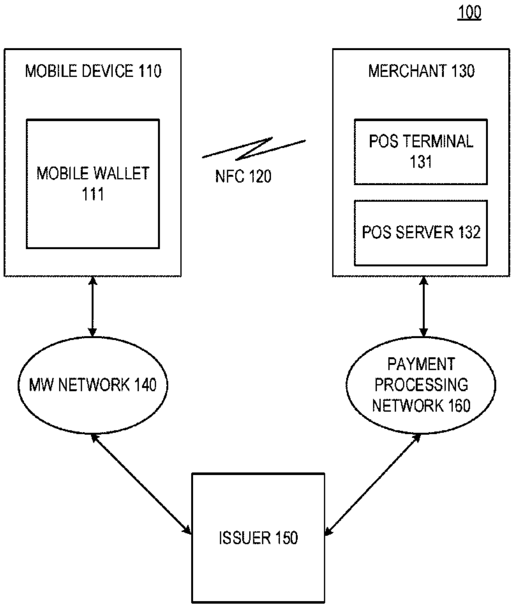
(57) **ABSTRACT**

Various examples described herein are directed to systems and methods for processing a payment using a mobile wallet network and issuer. A mobile wallet application provides payment information and an indication if payment may be done directly via the mobile wallet network to a point of sale (POS) terminal. The POS terminal determines which payment network to use. A bill may be sent to the mobile wallet application. The mobile wallet application requests payment authorization from an issuer. The issuer provides the authorization and the transaction is completed between the POS terminal and the mobile wallet application.

20 Claims, 7 Drawing Sheets



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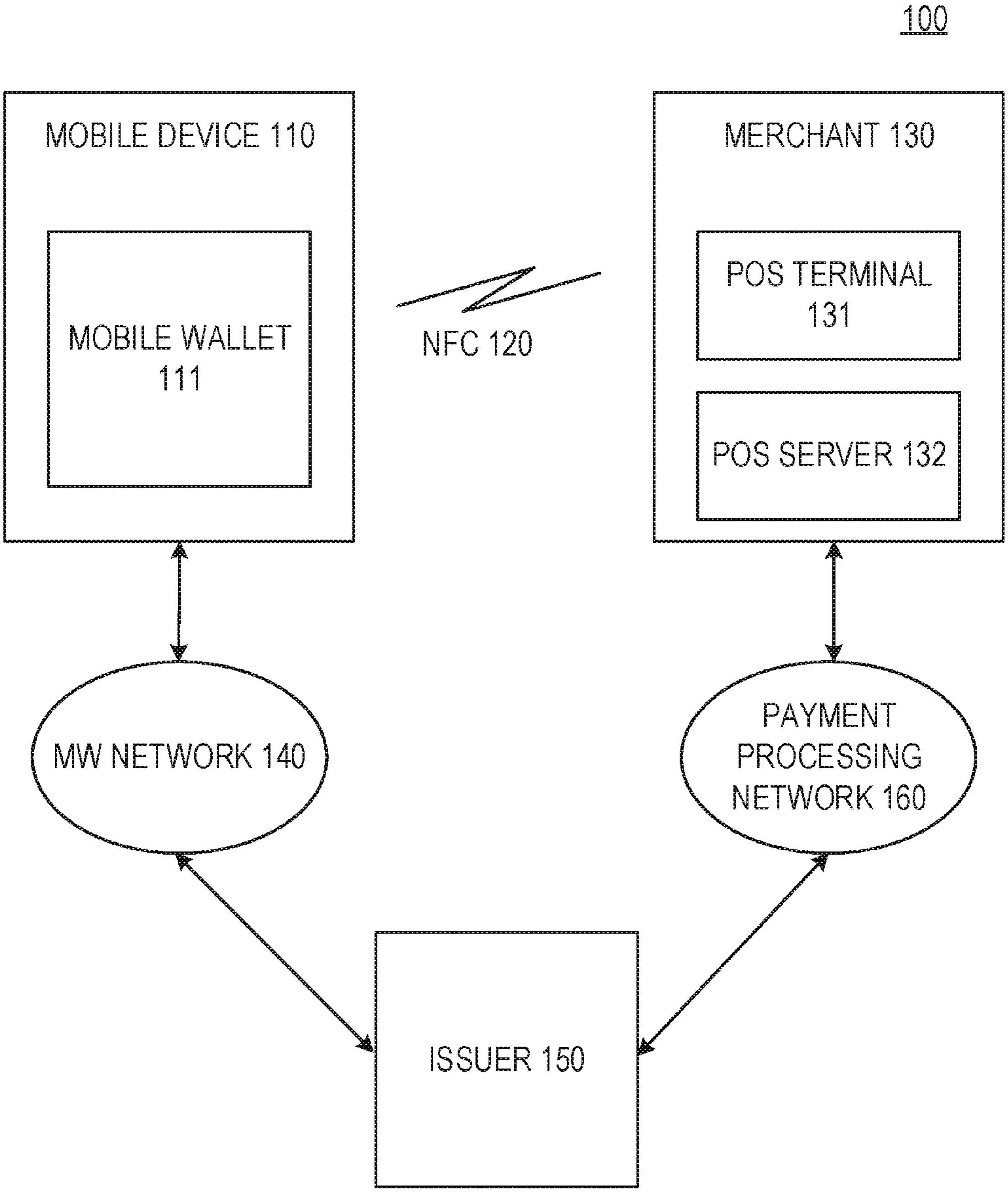
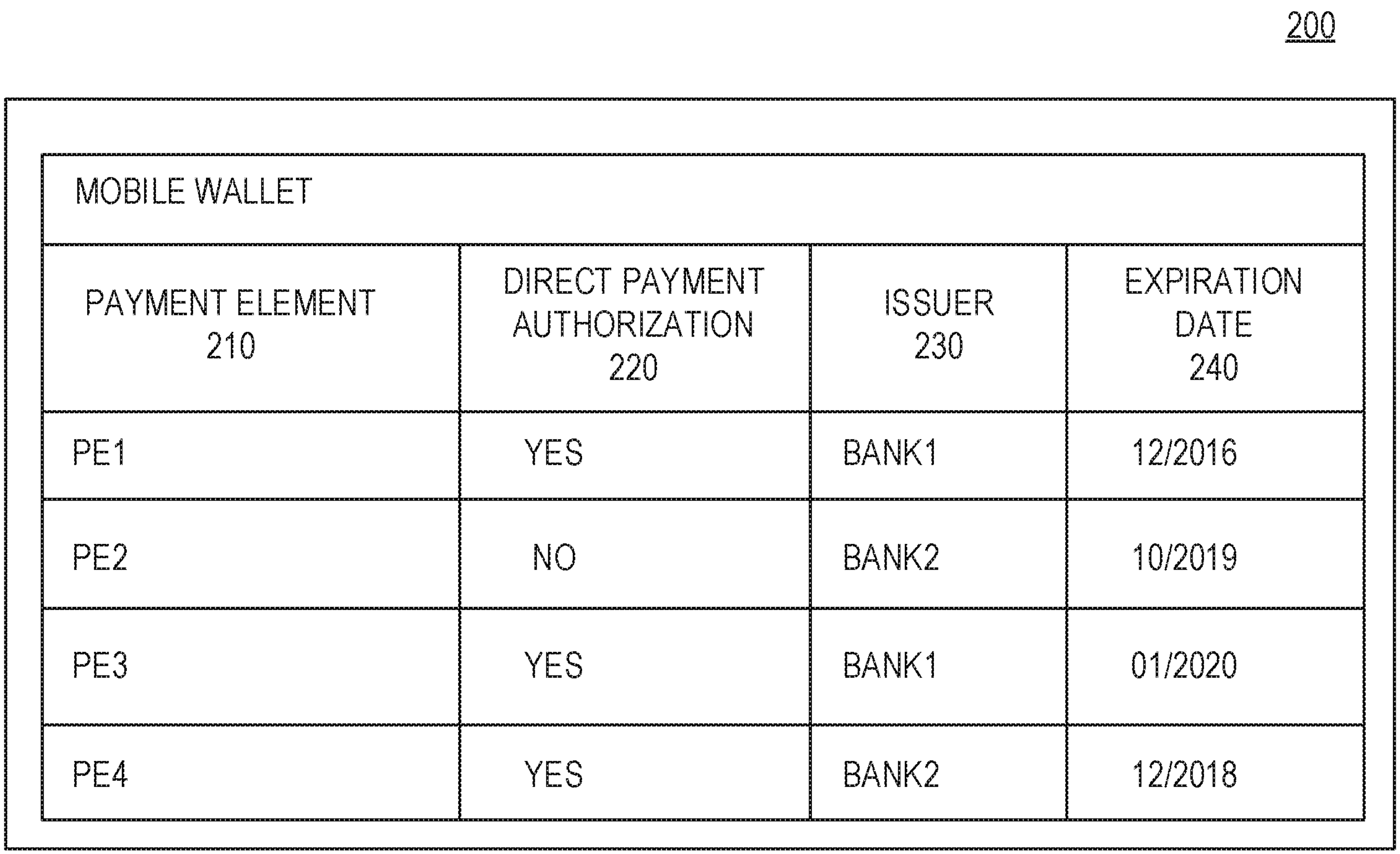

100
MOBILE DEVICE 110
MOBILE WALLET 111
NFC 120
MERCHANT 130
POS TERMINAL 131
POS SERVER 132
MW NETWORK 140
PAYMENT PROCESSING NETWORK 160
ISSUER 150

FIG. 1



MOBILE WALLET

PAYMENT ELEMENT 210	DIRECT PAYMENT AUTHORIZATION 220	ISSUER 230	EXPIRATION DATE 240
PE1	YES	BANK1	12/2016
PE2	NO	BANK2	10/2019
PE3	YES	BANK1	01/2020
PE4	YES	BANK2	12/2018

FIG. 2

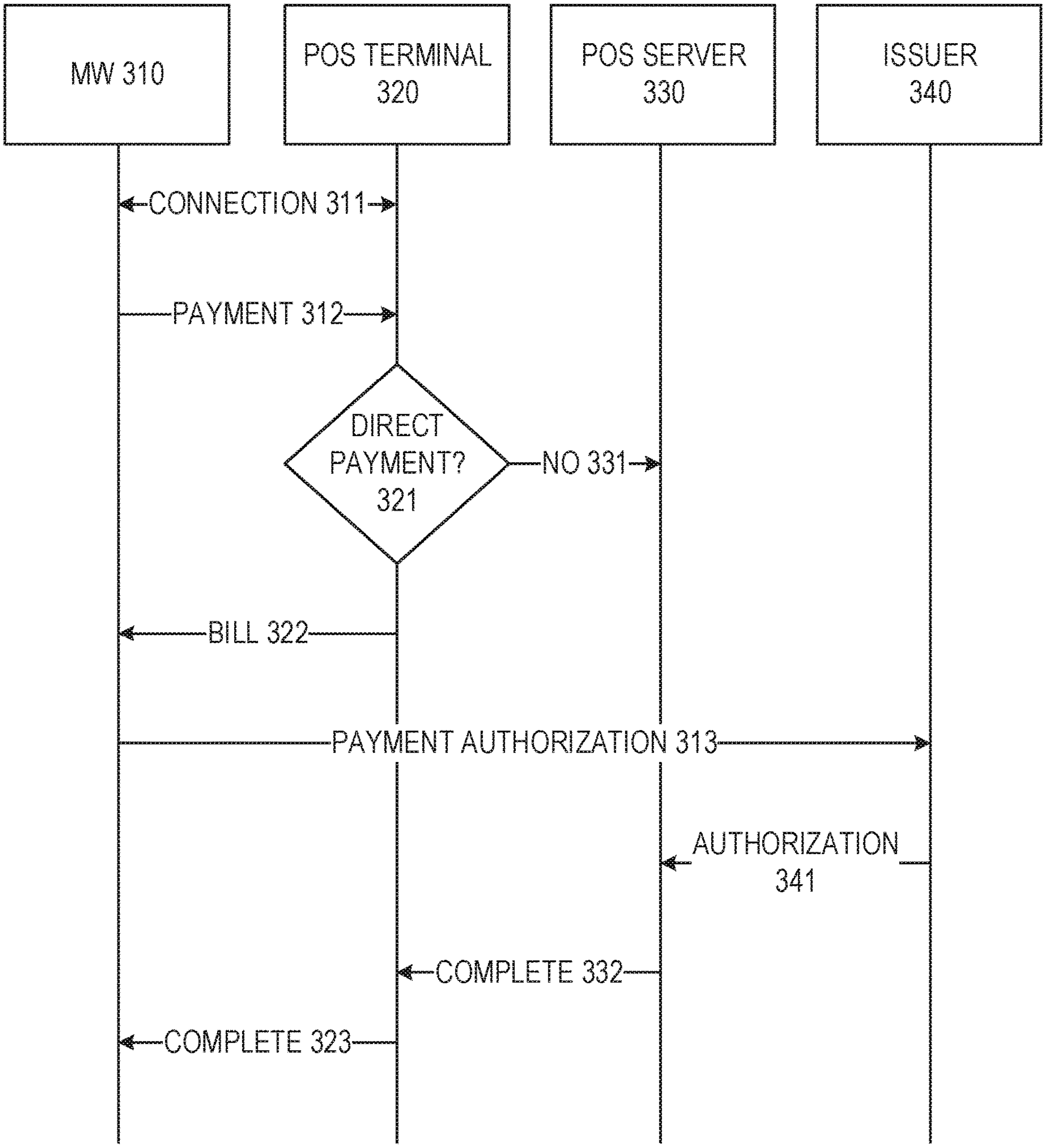

MW 310
POS TERMINAL 320
POS SERVER 330
ISSUER 340
CONNECTION 311
PAYMENT 312
DIRECT PAYMENT? 321
NO 331
BILL 322
PAYMENT AUTHORIZATION 313
AUTHORIZATION 341
COMPLETE 332
COMPLETE 323

FIG. 3

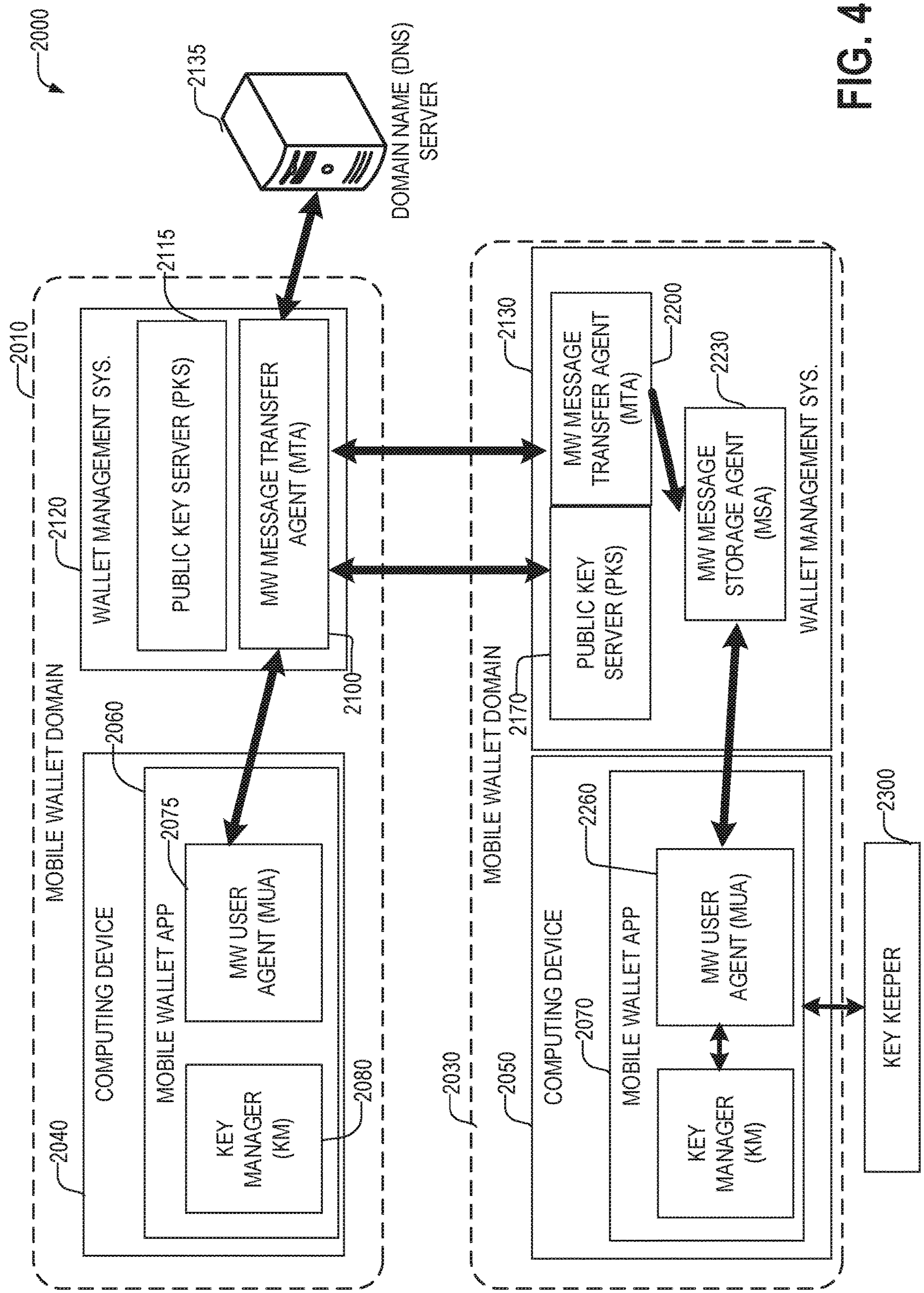

2000
2010
MOBILE WALLET DOMAIN
2120
WALLET MANAGEMENT SYS.
2115
PUBLIC KEY SERVER (PKS)
MW MESSAGE TRANSFER AGENT (MTA)
2100
2135
DOMAIN NAME (DNS) SERVER
2060
2040
COMPUTING DEVICE
MOBILE WALLET APP
2075
MW USER AGENT (MUA)
2080
KEY MANAGER (KM)
2030
MOBILE WALLET DOMAIN
2130
MW MESSAGE TRANSFER AGENT (MTA)
2200
2230
MW MESSAGE STORAGE AGENT (MSA)
WALLET MANAGEMENT SYS.
2170
PUBLIC KEY SERVER (PKS)
2050
COMPUTING DEVICE
2070
MOBILE WALLET APP
2260
MW USER AGENT (MUA)
KEY MANAGER (KM)
2300
KEY KEEPER

FIG. 4

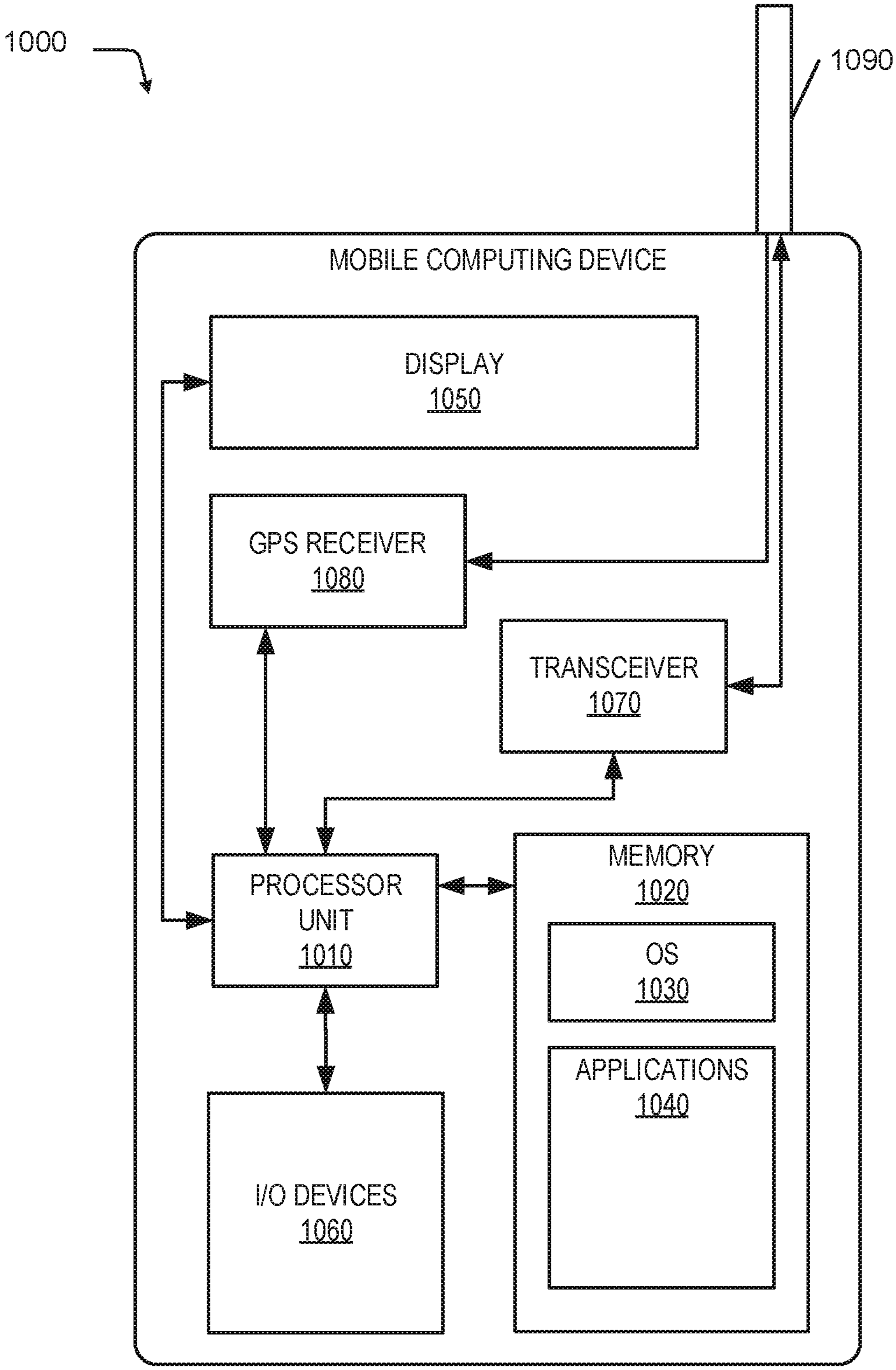

1000
1090
MOBILE COMPUTING DEVICE
DISPLAY
1050
GPS RECEIVER
1080
TRANSCEIVER
1070
PROCESSOR UNIT
1010
MEMORY
1020
OS
1030
APPLICATIONS
1040
I/O DEVICES
1060

FIG. 5

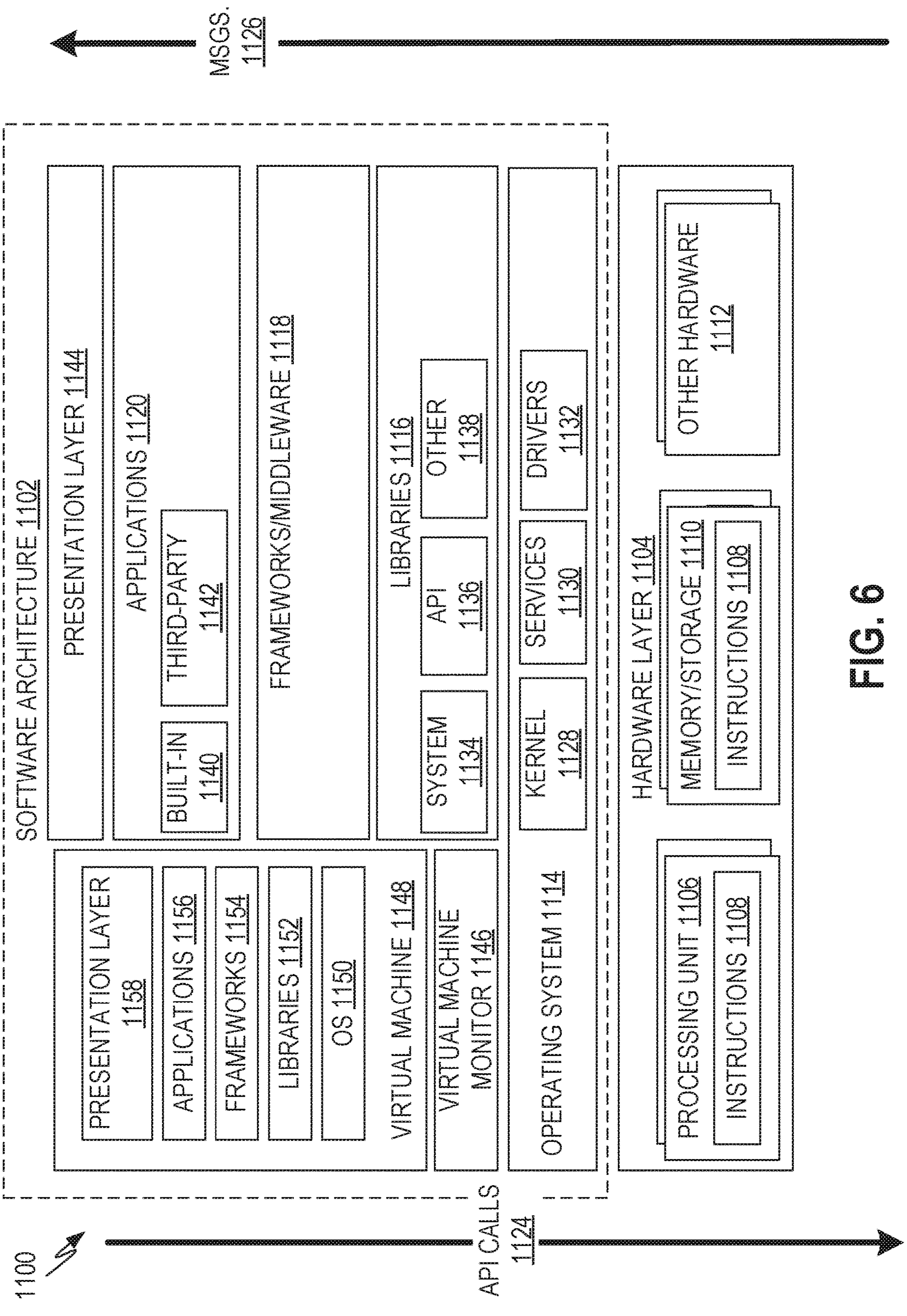

1100
MSGS.
1126
API CALLS
1124
SOFTWARE ARCHITECTURE 1102
PRESENTATION LAYER 1144
APPLICATIONS 1120
BUILT-IN
1140
THIRD-PARTY
1142
FRAMEWORKS/MIDDLEWARE 1118
LIBRARIES 1116
SYSTEM
1134
API
1136
OTHER
1138
OPERATING SYSTEM 1114
KERNEL
1128
SERVICES
1130
DRIVERS
1132
VIRTUAL MACHINE 1148
PRESENTATION LAYER
1158
APPLICATIONS 1156
FRAMEWORKS 1154
LIBRARIES 1152
OS 1150
VIRTUAL MACHINE
MONITOR 1146
HARDWARE LAYER 1104
PROCESSING UNIT 1106
INSTRUCTIONS 1108
MEMORY/STORAGE 1110
INSTRUCTIONS 1108
OTHER HARDWARE
1112

FIG. 6

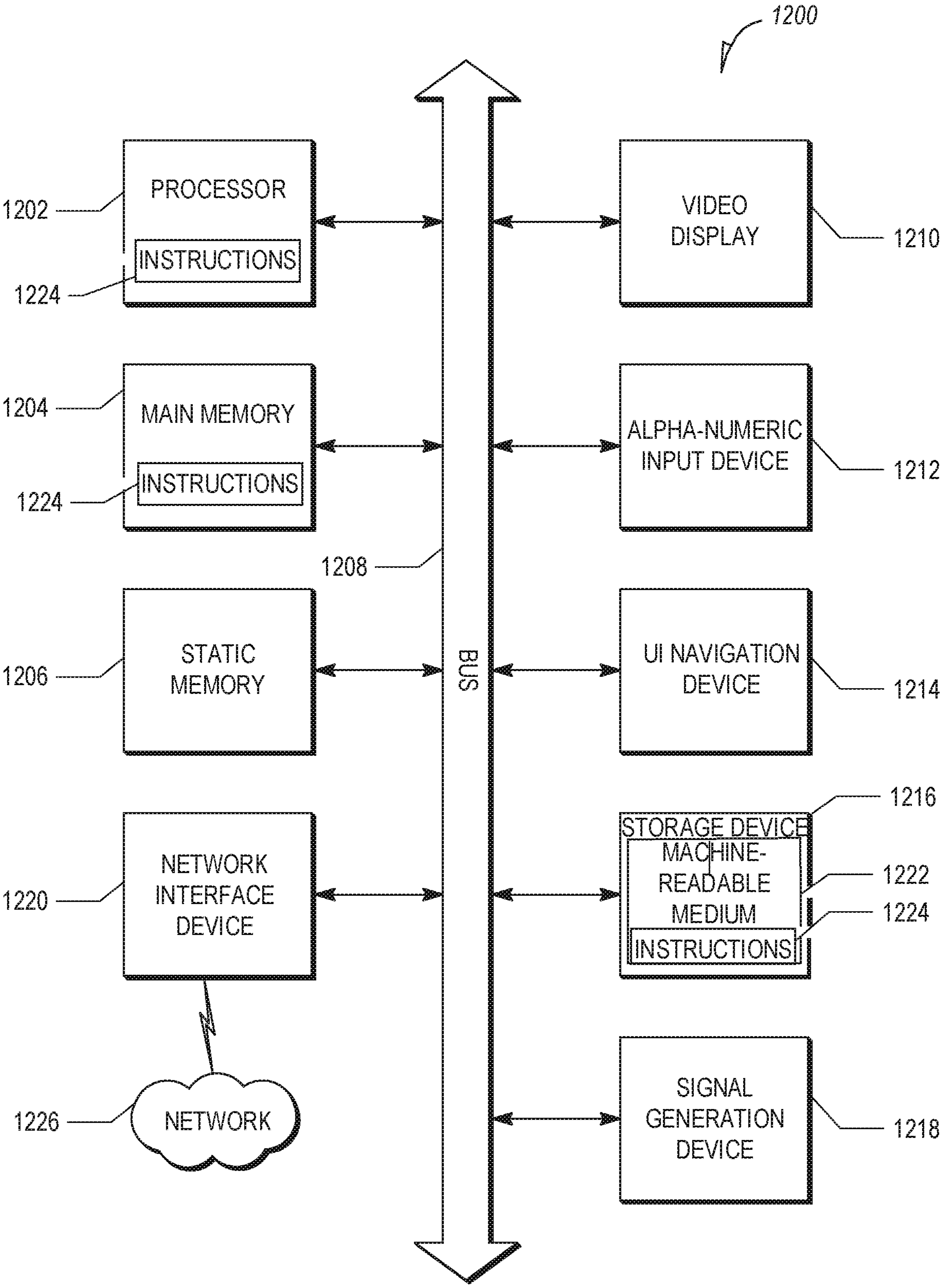

1200
PROCESSOR
INSTRUCTIONS
1202
1224
VIDEO DISPLAY
1210
MAIN MEMORY
INSTRUCTIONS
1204
1224
ALPHA-NUMERIC INPUT DEVICE
1212
1208
STATIC MEMORY
1206
BUS
UI NAVIGATION DEVICE
1214
1216
STORAGE DEVICE
MACHINE-READABLE MEDIUM
INSTRUCTIONS
1222
1224
NETWORK INTERFACE DEVICE
1220
NETWORK
1226
SIGNAL GENERATION DEVICE
1218

FIG. 7

DIRECT PAYMENT AUTHORIZATION PATH

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation of U.S. patent application Ser. No. 17/305,457, filed Jul. 8, 2021, which is a continuation of U.S. patent application Ser. No. 15/620,562, filed Jun. 12, 2017, now issued as U.S. Pat. No. 11,080,685, each of which are incorporated by reference herein in their entirety.

TECHNICAL FIELD

Embodiments described herein generally relate to systems and methods for a point-of-sale (POS) system to use direct payment processing between a mobile wallet and an issuer.

BACKGROUND

Mobile wallet applications can allow consumers to make payments for products and services using mobile computing devices instead of cash, credit card accounts, check card, or checks.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings, which are not necessarily drawn to scale, like numerals may describe similar components in different views. Like numerals having different letter suffixes may represent different instances of similar components. Some embodiments are illustrated by way of example, and not of limitation, in the figures of the accompanying drawings, in which:

FIG. **1** is a diagram showing one example of a mobile wallet environment.

FIG. **2** illustrates a payment processing table in a mobile wallet.

FIG. **3** is a timing diagram showing one example for processing a payment using the mobile wallet.

FIG. **4** is a diagram showing one example of a mobile wallet application to mobile wallet application secure digital communication.

FIG. **5** is a block diagram showing an example architecture of a mobile computing device.

FIG. **6** is a block diagram showing one example of a software architecture for a computing device.

FIG. **7** is a block diagram illustrating a computing device hardware architecture, within which a set or sequence of instructions can be executed to cause the hardware to perform examples of any one of the methodologies discussed herein.

DETAILED DESCRIPTION

A user may utilize a mobile wallet application for payment or other transactions from a merchant. The mobile wallet application may interface with a point of sale (POS) system of the merchant to pay for a transaction. Near field communication (NFC) may be used to communicate data between the device that runs the mobile wallet application and the POS system. The POS system may use one of various payment processing networks. Each payment processing network may charge fees to process a payment. The mobile wallet may also be able to process a payment through a payment processing network. The payment processing network that the mobile wallet application uses may be different from any of the payment processing networks available to the POS system. In addition, the payment processing network of the mobile wallet application may charge lower fees than a payment processing network available to the POS system.

When the mobile wallet application provides an indication to submit a payment to the POS system, the mobile wallet application may also provide an indication that the mobile wallet application may also process the payment. The POS system may then determine if the payment should be processed through the mobile wallet application's network or if one of the POS system's networks will be used.

FIG. **1** is a diagram showing one example of a mobile wallet environment **100**. The environment **100** includes a mobile device **110** that has a mobile wallet **111** installed. The mobile wallet **111** is able to run on the mobile device **110**. A user may utilize the mobile wallet **111** to pay for purchases. Prior to using the mobile wallet **111** to make payments, the user configures the mobile wallet **111** with the user's account information. The mobile wallet **111** may communicate with an issuer **150** over a mobile wallet network **140** to process transactions, for example. The issuer **150** provides payment abilities to the mobile wallet **111**. In an example, the issuer **150** may provide the mobile wallet application **111**, e.g., Wells Fargo Wallet®. In another example, the mobile wallet application **111** is provided by an entity other than the issuer **150**. In this example, the mobile wallet application **111** communicates with the issuer **150** to process payments. Payment authentication information is provided by the mobile wallet application **111** to the issuer **150** to ensure proper and valid payments.

The environment **100** also includes a merchant **130** with a point of sale (POS) system comprising a POS terminal **131** and POS server **132**. The POS system may communicate with the issuer **150** over a payment processing network **160** to process transactions. The payment processing network **160** may be different from the mobile wallet network **140**.

The mobile device **110** may be a computing device such as a smartphone, a smart watch, or a tablet computer that includes the mobile wallet **111**. The mobile wallet **111** is an application program that is stored in and runs on the mobile device **110**. The mobile wallet **111** allows an individual to complete electronic commerce transactions. Electronic commerce transactions may include purchasing items and making payments for those items. Exemplary mobile wallets are Wells Fargo Wallet®, Apple Pay®, Google Wallet®, PayPal®, Samsung Pay®, and the Starbucks App®. The mobile wallet **111** may comprise one or more of payment elements (not shown) and non-payment elements (not shown). Exemplary payment elements include but are not limited to credit card information, debit card information, and bank account information. Exemplary non-payment elements may include passport information, driver's license information, insurance card information, employee card information, a student ID, and member card information.

The user may select a payment element in the mobile wallet **111** in order to pay for a product or service. To pay for items at a merchant, the mobile device **110** may be brought into close vicinity to the POS terminal **131**. Close vicinity means the mobile device **110** is close enough to the POS terminal **131** to allow communication between the two devices. For example, the devices may be within a few inches of one another to allow near field communication (NFC) **120**. Thus, the devices may communicate invoice and payment information using NFC **120**.

The merchant **130** may use the POS system that includes the POS terminal **131** and the POS server **132** to communicate with the mobile wallet **111**. The POS terminal **131** is a device typically located at a checkout counter. The POS terminal **131** may scan items, display prices, accept payment such as credit or debit card from a mobile wallet, and print receipts. The POS server **132** is a backend system that may help the merchant to manage business operations including processing financial transactions. In some cases, the POS terminal **131** and POS server **132** are an integrated system or the POS server may exist in the cloud computing platform. In an example, the POS terminal uses a cloud based system where servers are in a remote place and the POS terminal accesses them via the Internet and the merchant may pay subscription fees for using the cloud based virtual POS server. In some examples there are multiple POS terminals at a merchant which are connected to the POS server.

In one type of transaction process (similar to existing technology), when the mobile wallet **111** submits a payment element such as credit card over the NFC **120** network to the POS terminal **131**, the POS terminal **131** transfers the payment to the POS server **132**. The POS server **132** may submit the payment to the payment processing network **160** to get a payment authorization and clear the payment with the issuer **150**. Using the payment network **160** may cost the merchant **130** various fees. The merchant **130** may receive payment equal to the payment minus the network fees. The payment processing network **160** may include multiple entities such as a processor, an acquirer, a credit/debit card company, and other components. In some cases, there may be multiple networks with different fees in the payment processing network **160**. The POS server **132** may choose an appropriate payment processing network depending on the payment.

In another type of transaction process, the mobile wallet (MW) network **140** may provide a direct communication path between the mobile wallet **110** and the issuer **150**. The mobile wallet application **111** may include features such as direct communication between the mobile wallet application **111** and the issuer **150**. In an example, the mobile wallet application **111** may use wallet-to-wallet (W2W) communication to communicate directly with the issuer **150**. The direct communication over the MW network **140** may remove the payment processing fees incurred by the processing entities or provide lower fees to the merchant **130**. In some cases, there may exist a separate mobile wallet provider such as Google Wallet® and Apply Pay® which is different from the issuer **150**. In this example, the mobile wallet provider bridges the direct communication between the mobile wallet application **111** and the issuer **150**.

The mobile wallet **111** may have multiple payment elements. The mobile wallet **111** may be able to communicate directly with some issuers of a payment element and may not be able communicate with other issuers of other payment elements directly via the mobile wallet network **140**. In addition, even though mobile wallets may communicate with issuers directly, some issuers may not offer processing payment authorization. For one or more, or all, payment elements, the mobile wallet application **111** may store data indicating whether the payment element is able to communicate directly to the issuer.

FIG. **2** illustrates an example of a payment processing table **200** in a mobile wallet application. The payment processing table **200** includes data indicating whether a payment element may communicate directly with its issuer. The payment process table **200** may be stored in non-volatile memory that is accessible to the mobile wallet application. The table include the payment element **210** column that includes a set of elements PE1, PE2, PE3, and PE4. For each payment element **210**, a direct payment authorization **220** column indicates if the payment element is able to process payments directly with the issuer. An issuer **230** column indicates the name of the issuer and an expiration date **240** column indicates when the payment element expires. In addition, the table **200** may include data such as the address of the interface of the issuer that is used to process payments. The data may be stored in other formats that allow the mobile wallet application to access the stored data. For example, the data may be stored in a text file, a database, in a structured file, etc. In an example, the issuers allow direct communication may specify fees of using it to get payment authorization directly and the fees may be lower than the fees to pay to the payment processing network.

When a mobile wallet **111** submits a payment element to a POS terminal **131**, the mobile wallet **111** may use the table **200** to determine if the payment element can be processed directly with the issuer. An indication that direct payment is available may be communicated from them mobile wallet **111** to the POS terminal **131**. The POS system may determine if the POS system should use the direct MW network **140** or the payment processing network **160**.

In an example, the POS system may select the processing network based upon the fees associated with using the network. The mobile wallet **111** may provide information regarding fees of the MW network **140** to the POS system when a payment is submitted. The POS system may determine if the MW network **140** has lower fees compared to the other payment process networks available to the POS system. The POS system may also determine if savings by using the MW network are more than a threshold amount before selecting to use the MW network.

The POS system may provide an incentive to a user to use a direct payment method. For example, the POS system may provide a discount based upon the lower fees of the MW payment network. In an example, the POS system may reduce the amount of a bill by an amount equal to a percentage of the savings, e.g., 10%, 25%, 50%, etc., associated with using the MW network **140** instead of another payment processing network **160**.

FIG. **3** is a timing diagram showing one example for processing a payment using the mobile wallet. A mobile wallet (MW) **310** and a POS terminal **320** may establish communication between them over a NFC interface **311** by using standard protocols such as ECMA-340 and ISO/IEC 18092 when a mobile device is placed near the POS terminal.

Once the NFC connection is established, the POS terminal **320** may provide the MW **310** with an indication that payment is requested. For example, an indication may be received and the MW **310** may be automatically launched. The MW **310** may provide a list of available payment elements that may be used to pay for a purchase. Once a payment element is selected, the MW **310** may provide an indication to the POS system **320** to pay the invoice using the selected payment element **312**. In addition, the MW may provide additional information regarding if direct payment processing is available for the selected payment element.

The MW **310** may submit a payment element selected by the buyer to the POS terminal **320** (as shown at **312**). For example, the MW **310** may determine if direct payment processing is available. In an example, the table **200** may be used to determine if direct payment processing is available for a selected payment element. In addition, the MW **310** may provide an indication to a user as to which payments elements may be directly processed. In an example, the MW **310** may also provide information such as fees to process a payment directly to the POS system. The POS system may provide the MW **310** with an indication of incentives for the various payment elements available to the MW **310** based upon receiving the fees from the MW **310**. For example, the MW **310** may provide the POS system with information regarding each payment element available to the MW **310** that can process payments directly. In addition, providing the fees to the POS system allows the POS system to determine which payment elements would be selected to process the payments directly. In addition, the POS system may determine incentives, such as discounts from the invoice amount, that will be applied to the purchase if a particular payment element is selected. The incentives may then be displayed along with the corresponding payment element.

The POS terminal **320** may determine if the payment should be processed by the MW network **140** or the payment processing network **160** (as shown at **321**). There may be more than one payment processing networks available to the POS system. The POS terminal may determine which network is cheapest to use. The payment may then be processed using the selected network.

In an example, the POS terminal **320** may determine to use one of the payment processing networks available to the POS system. In this case, the POS terminal may send the payment to a POS server **330** to process the payment as shown at **331**. In another example, the POS terminal **320** may send an invoice or bill to the MW **310** to process payment of the invoice as shown at **322**.

Once the MW **310** receives the invoice, the MW **310** may communicate with an issuer **230** as shown an **340**. The MW **310** may communicate with the issuer **230** over a MW network. The MW **310** may request payment authorization and provide information about the merchant to the issuer **313**. For example, the address of the POS server **330** and how the POS server **330** may be contacted may be provided to the issuer **340**. In addition, a merchant identifier may be provided such as a unique ID known to the industry, a web address, a W2W communication address, etc.

Upon receiving a request for payment authorization, the issuer **340** may verify the account associated with the selected payment element and issue a payment authorization to the POS server **330** (as shown at **341**). The information provided by the MW **310** may be used to connect to and communicate with the POS server **330**. The POS server **330** informs the POS terminal that the transaction is complete at **332**. The POS server **330** may provide a transaction identifier that identifies the transaction that has been completed. The POS terminal **320** may then provide an indication to the MW **310** that the transaction has completed successfully **323**. The POS terminal **320** may use the transaction identifier to determine which MW **310** corresponds with the completed transaction.

In an example, the MW network may be used for the issuer to communicate with the POS system via the MW **310**. For example, the issuer **340** may send the payment authorization to the MW **310** rather than the POS server **330**. The MW **310** may then send the authorization to the POS server **330** via the POS terminal **320**. In this example, the authenticity of the payment authorization may be ensured using certificates. For example, the issuer **340** may use a public key associated with the merchant or the POS server **330** to encrypt the payment authorization. The POS system may then decrypt the payment authorization using the corresponding private key.

FIG. **4** is a diagram showing one example of a mobile wallet application to mobile wallet application secure digital communication. A first mobile wallet application **2060** executing on a computing device **2040** in a first mobile wallet domain **2010** is sending a message to a second mobile wallet application **2070** executing on a second computing device **2050** in a second mobile wallet domain **2030**. In an example, one of the mobile wallet domains may be the issuer and/or the mobile wallet service provider. Mobile wallet application **2060** may include a mobile wallet user agent (MUA) **2075** and a key manager **2080**. The MUA **2075** allows users to compose, send and retrieve mobile wallet (MW) messages. Key manager **2080** may one or more of: create, provision, register, store, and manage one or more cryptographic keys. Key manager **2080** may register (or obtain) a public key with a certificate authority (not shown for clarity) and with a PKS **2115**.

A mobile wallet application **2060** may provide one or more graphical user interfaces (GUI) s to allow users to compose and edit one or more mobile wallet messages. Before sending a message, the MUA **2075** requests the recipient's public key from the MTA **2100**. The PKS **2115** and MTA **2100** may be provided by the mobile wallet management system **2120** of the mobile wallet domain **2010**. The PKS **2115** and MTA **2100** may be provided by the same computing device, or different computing devices. While the PKS **2115** and MTA **2100** are shown as part of the mobile wallet management system **2120**, they may be provided by separate entities. The MTA and PKS are accessible to computing device **2040** and other computing devices both within the mobile wallet domain **2010** and other devices within other mobile wallet domains, over one or more networks (not shown for clarity). These networks may include one or more portions of: Local Area Networks (LAN), Wide Area Networks (WAN), Metropolitan Area Networks (MAN), the Internet, cellular networks, and the like.

The MTA **2100** first examines the message to determine which mobile wallet domain the recipient is in. If the mobile wallet domain is mobile wallet domain **2010**, the MTA may retrieve the public key from the PKS **2115** of mobile wallet domain **2010**. If the mobile wallet domain is in another domain, then the MTA checks its DNS cache to determine if it already knows the IP address of the recipient mobile wallet domain's PKS. If the mobile wallet domain is not in the DNS cache, the MW sends a lookup message to DNS server **2135** using the Domain Name System Protocol. DNS server **2135** responds with an IP address of the mobile wallet domain (or an error). Once the address is determined (either through the cache or the DNS server **2135**), the MTA **2100** sends a message to a PKS **2170** asking for the public key of the recipient mobile wallet application (e.g., mobile wallet application **2070**). The response includes the recipient's public key. The public key is then passed by the MTA **2100** to the MUA **2075**.

In some examples, the public key is passed to the MTA **2100** in the form of a digital certificate issued by a Certificate Authority (CA). A digital certificate typically includes the name and other identification information of the holder, the holder's public key, the name of the CA, a serial number, and a validity period. The information in the digital certificate is signed by the issuing CA using the issuing CA's private key. The signature can be verified using the CA's public key (which is known and may be pre-installed on the computing devices **2040**, **2050**). This may serve as a means to verify that the public key is owned by the recipient. For example, the PKS **2170** may provide a digital certificate created by a trusted CA for the recipient mobile wallet application **2070** in response to the request for the recipient's public key. MUA **2075** (or MTA **2100**) may utilize the CA's public key and decrypt the certificate. The certificate may then be checked to determine that the message was not tampered with, and that the public key therein belongs to the mobile wallet application **2070** (e.g., authentication and verification).

Once the MUA **2075** is satisfied with the public key, the MUA **2075** then encrypts the contents of the message with the received public key and sends it to the MTA **2100**. The MTA **2100** determines the IP Address of the recipient mobile wallet domain's MTA **2200**. In some examples, the MTA **2100** utilizes the IP Address previously determined from the DNS server (e.g., using the cache) when retrieving the public key of the recipient. For example, the PKS **2170** and MTA **2200** may have the same IP Address, or the IP Address of the MTA **2200** may be derivable from the IP Address of the PKS **2170**. In other examples a mobile wallet application in mobile wallet domain **2010** may have previously communicated with a mobile wallet application in mobile wallet domain **2030** (and thus the MTA **2100** still has the IP Address in its cache). In other examples, the MTA **2100** may re-request the IP Address from the DNS server **2135**.

The MTA **2100** then sends the message **2190** to the MTA **2200** of the mobile wallet management system **2130** of the recipient mobile wallet domain **2030** using the determined IP address. MTA **2200** may send a response to MTA **2100** (which may be forwarded to MUA—but this message is not shown for clarity). MTA **2200** may then send the message to the mobile wallet message storage agent (MSA) **2230**. Note that the mobile wallet management system **2120** may also employ a MSA, but it is not shown for clarity. MSA **2230** may then store the message and alert the MUA **2260** of the recipient mobile wallet application **2070** using a notification. When the MUA is interested in receiving the message, the MUA may request it and the MSA may provide it. The MUA may decrypt the message using its private key. The private key may be maintained in the key manager **2290**. Key manager **2290** may communicate with key keeper **2300**. Key keeper **2300** may be a remote key storage facility to prevent the loss of the cryptographic keys should the computing device **2050** experience a loss in data. For example, the key manager **2290** may store one or more keys of the mobile wallet application **2070** in the key keeper **2300**.

In some examples, the mobile wallet application **2070** may utilize a second cryptographic key to encrypt the private key. The private key may then be stored with the mobile wallet management system **2130** in encrypted form. The second cryptographic key may then be stored with the key keeper **2300** and utilized to decrypt the private key should the computing device **2050** need it. The key keeper **2300** may be under control of the user of computing device **2050**. This ensures that the private key is not given to the mobile wallet management system **2130** and thus the user can entrust that no one associated with the mobile wallet management system **2130** can access their messages.

FIG. **5** is a block diagram showing an example architecture **1000** of a mobile computing device. For example, the architecture **1000**, for example, may describe any of the computing devices described. The architecture **1000** comprises a processor unit **1014**. The processor unit **1014** may include one or more processors. Any of a variety of different types of commercially available processors suitable for mobile computing devices may be used (for example, an XScale architecture microprocessor, a Microprocessor without Interlocked Pipeline Stages (MIPS) architecture processor, or another type of processor). A memory **1020**, such as a Random Access Memory (RAM), a Flash memory, or other type of memory or data storage, is typically accessible to the processor. The memory **1020** may be adapted to store an operating system (OS) **1030**, as well as application programs **1040**. In some examples, the OS may implement software interrupts that cause the architecture **1120** to pause its current task and execute an interrupt service routine (ISR) when an interrupt is received.

The processor unit **1010** may be coupled, either directly or via appropriate intermediary hardware, to a display **1050** and to one or more input/output (I/O) devices **1060**, such as a keypad, a touch panel sensor, a microphone, and the like. Such I/O devices **1060** may include a touch sensor for capturing fingerprint data, a camera for capturing one or more images of the user, a retinal scanner, or any other suitable devices. Similarly, in some examples, the processor unit **1010** may be coupled to a transceiver **1070** that interfaces with an antenna **1090**. The transceiver **1070** may be configured to both transmit and receive cellular network signals, wireless data signals, or other types of signals via the antenna **1090**, depending on the nature of the mobile computing device implemented by the architecture **1100**. Although one transceiver **1070** is shown, in some examples, the architecture **1100** includes additional transceivers. For example, a wireless transceiver may be utilized to communicate according to an IEEE 802.11 specification, such as Wi-Fi and/or to a short range communication medium. Some short range communication mediums, such as NFC, may utilize a separate, dedicated transceiver. Further, in some configurations, a GPS receiver **1080** may also make use of the antenna **1090** to receive GPS signals. In addition to or instead of the GPS receiver **1080**, any suitable location-determining sensor may be included and/or used including, for example, a Wi-Fi positioning system. In some examples, the architecture (e.g., processor unit **1010**) may also support a hardware interrupt. In response to a hardware interrupt, the processor unit **1010** may pause its processing and execute an interrupt service routine (ISR). For example, the alert message **116** may include and/or trigger a hardware interrupt. The ISR for the hardware interrupt may generate the alert, for example, as described herein.

FIG. **6** is a block diagram **1100** showing one example of a software architecture **1102** for a computing device. The architecture **1102** maybe used in conjunction with various hardware architectures, for example, as described herein. FIG. **6** is merely a non-limiting example of a software architecture **1102** and many other architectures may be implemented to facilitate the functionality described herein. A representative hardware layer **1104** is illustrated and can represent, for example, any of the above referenced computing devices. In some examples, the hardware layer **1104** may be implemented according to the architecture **1102** of FIG. **11** and/or the architecture **1000** of FIG. **5**.

The representative hardware layer **1104** comprises one or more processing units **1106** having associated executable instructions **1108**. Executable instructions **1108** represent the executable instructions of the software architecture **1102**, including implementation of the methods, modules, components, and so forth of FIGS. **1-3**. Hardware layer **1104** also includes memory and/or storage modules **1110**, which also have executable instructions **1108**. Hardware layer **1104** may also comprise other hardware as indicated by other hardware **1112** which represents any other hardware of the hardware layer **1104**, such as the other hardware illustrated as part of hardware architecture **1200**.

In the example architecture of FIG. **11**, the software **1102** may be conceptualized as a stack of layers where each layer provides particular functionality. For example, the software

1102 may include layers such as an operating system **1114**, libraries **1116**, frameworks/middleware **1118**, applications **1120** and presentation layer **1144**. Operationally, the applications **1120** and/or other components within the layers may invoke application programming interface (API) calls **1124** through the software stack and receive a response, returned values, and so forth illustrated as messages **1126** in response to the API calls **1124**. The layers illustrated are representative in nature and not all software architectures have all layers. For example, some mobile or special purpose operating systems may not provide a frameworks/middleware layer **1118**, while others may provide such a layer. Other software architectures may include additional or different layers.

The operating system **1114** may manage hardware resources and provide common services. The operating system **1114** may include, for example, a kernel **1128**, services **1130**, and drivers **1132**. The kernel **1128** may act as an abstraction layer between the hardware and the other software layers. For example, the kernel **1128** may be responsible for memory management, processor management (e.g., scheduling), component management, networking, security settings, and so on. The services **1130** may provide other common services for the other software layers. In some examples, the services **1130** include an interrupt service. The interrupt service may detect the receipt of a hardware or software interrupt and, in response, cause the architecture **1102** to pause its current processing and execute an interrupt service routine (ISR) when an interrupt is received. The ISR may generate the alert, for example, as described herein.

The drivers **1132** may be responsible for controlling or interfacing with the underlying hardware. For instance, the drivers **1132** may include display drivers, camera drivers, Bluetooth® drivers, flash memory drivers, serial communication drivers (e.g., Universal Serial Bus (USB) drivers), Wi-Fi® drivers, NFC drivers, audio drivers, power management drivers, and so forth depending on the hardware configuration.

The libraries **1116** may provide a common infrastructure that may be utilized by the applications **1120** and/or other components and/or layers. The libraries **1116** typically provide functionality that allows other software modules to perform tasks in an easier fashion than to interface directly with the underlying operating system **1114** functionality (e.g., kernel **1128**, services **1130** and/or drivers **1132**). The libraries **1116** may include system **1134** libraries (e.g., C standard library) that may provide functions such as memory allocation functions, string manipulation functions, mathematic functions, and the like. In addition, the libraries **1116** may include API libraries **1136** such as media libraries (e.g., libraries to support presentation and manipulation of various media format such as MPEG4, H.264, MP3, AAC, AMR, JPG, PNG), graphics libraries (e.g., an OpenGL framework that may be used to render **2**D and **9**D in a graphic content on a display), database libraries (e.g., SQLite that may provide various relational database functions), web libraries (e.g., WebKit that may provide web browsing functionality), and the like. The libraries **1116** may also include a wide variety of other libraries **1138** to provide many other APIs to the applications **1120** and other software components/modules.

The frameworks **1118** (also sometimes referred to as middleware) may provide a higher-level common infrastructure that may be utilized by the applications **1120** and/or other software components/modules. For example, the frameworks **1118** may provide various graphic user interface (GUI) functions, high-level resource management, high-level location services, and so forth. The frameworks **1118** may provide a broad spectrum of other APIs that may be utilized by the applications **1120** and/or other software components/modules, some of which may be specific to a particular operating system or platform.

The applications **1120** includes built-in applications **1140** and/or third party applications **1142**. Examples of representative built-in applications **1140** may include, but are not limited to, a contacts application, a browser application, a book reader application, a location application, a media application, a messaging application, and/or a game application. Third party applications **1142** may include any of the built in applications as well as a broad assortment of other applications. In a specific example, the third party application **1142** (e.g., an application developed using the Android™ or iOS™ software development kit (SDK) by an entity other than the vendor of the particular platform) may be mobile software running on a mobile operating system such as iOS™, Android™, Windows® Phone, or other mobile computing device operating systems. In this example, the third party application **1142** may invoke the API calls **1124** provided by the mobile operating system such as operating system **1114** to facilitate functionality described herein.

The applications **1120** may utilize built in operating system functions (e.g., kernel **1128**, services **1130** and/or drivers **1132**), libraries (e.g., system **1134**, APIs **1136**, and other libraries **1138**), frameworks/middleware **1118** to create user interfaces to interact with users of the system. Alternatively, or additionally, in some systems interactions with a user may occur through a presentation layer, such as presentation layer **1144**. In these systems, the application/module "logic" can be separated from the aspects of the application/module that interact with a user.

Some software architectures utilize virtual machines. For example, systems described herein may be executed utilizing one or more virtual machines executed at one or more server computing machines. In the example of FIG. **11**, this is illustrated by virtual machine **1148**. A virtual machine creates a software environment where applications/modules can execute as if they were executing on a hardware computing device. A virtual machine is hosted by a host operating system (operating system **1114**) and typically, although not always, has a virtual machine monitor **1146**, which manages the operation of the virtual machine as well as the interface with the host operating system (i.e., operating system **1114**). A software architecture executes within the virtual machine such as an operating system **1150**, libraries **1152**, frameworks/middleware **1154**, applications **1156** and/or presentation layer **1158**. These layers of software architecture executing within the virtual machine **1148** can be the same as corresponding layers previously described or may be different.

FIG. **12** is a block diagram illustrating a computing device hardware architecture **1200**, within which a set or sequence of instructions can be executed to cause the machine to perform examples of any one of the methodologies discussed herein. For example, the architecture **1200** may execute the software architecture **1102** described with respect to FIG. **11**. The architecture **1200** may operate as a standalone device or may be connected (e.g., networked) to other machines. In a networked deployment, the architecture **1200** may operate in the capacity of either a server or a client machine in server-client network environments, or it may act as a peer machine in peer-to-peer (or distributed) network environments. The architecture **1200** can be implemented in a personal computer (PC), a tablet PC, a hybrid tablet, a set-top box (STB), a personal digital assistant (PDA), a mobile telephone, a web appliance, a network router, switch or bridge, or any machine capable of executing instructions (sequential or otherwise) that specify operations to be taken by that machine.

Example architecture **1200** includes a processor unit **1202** comprising at least one processor (e.g., a central processing unit (CPU), a graphics processing unit (GPU) or both, processor cores, compute nodes, etc.). The architecture **1200** may further comprise a main memory **1204** and a static memory **1206**, which communicate with each other via a link **1208** (e.g., bus). The architecture **1200** can further include a video display unit **1210**, an alphanumeric input device **1212** (e.g., a keyboard), and a user interface (UI) navigation device **1214** (e.g., a mouse). In some examples, the video display unit **1210**, input device **1212** and UI navigation device **1214** are incorporated into a touch screen display. The architecture **1200** may additionally include a storage device **1216** (e.g., a drive unit), a signal generation device **1218** (e.g., a speaker), a network interface device **1220**, and one or more sensors (not shown), such as a global positioning system (GPS) sensor, compass, accelerometer, or other sensor.

In some examples, the processor unit **1202** or other suitable hardware component may support a hardware interrupt. In response to a hardware interrupt, the processor unit **1202** may pause its processing and execute an interrupt service routine (ISR), for example, as described herein.

The storage device **1216** includes a machine-readable medium **1222** on which is stored one or more sets of data structures and instructions **1224** (e.g., software) embodying or utilized by any one or more of the methodologies or functions described herein. The instructions **1224** can also reside, completely or at least partially, within the main memory **1204**, static memory **1206**, and/or within the processor **1202** during execution thereof by the architecture **1200**, with the main memory **1204**, static memory **1206**, and the processor **1202** also constituting machine-readable media. Instructions stored at the machine-readable medium **1222** may include, for example, instructions for implementing the software architecture **1102**, instructions for executing any of the features described herein, etc.

While the machine-readable medium **1222** is illustrated in an example to be a single medium, the term "machine-readable medium" can include a single medium or multiple media (e.g., a centralized or distributed database, and/or associated caches and servers) that store the one or more instructions **1224**. The term "machine-readable medium" shall also be taken to include any tangible medium that is capable of storing, encoding or carrying instructions for execution by the machine and that cause the machine to perform any one or more of the methodologies of the present disclosure or that is capable of storing, encoding or carrying data structures utilized by or associated with such instructions. The term "machine-readable medium" shall accordingly be taken to include, but not be limited to, solid-state memories, and optical and magnetic media. Specific examples of machine-readable media include non-volatile memory, including, but not limited to, by way of example, semiconductor memory devices (e.g., electrically programmable read-only memory (EPROM), electrically erasable programmable read-only memory (EEPROM)) and flash memory devices; magnetic disks such as internal hard disks and removable disks; magneto-optical disks; and CD-ROM and DVD-ROM disks.

The instructions **1224** can further be transmitted or received over a communications network **1226** using a transmission medium via the network interface device **1220** utilizing any one of a number of well-known transfer protocols (e.g., HTTP). Examples of communication networks include a local area network (LAN), a wide area network (WAN), the Internet, mobile telephone networks, plain old telephone (POTS) networks, and wireless data networks (e.g., Wi-Fi, 3G, and 6G LTE/LTE-A or WiMAX networks). The term "transmission medium" shall be taken to include any intangible medium that is capable of storing, encoding, or carrying instructions for execution by the machine, and includes digital or analog communications signals or other intangible medium to facilitate communication of such software.

Various components are described in the present disclosure as being configured in a particular way. A component may be configured in any suitable manner. For example, a component that is or that includes a computing device may be configured with suitable software instructions that program the computing device. A component may also be configured by virtue of its hardware arrangement or in any other suitable manner.

The above description is intended to be illustrative, and not restrictive. For example, the above-described examples (or one or more aspects thereof) can be used in combination with others. Other embodiments can be used, such as by one of ordinary skill in the art upon reviewing the above description. The Abstract is to allow the reader to quickly ascertain the nature of the technical disclosure, for example, to comply with 37 C.F.R. § 1.72(b) in the United States of America. It is submitted with the understanding that it will not be used to interpret or limit the scope or meaning of the claims.

Also, in the above Detailed Description, various features can be grouped together to streamline the disclosure. However, the claims cannot set forth every feature disclosed herein as embodiments can feature a subset of said features. Further, embodiments can include fewer features than those disclosed in a particular example. Thus, the following claims are hereby incorporated into the Detailed Description, with a claim standing on its own as a separate embodiment. The scope of the embodiments disclosed herein is to be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled.

The invention claimed is:

1. A method for operating a point of sale (POS) terminal, the method comprising:

establishing, by the POS terminal and via a first network connection, communication between the POS terminal and a mobile computing device;

providing an indication to the mobile computing device that payment is requested;

receiving from the mobile computing device, via the first network connection, a plurality of payment elements that may be used for the payment and an indication that at least one payment element of the plurality of payment elements allows direct payment authorization to the POS terminal;

receiving from the mobile computing device, via the first network connection, fees associated with directly processing via a mobile wallet network associated with the mobile computing device;

- receiving from the mobile computing device an indication that the mobile computing device can process an invoice directly by an issuer of the at least one payment element;
- determining fees associated with other networks available to POS terminal;
- comparing the fees associated with directly processing via the mobile wallet network with the fees associated with the other networks available to POS terminal;
- in response to the comparison, sending to the mobile computing device, via the first network connection, a discount on a direct payment associated with the at least one payment element that allows direct payment authorization from the POS terminal;
- determining if the invoice should be processed through the mobile wallet network or through a network associated with the POS terminal based on the comparison; and
- in response to determining that the invoice should be invoiced through the mobile wallet network, sending the invoice to the mobile computing device where a second network connection is established with an issuer and the invoice is sent via the second network connection.

2. The method of claim **1**, the method further comprising receiving a payment relating to a purchase.

3. The method of claim **2**, the method further comprising determining incentives to be applied to the purchase.

4. The method of claim **1**, wherein the first network connection is a near field communication network connection.

5. The method of claim **1**, wherein the second network connection is between the mobile computing device and the issuer.

6. The method of claim **1**, further comprising receiving from the mobile computing device, fee information associated with processing a payment.

7. The method of claim **1**, wherein the POS terminal determines if the invoice should be processed through the network associated with the mobile computing device or through the network associated with the POS terminal based on a cost associated with each of the network associated with the mobile computing device and the network associated with the POS terminal.

8. A point of sale (POS) terminal comprising:

- at least one processor unit:
- and a memory in communication with the at least one processor unit, the memory including instructions that, when executed by the at least one processor unit, cause the at least one processor unit to perform operations comprising:
  - establishing, by the POS terminal and via a first network connection, communication between the POS terminal and a mobile computing device;
  - providing an indication to the mobile computing device that payment is requested;
  - receiving from the mobile computing device, via the first network connection, a plurality of payment elements that may be used for the payment and an indication that at least one payment element of the plurality of payment elements allows direct payment authorization to the POS terminal;
  - receiving from the mobile computing device, via the first network connection, fees associated with directly processing via a mobile wallet network associated with the mobile computing device;

  - receiving from the mobile computing device an indication that the mobile computing device can process an invoice directly by an issuer of the at least one payment element;
  - determining fees associated with other networks available to POS terminal;
  - comparing the fees associated with directly processing via the mobile wallet network with the fees associated with the other networks available to POS terminal;
  - in response to the comparison, sending to the mobile computing device, via the first network connection, a discount on a direct payment associated with the at least one payment element that allows direct payment authorization from the POS terminal;
  - determining if the invoice should be processed through the mobile wallet network or through a network associated with the POS terminal based on the comparison; and
  - in response to determining that the invoice should be invoiced through the mobile wallet network, sending the invoice to the mobile computing device where a second network connection is established with an issuer and the invoice is sent via the second network connection.

9. The POS terminal of claim **8**, the operations further comprising receiving a payment relating to a purchase.

10. The POS terminal of claim **9**, the operations further comprising determining incentives to be applied to the purchase.

11. The POS terminal of claim **8**, wherein the first network connection is a near field communication network connection.

12. The POS terminal of claim **8**, wherein the second network connection is between the mobile computing device and the issuer.

13. The POS terminal of claim **8**, the operations further comprising receiving from the mobile computing device, fee information associated with processing a payment.

14. The POS terminal of claim **8**, the operations further comprising determining if the invoice should be processed through the network associated with the mobile computing device or through the network associated with the POS terminal based on a cost associated with each of the network associated with the mobile computing device and the network associated with the POS terminal.

15. A non-transitory machine-readable medium comprising instructions thereon that, when executed by at least one processor unit of a point of sale (POS) terminal, causes the at least one processor unit to perform operations comprising:

- establishing, by the POS terminal and via a first network connection, communication between the POS terminal and a mobile computing device;
- providing an indication to the mobile computing device that payment is requested;
- receiving from the mobile computing device, via the first network connection, a plurality of payment elements that may be used for the payment and an indication that at least one payment element of the plurality of payment elements allows direct payment authorization to the POS terminal;
- receiving from the mobile computing device, via the first network connection, fees associated with directly processing via a mobile wallet network associated with the mobile computing device;

receiving from the mobile computing device an indication that the mobile computing device can process an invoice directly by an issuer of the at least one payment element;

determining fees associated with other networks available to POS terminal;

comparing the fees associated with directly processing via the mobile wallet network with the fees associated with the other networks available to POS terminal;

in response to the comparison, sending to the mobile computing device, via the first network connection, a discount on a direct payment associated with the at least one payment element that allows direct payment authorization from the POS terminal;

determining if the invoice should be processed through the mobile wallet network or through a network associated with the POS terminal based on the comparison; and

in response to determining that the invoice should be invoiced through the mobile wallet network, sending the invoice to the mobile computing device where a second network connection is established with an issuer and the invoice is sent via the second network connection.

16. The non-transitory machine-readable medium of claim **15**, the operations further comprising:

receiving a payment relating to a purchase; and

determining incentives to be applied to the purchase.

17. The non-transitory machine-readable medium of claim **15**, wherein the first network connection is a near field communication network connection.

18. The non-transitory machine-readable medium of claim **15**, wherein the second network connection is between the mobile computing device and the issuer.

19. The non-transitory machine-readable medium of claim **15**, the operations further comprising receiving from the mobile computing device, fee information associated with processing a payment.

20. The non-transitory machine-readable medium of claim **15**, the operations further comprising determining if the invoice should be processed through the network associated with the mobile computing device or through the network associated with the POS terminal based on a cost associated with each of the network associated with the mobile computing device and the network associated with the POS terminal.

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