

METHOD AND SYSTEM FOR MERCHANT ACCEPTANCE OF CRYPTOCURRENCY VIA PAYMENT RAILS

FIELD

[0001] The present disclosure relates to acceptance of blockchain payment at a traditional point of sale device, specifically the use of traditional payment rails and point of sale devices while enabling payment via a blockchain transaction for a fiat transaction through the use of issuer processing of a blockchain transaction.

BACKGROUND

[0002] Blockchain was initially created as a storage mechanism for use in conducting payment transactions with a cryptographic currency. Using a blockchain provides a number of benefits, such as decentralization, distributed computing, transparency regarding transactions, and yet also providing anonymity as to the individuals or entities involved in a transaction. As a result, many consumers may be interested in using blockchain as a payment method for transactions. However, traditionally, merchants have been required to provide new point of sale devices that are interfaced with computing devices that are suitable for accepting blockchain payments, through the merchant's own blockchain wallet. This high barrier for entry has resulted in a minimal number of merchants enabling acceptance of blockchain payments.

[0003] Thus, there is a need for a technical system that can enable a consumer to use blockchain to pay for a transaction while utilizing legacy point of sale systems.

SUMMARY

[0004] The present disclosure provides a description of systems and methods for acceptance of a blockchain payment at a traditional point of sale device through issuer processing. A fiat payment transaction can proceed as normal, with the consumer presenting a payment card that is read from a legacy point of sale device and an authorization request submitted through payment rails. When the authorization request arrives at the issuer, the issuer can identify that payment via blockchain is possible, and may initiate a blockchain transaction for payment of an equivalent amount to a cryptocurrency exchange. The transaction is completed at the point of sale through traditional methods, while the cryptocurrency exchange settles with the issuer for the proper transaction amount, which can be settled with the acquirer and merchant using standard processes. The result is that payment is made by the consumer via cryptocurrency through their issuer, while the merchant and acquirer participate in the transaction using standard devices and systems and receive traditional, fiat settlement. Thus, a consumer can pay for a fiat transaction with cryptocurrency while utilizing legacy point of sale devices and systems for merchants, enabling any merchant to accept cryptocurrency payment without making any modifications to their existing systems.

[0005] A method for acceptance of blockchain payment at a traditional point of sale device through issuer processing includes: receiving, by a receiver of a processing server, an authorization request for a fiat payment transaction originating from a point of sale device and routed through a payment network, wherein the authorization

request includes at least a transaction account number and a transaction amount; identifying, by a processor of the processing server, blockchain payment acceptance for a transaction account associated with the transaction account number; receiving, by the receiver of the processing server, a destination address for an electronic wallet associated with a blockchain network; transmitting, by a transmitter of the processing server, a new blockchain transaction to a blockchain node in the blockchain network, the new blockchain transaction including at least the destination address, a cryptocurrency amount based on the transaction amount, a digital signature, and one or more unspent transaction outputs; receiving, by the receiver of the processing server, a transaction identifier from the blockchain node; and transmitting, by the transmitter of the processing server, an authorization response for the fiat payment transaction to the payment network for routing to the point of sale device, wherein the authorization response includes an indication of approval of the fiat payment transaction and the transaction identifier.

[0006] A system for acceptance of blockchain payment at a traditional point of sale device through issuer processing includes: a payment network; a blockchain network comprised of a plurality of blockchain nodes; a point of sale device; and a processing server, the processing server including a receiver receiving an authorization request for a fiat payment transaction originating from the point of sale device and routed through the payment network, wherein the authorization request includes at least a transaction account number and a transaction amount, a processor identifying blockchain payment acceptance for a transaction account associated with the

transaction account number, and a transmitter, wherein the receiver further receives a destination address for an electronic wallet associated with a blockchain network, the transmitter transmits a new blockchain transaction to one of the plurality of blockchain nodes in the blockchain network, the new blockchain transaction including at least the destination address, a cryptocurrency amount based on the transaction amount, a digital signature, and one or more unspent transaction outputs, the receiver receives a transaction identifier from the one of the plurality of blockchain nodes, and the transmitter transmits an authorization response for the fiat payment transaction to the payment network for routing to the point of sale device, wherein the authorization response includes an indication of approval of the fiat payment transaction and the transaction identifier.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

[0007] The scope of the present disclosure is best understood from the following detailed description of exemplary embodiments when read in conjunction with the accompanying drawings. Included in the drawings are the following figures:

[0008] FIG. 1 is a block diagram illustrating a high level system architecture for acceptance of blockchain payments at a traditional point of sale device in accordance with exemplary embodiments.

[0009] FIG. 2 is a block diagram illustrating the processing server of the system of FIG. 1 for acceptance of blockchain payments in accordance with exemplary embodiments.

[0010] FIGS. 3A and 3B are a flow diagram illustrating a process for acceptance of blockchain payments at a traditional point of sale device in the system of FIG. 1 in accordance with exemplary embodiments.

[0011] FIG. 4 is a flow chart illustrating an exemplary method for acceptance of blockchain payment at a traditional point of sale device in accordance with exemplary embodiments.

[0012] FIG. 5 is a block diagram illustrating a computer system architecture in accordance with exemplary embodiments.

[0013] Further areas of applicability of the present disclosure will become apparent from the detailed description provided hereinafter. It should be understood that the detailed description of exemplary embodiments are intended for illustration purposes only and are, therefore, not intended to necessarily limit the scope of the disclosure.

DETAILED DESCRIPTION

Glossary of Terms

[0014] Blockchain – A public ledger of all transactions of a blockchain-based currency. One or more computing devices may comprise a blockchain network, which may be configured to process and record transactions as part of a block in the blockchain. Once a block is completed, the block is added to the blockchain and the transaction record thereby updated. In many instances, the blockchain may be a ledger of transactions in chronological order, or may be presented in any other order that may be suitable for use by the blockchain network. In some configurations, transactions recorded in the blockchain may include a destination address and a currency amount,

such that the blockchain records how much currency is attributable to a specific address. In some instances, the transactions are financial and others not financial, or might include additional or different information, such as a source address, timestamp, etc. In some embodiments, a blockchain may also or alternatively include nearly any type of data as a form of transaction that is or needs to be placed in a distributed database that maintains a continuously growing list of data records hardened against tampering and revision, even by its operators, and may be confirmed and validated by the blockchain network through proof of work and/or any other suitable verification techniques associated therewith. In some cases, data regarding a given transaction may further include additional data that is not directly part of the transaction appended to transaction data. In some instances, the inclusion of such data in a blockchain may constitute a transaction. In such instances, a blockchain may not be directly associated with a specific digital, virtual, fiat, or other type of currency.

[0015] Payment Network – A system or network used for the transfer of money via the use of cash-substitutes for thousands, millions, and even billions of transactions during a given period. Payment networks may use a variety of different protocols and procedures in order to process the transfer of money for various types of transactions. Transactions that may be performed via a payment network may include product or service purchases, credit purchases, debit transactions, fund transfers, account withdrawals, etc. Payment networks may be configured to perform transactions via cash-substitutes, which may include payment cards, letters of credit, checks, transaction accounts, etc. Examples of networks or systems configured to perform as

payment networks include those operated by Mastercard®, VISA®, Discover®, American Express®, PayPal®, etc. Use of the term “payment network” herein may refer to both the payment network as an entity, and the physical payment network, such as the equipment, hardware, and software comprising the payment network.

[0016] Transaction Account – A financial account that may be used to fund a transaction, such as a checking account, savings account, credit account, virtual payment account, etc. A transaction account may be associated with a consumer, which may be any suitable type of entity associated with a payment account, which may include a person, family, company, corporation, governmental entity, etc. In some instances, a transaction account may be virtual, such as those accounts operated by PayPal®, etc.

[0017] Payment Card – A card or data associated with a transaction account that may be provided to a merchant in order to fund a financial transaction via the associated transaction account. Payment cards may include credit cards, debit cards, charge cards, stored-value cards, prepaid cards, fleet cards, virtual payment numbers, virtual card numbers, controlled payment numbers, etc. A payment card may be a physical card that may be provided to a merchant, or may be data representing the associated transaction account (e.g., as stored in a communication device, such as a smart phone or computer). For example, in some instances, data including a payment account number may be considered a payment card for the processing of a transaction funded by the associated transaction account. In some instances, a check may be considered a payment card where applicable.

[0018] Merchant – An entity that provides products (e.g., goods and/or services) for purchase by another entity, such as a consumer or another merchant. A merchant may be a consumer, a retailer, a wholesaler, a manufacturer, or any other type of entity that may provide products for purchase as will be apparent to persons having skill in the relevant art. In some instances, a merchant may have special knowledge in the goods and/or services provided for purchase. In other instances, a merchant may not have or require any special knowledge in offered products. In some embodiments, an entity involved in a single transaction may be considered a merchant. In some instances, as used herein, the term “merchant” may refer to an apparatus or device of a merchant entity.

[0019] Issuer – An entity that establishes (e.g., opens) a letter or line of credit in favor of a beneficiary, and honors drafts drawn by the beneficiary against the amount specified in the letter or line of credit. In many instances, the issuer may be a bank or other financial institution authorized to open lines of credit. In some instances, any entity that may extend a line of credit to a beneficiary may be considered an issuer. The line of credit opened by the issuer may be represented in the form of a payment account, and may be drawn on by the beneficiary via the use of a payment card. An issuer may also offer additional types of payment accounts to consumers as will be apparent to persons having skill in the relevant art, such as debit accounts, prepaid accounts, electronic wallet accounts, savings accounts, checking accounts, etc., and may provide consumers with physical or non-physical means for accessing and/or utilizing such an account, such as debit cards, prepaid cards, automated teller machine cards, electronic wallets, checks, etc.

[0020] Acquirer – An entity that may process payment card transactions on behalf of a merchant. The acquirer may be a bank or other financial institution authorized to process payment card transactions on a merchant's behalf. In many instances, the acquirer may open a line of credit with the merchant acting as a beneficiary. The acquirer may exchange funds with an issuer in instances where a consumer, which may be a beneficiary to a line of credit offered by the issuer, transacts via a payment card with a merchant that is represented by the acquirer.

[0021] Payment Transaction – A transaction between two entities in which money or other financial benefit is exchanged from one entity to the other. The payment transaction may be a transfer of funds, for the purchase of goods or services, for the repayment of debt, or for any other exchange of financial benefit as will be apparent to persons having skill in the relevant art. In some instances, payment transactions may refer to transactions funded via a payment card and/or payment account, such as credit card transactions. Such payment transactions may be processed via an issuer, payment network, and acquirer. The process for processing such a payment transaction may include at least one of authorization, batching, clearing, settlement, and funding. Authorization may include the furnishing of payment details by the consumer to a merchant, the submitting of transaction details (e.g., including the payment details) from the merchant to their acquirer, and the verification of payment details with the issuer of the consumer's payment account used to fund the transaction. Batching may refer to the storing of an authorized transaction in a batch with other authorized transactions for distribution to an acquirer. Clearing may include the sending of batched transactions from the acquirer to a payment network for

processing. Settlement may include the debiting of the issuer by the payment network for transactions involving beneficiaries of the issuer. In some instances, the issuer may pay the acquirer via the payment network. In other instances, the issuer may pay the acquirer directly. Funding may include payment to the merchant from the acquirer for the payment transactions that have been cleared and settled. It will be apparent to persons having skill in the relevant art that the order and/or categorization of the steps discussed above performed as part of payment transaction processing.

System for Blockchain Payments at a Traditional Point of Sale

[0022] FIG. 1 illustrates a system 100 for the use of a blockchain for payment of a fiat payment transaction conducted using a traditional point of sale device and transaction messaging utilizing a card-based payment network.

[0023] The system 100 may include an issuer processing server 102, also referred to herein as a “processing server” 102. The issuer processing server 102, discussed in more detail below, may be configured to facilitate the use of a cryptographic currency, also referred to herein as a “cryptocurrency,” for payment of a fiat payment transaction submitted through payment rails via a blockchain transaction. In the system 100, an issuing financial institution associated with the issuing processing server 102 may issue a transaction account to a consumer 104. The transaction account may be a fiat transaction account that can be used to fund standard (e.g., for fiat currency) electronic payment transactions via the use of a payment card 106 issued to the consumer 104 that is encoded with payment details for the associated transaction account. The consumer 104 may present the payment card 106 to a point of sale

device 108 to fund a fiat payment transaction via the associated transaction account, using traditional transaction processing.

[0024] In a traditional, fiat payment transaction, the point of sale device 108 reads the payment details from the payment card 106 using any suitable method, where the payment details may include at least a transaction account number for the associated transaction account. Additional payment details may include, for instance, a name, expiration date, security code, application cryptogram, etc. The point of sale device 108 may provide the payment details and additional transaction data for the payment transaction to an acquirer processing server 110, which may be operated or otherwise associated with an acquiring financial institution, such as one that has issued a transaction account to the merchant of the point of sale device 108 for use in receiving funds as part of fiat payment transactions. The acquirer processing server 110 may generate an authorization request for the fiat payment transaction, where the authorization request is a type of transaction message, which is a specially formatted data message that is formatted for transmission via payment rails and processing via a payment network 112. An authorization request or a transaction message may be formatted pursuant to one or more standards governing the exchange of financial transaction messages, such as the International Organization of Standardization's ISO 8583 or ISO 20022 standards. An authorization request may be a type of a transaction message as designated by a message type indicator included therein. The authorization request may include a plurality of data elements that store data as indicated in the applicable standard(s), such as including the transaction account number, other payment details, a transaction amount, a currency code, a transaction

time, a transaction date, a merchant identifier, a point of sale identifier, product data, offer data, reward data, loyalty data, etc.

[0025] The authorization request may be submitted to a payment network 112 for processing through payment rails associated therewith. In some cases, the authorization request may be routed through a gateway processor or other intermediate entity between the acquirer processing server 110 and the payment network 112, through the payment rails. The payment network 112 may perform any value-added services with respect to the authorization request, such as account mapping, fraud scoring, etc., and may route the authorization request to the issuer processing server 102 via the payment rails, where the issuer processing server 102 may be identified using the transaction account number. For example, the transaction account number may include an issuer identification number therein, which may be used by the payment network 112 to identify the issuer processing server 102 and route the authorization request thereto.

[0026] In a traditional fiat payment transaction, the issuer processing server 102 would identify the transaction account used by the consumer 104, based on the transaction account number, and approve or deny the fiat payment transaction using traditional methods and return an authorization response to the payment network 112 via the payment rails. In the system 100, the issuer processing server 102 may identify the transaction account using the transaction account number and identify that the transaction account is eligible for payment of the fiat payment transaction through a blockchain using a cryptocurrency associated therewith. In the system 100, the consumer 104 may register their transaction account for blockchain payment

acceptance with the issuer processing server 102 using any suitable method, such as during issuance of the transaction account or later on, such as via a banking application program, a web page associated with the issuer processing server 102, etc. As part of the registration of the transaction account, the consumer 104 may provide the issuer processing server 102 with a blockchain wallet, discussed in more detail below, for use in cryptocurrency payments or may authorize the issuer processing server 102 to use its own blockchain wallet for cryptocurrency payments, which may be settled with the consumer's transaction account through fiat currency or a cryptocurrency balance.

[0027] In some cases, when the issuer processing server 102 determines that the consumer 104 has registered for blockchain payment acceptance, the issuer processing server 102 may request permission for blockchain payment from the consumer 104, such as through a computing device associated with the consumer 104. For example, a short message service message may be transmitted to a computing device of the consumer 104, where the consumer 104 may respond thereto with authorization, or denial, for payment of the fiat payment transaction through cryptocurrency. In other cases, the consumer 104 may provide authorization for blockchain payment prior to initiating the payment transaction with the point of sale device 108, such as through an electronic banking application program on their computing device.

[0028] In order to facilitate payment via cryptocurrency, the issuer processing server 102 must identify a cryptocurrency exchange that is willing to accept cryptocurrency payment in exchange for settlement via a fiat currency. In some embodiments, the

issuer processing server 102 may contact an exchange server 114 associated with a cryptocurrency exchange directly. In other embodiments, a third party service may be configured to identify suitable cryptocurrency exchanges for the issuer processing server 102, such as may be offered by the payment network 112. In such embodiments, the payment network 112 (e.g., or other third party) may be contacted by the issuer processing server 102 and may contact one or more exchange servers 114 and receive exchange rates and blockchain addresses therefrom. Exchange rates may be currency exchange rates between the fiat currency used in the fiat payment transaction and the cryptocurrency used by the exchange server 114. The blockchain address may be a destination address for a blockchain transaction using the blockchain that is used for transactions in the cryptocurrency used by the exchange server 114. The payment network 112 may then provide the exchange rate and blockchain address data to the issuer processing server 102. If information for more than one exchange server 114 is provided to the issuer processing server 102, the issuer processing server 102 may choose an exchange server 114 to use (e.g., based on the most favorable exchange rate for the consumer 104). If the issuer processing server 102 does not utilize a third party service, the issuer processing server 102 may query exchange servers 114 for exchange rates and blockchain addresses directly.

[0029] Once the issuer processing server 102 has identified an exchange server 114 with which to transact in cryptocurrency, the issuer processing server 102 may submit a new blockchain transaction to a blockchain network 116 that manages the cryptocurrency through which the blockchain transaction is to be conducted. The

blockchain network 116 may be comprised of a plurality of blockchain nodes. Each blockchain node may be a computing system, such as illustrated in FIG. 5, discussed in more detail below, that is configured to perform functions related to the processing and management of the blockchain, including the generation of blockchain data values, verification of proposed blockchain transactions, verification of digital signatures, generation of new blocks, validation of new blocks, and maintenance of a copy of the blockchain. In some embodiments, the payment network 112 may operate one or more nodes of the blockchain network 116. In some cases, the exchange server 114 may be a blockchain node in the associated blockchain network 116.

[0030] The blockchain may be a distributed ledger that is comprised of at least a plurality of blocks. Each block may include at least a block header and one or more data values. Each block header may include at least a timestamp, a block reference value, and a data reference value. The timestamp may be a time at which the block header was generated, and may be represented using any suitable method (e.g., UNIX timestamp, DateTime, etc.). The block reference value may be a value that references an earlier block (e.g., based on timestamp) in the blockchain. In some embodiments, a block reference value in a block header may be a reference to the block header of the most recently added block prior to the respective block. In an exemplary embodiment, the block reference value may be a hash value generated via the hashing of the block header of the most recently added block. The data reference value may similarly be a reference to the one or more data values stored in the block that includes the block header. In an exemplary embodiment, the data reference value may be a hash value generated via the hashing of the one or more data values. For

instance, the block reference value may be the root of a Merkle tree generated using the one or more data values.

[0031] The use of the block reference value and data reference value in each block header may result in the blockchain being immutable. Any attempted modification to a data value would require the generation of a new data reference value for that block, which would thereby require the subsequent block's block reference value to be newly generated, further requiring the generation of a new block reference value in every subsequent block. This would have to be performed and updated in every single node in the blockchain network 116 prior to the generation and addition of a new block to the blockchain in order for the change to be made permanent. Computational and communication limitations may make such a modification exceedingly difficult, if not impossible, thus rendering the blockchain immutable.

[0032] In some embodiments, the blockchain may be used to store information regarding blockchain transactions conducted between two different blockchain wallets. A blockchain wallet may include a private key of a cryptographic key pair that is used to generate digital signatures that serve as authorization by a payer for a blockchain transaction, where the digital signature can be verified by the blockchain network 116 using the public key of the cryptographic key pair. In some cases, the term "blockchain wallet" may refer specifically to the private key. In other cases, the term "blockchain wallet" may refer to a computing device (e.g., issuer processing server 102 and exchange server 114) that stores the private key for use thereof in blockchain transactions. For instance, each computing device may each have their own private key for respective cryptographic key pairs, and may each be a blockchain wallet for

use in transactions with the blockchain associated with the blockchain network.

Computing devices may be any type of device suitable to store and utilize a blockchain wallet, such as a desktop computer, laptop computer, notebook computer, tablet computer, cellular phone, smart phone, smart watch, smart television, wearable computing device, implantable computing device, etc.

[0033] Each blockchain data value stored in the blockchain may correspond to a blockchain transaction or other storage of data, as applicable. A blockchain transaction may consist of at least: a digital signature of the sender of currency (e.g., the issuer processing server 102) that is generated using the sender's private key, a blockchain address of the recipient of currency (e.g., the exchange server 114) generated using the recipient's public key, and a blockchain currency amount that is transferred or other data being stored. In some blockchain transactions, the transaction may also include one or more blockchain addresses of the sender where blockchain currency is currently stored (e.g., where the digital signature proves their access to such currency), as well as an address generated using the sender's public key for any change that is to be retained by the sender. Addresses to which cryptographic currency has been sent that can be used in future transactions are referred to as "output" addresses, as each address was previously used to capture output of a prior blockchain transaction, also referred to as "unspent transactions," due to there being currency sent to the address in a prior transaction where that currency is still unspent. In some cases, a blockchain transaction may also include the sender's public key, for use by an entity in validating the transaction.

[0034] For the traditional processing of a blockchain transaction, such data may be provided to a blockchain node in the blockchain network 104, either by the sender or the recipient. The node may verify the digital signature using the public key in the cryptographic key pair of the sender's wallet and also verify the sender's access to the funds (e.g., that the unspent transactions have not yet been spent and were sent to address associated with the sender's wallet), a process known as "confirmation" of a transaction, and then include the blockchain transaction in a new block. The new block may be validated by other nodes in the blockchain network 116 before being added to the blockchain and distributed to all of the blockchain nodes in the blockchain network 116 in traditional blockchain implementations. In cases where a blockchain data value may not be related to a blockchain transaction, but instead the storage of other types of data, blockchain data values may still include or otherwise involve the validation of a digital signature.

[0035] In the system 100, the issuer processing server 102 may submit a blockchain transaction to a node in the blockchain network 116 for payment of a suitable amount of cryptocurrency (e.g., based on the transaction amount in the fiat payment transaction and the exchange rate offered by the exchange server 114) from a blockchain wallet associated with the consumer's transaction account or the issuer processing server 102 generally for payment to a blockchain wallet of the exchange server 114. The blockchain transaction may include the cryptocurrency amount, the blockchain address for receipt by the exchange server 114, one or more unspent transaction outputs, and a digital signature generated using the private key of the blockchain wallet from which payment is being made. In an exemplary embodiment,

the private key and unspent transaction outputs may be stored in an account profile for the consumer's transaction account, such as identified using the transaction account number included in the authorization request routed to the issuer processing server 102 via the payment rails. The node in the blockchain network 116 may receive the blockchain transaction and process the blockchain transaction using traditional methods, such as by confirming the transaction and including it in a new block that is confirmed by other nodes in the blockchain network 116 and then added to the blockchain. As part of the processing of the blockchain transaction, the node may identify a transaction identifier, which is a unique value for the blockchain transaction, which may be returned to the issuer processing server 102 as confirmation of the blockchain transaction. In some embodiments, the issuer processing server 102 may await posting of the blockchain transaction in the blockchain and identify the transaction identifier therefrom.

[0036] After successful processing of the blockchain transaction, the issuer processing server 102 may provide the exchange server 114 with a notification of the successful cryptocurrency payment thereto, such as by providing the transaction identifier to the exchange server 114. In embodiments where a third party service is utilized, the third party service (e.g., the payment network 112) may provide the notification to the exchange server 114, such as on behalf of the issuer processing server 102. With successful processing of the cryptocurrency payment to the exchange server 114, the issuer processing server 102 may return an authorization response to the payment network 112 for the fiat payment transaction that indicates that the fiat payment transaction is approved. The authorization response may be a transaction message

that includes a message type indicator indicative of an authorization response, where the data element stored therein may include a data element that stores a response code indicating approval of the fiat payment transaction. In some cases, the transaction identifier for the blockchain transaction may be included in the authorization response. In such cases, the transaction identifier may be stored in a data element that is reserved in the applicable standard(s) for private use, such as data element 123 in ISO 8583. The payment network 112 may receive the authorization response from the issuer processing server 102 via the payment rails and may route the authorization response back to the acquirer processing server 102 using the payment rails.

[0037] The acquirer processing server 110 may receive the authorization response and provide a notification (e.g., as the authorization response or separate therefrom) to the point of sale device 108 that the fiat payment transaction was approved. The merchant may then provide the consumer 104 with the transacted-for goods or services.

[0038] Following completion of the processing of the fiat payment transaction, the exchange server 114 may perform settlement with the issuer processing server 102. Settlement may include providing the issuer processing server 102 with the fiat transaction amount based on the cryptocurrency payment made to the exchange server 114, using the exchange rate provided by the exchange server 114. In cases where the cryptocurrency payment was made directly from a blockchain wallet of the consumer 104, the consumer's account may accurately reflect the transaction as a result of the cryptocurrency payment. In cases where the issuer processing server

102 used its own blockchain wallet, the issuer processing server 102 may debit the consumer's fiat transaction account for the appropriate fiat transaction amount. The issuing financial institution may also provide fiat payment to the acquiring financial institution as part of traditional settlement between the financial institutions. The acquiring financial institution may credit the merchant's transaction account accordingly.

[0039] The result is that payment may be made for a fiat payment transaction through a cryptocurrency, while the point of sale device 108 and acquirer processing server 110 perform standard processes for a fiat payment transaction using standard devices and systems. Thus, payment can be made using a cryptocurrency on legacy point of sale devices 108 and through legacy acquirer processing servers 110 using the payment rails of the payment network 112. The consumer 104 is free to use their payment card 106 issued on their fiat transaction account for cryptocurrency payments and may do so at every merchant regardless of direct blockchain acceptance by the merchant, as the merchant and acquirer receive settlement for the transaction through fiat currency. Accordingly, the methods and systems discussed herein solve the problems of merchants and acquirers accepting payment via cryptocurrency by enabling the consumer to pay with cryptocurrency without the merchant or acquirer having to be involved and on legacy systems.

Issuer Processing Server

[0040] FIG. 2 illustrates an embodiment of the issuer processing server 102 in the system 100. It will be apparent to persons having skill in the relevant art that the embodiment of the issuer processing server 102 illustrated in FIG. 2 is provided as

illustration only and may not be exhaustive to all possible configurations of the issuer processing server 102 suitable for performing the functions as discussed herein. For example, the computer system 500 illustrated in FIG. 5 and discussed in more detail below may be a suitable configuration of the issuer processing server 102. In some cases, payment networks 112, exchange servers 114, blockchain networks 116, and acquirer processing servers 110 may include components as illustrated in FIG. 2 and be configured to perform the functions discussed herein.

[0041] The issuer processing server 102 may include a receiving device 202. The receiving device 202 may be configured to receive data over one or more networks via one or more network protocols. In some instances, the receiving device 202 may be configured to receive data from payment networks 112, exchange servers 114, blockchain networks 116, and other systems and entities via one or more communication methods, such as radio frequency, local area networks, wireless area networks, cellular communication networks, Bluetooth, the Internet, etc. In some embodiments, the receiving device 202 may be comprised of multiple devices, such as different receiving devices for receiving data over different networks, such as a first receiving device for receiving data over a local area network and a second receiving device for receiving data via the Internet. The receiving device 202 may receive electronically transmitted data signals, where data may be superimposed or otherwise encoded on the data signal and decoded, parsed, read, or otherwise obtained via receipt of the data signal by the receiving device 202. In some instances, the receiving device 202 may include a parsing module for parsing the received data signal to obtain the data superimposed thereon. For example, the receiving device

202 may include a parser program configured to receive and transform the received data signal into usable input for the functions performed by the processing device to carry out the methods and systems described herein.

[0042] The receiving device 202 may be configured to receive data signals electronically transmitted by payment networks 112 that are transmitted via payment rails and superimposed or otherwise encoded with transaction messages, such as authorization requests for fiat payment transactions, or with data regarding cryptocurrency exchanges, such as exchange rates and destination blockchain addresses. The receiving device 202 may also be configured to receive data signals electronically transmitted by exchange servers 114, which may be superimposed or otherwise encoded with exchange rates and address information. The receiving device 202 may be further configured to receive data signals electronically transmitted by blockchain networks 116, such as via blockchain nodes included therein, that may be superimposed or otherwise encoded with transaction identifiers or other data regarding the processing of blockchain transactions.

[0043] The issuer processing server 102 may also include a communication module 204. The communication module 204 may be configured to transmit data between modules, engines, databases, memories, and other components of the issuer processing server 102 for use in performing the functions discussed herein. The communication module 204 may be comprised of one or more communication types and utilize various communication methods for communications within a computing device. For example, the communication module 204 may be comprised of a bus, contact pin connectors, wires, etc. In some embodiments, the communication module

204 may also be configured to communicate between internal components of the issuer processing server 102 and external components of the issuer processing server 102, such as externally connected databases, display devices, input devices, etc. The issuer processing server 102 may also include a processing device. The processing device may be configured to perform the functions of the issuer processing server 102 discussed herein as will be apparent to persons having skill in the relevant art. In some embodiments, the processing device may include and/or be comprised of a plurality of engines and/or modules specially configured to perform one or more functions of the processing device, such as a querying module 214, generation module 216, transaction processing module 218, etc. As used herein, the term “module” may be software or hardware particularly programmed to receive an input, perform one or more processes using the input, and provides an output. The input, output, and processes performed by various modules will be apparent to one skilled in the art based upon the present disclosure.

[0044] The processing server 102 may include an account database 206. The account database 206 may be configured to store a plurality of account profiles 208 using a suitable data storage format and schema. The account database 206 may be a relational database that utilizes structured query language for the storage, identification, modifying, updating, accessing, etc. of structured data sets stored therein. Each account profile 208 may be a structured data set configured to store data related to a transaction account. An account profile 208 may include, for instance, a transaction account number for the related transaction account, and other payment details associated therewith, blockchain wallet data (e.g., a private key and

public key for a cryptographic key pair, unspent transaction outputs, balance data), and any other data used in the processing of fiat and cryptocurrency payment transactions, such as balances, credit information, reward data, etc.

[0045] The issuer processing server 102 may include a querying module 214. The querying module 214 may be configured to execute queries on databases to identify information. The querying module 214 may receive one or more data values or query strings, and may execute a query string based thereon on an indicated database, such as the account database 206 of the issuer processing server 102 to identify information stored therein. The querying module 214 may then output the identified information to an appropriate engine or module of the issuer processing server 102 as necessary. The querying module 214 may, for example, execute a query on the account database 206 to identify an account profile 208 related to a fiat payment transaction using the transaction account number included in a received authorization request, such as to determine if the consumer 104 has accepted payment via blockchain or for approval or denial of the fiat payment transaction based on balance and credit information.

[0046] The issuer processing server 102 may also include a generation module 216. The generation module 216 may be configured to generate data for use by the issuer processing server 102 in performing the functions discussed herein. The generation module 216 may receive instructions as input, may generate data based on the instructions, and may output the generated data to one or more modules of the issuer processing server 102. For example, the generation module 216 may be configured to generate new transaction messages, generate digital signatures for new blockchain

transactions, generate new blockchain transactions, generate cryptocurrency amounts based on fiat transaction amounts and exchange rates, etc.

[0047] The issuer processing server 102 may also include a transaction processing module 218. The transaction processing module 218 may be configured to perform the functions of the issuer processing server 102 related to the processing of payment transactions, including fiat payment transactions and blockchain transactions. The transaction processing module 218 may, for example, determine approval or denial of a payment transaction, such as based on credit and balance information, determine a fraud score for a payment transaction, determine approval or denial based on fraud or other factors and criteria, perform account mapping, identify routing information for transaction messages, etc.

[0048] The issuer processing server 102 may also include a transmitting device 220. The transmitting device 220 may be configured to transmit data over one or more networks via one or more network protocols. In some instances, the transmitting device 220 may be configured to transmit data to payment networks 112, exchange servers 114, blockchain networks 116, and other entities via one or more communication methods, local area networks, wireless area networks, cellular communication, Bluetooth, radio frequency, the Internet, etc. In some embodiments, the transmitting device 220 may be comprised of multiple devices, such as different transmitting devices for transmitting data over different networks, such as a first transmitting device for transmitting data over a local area network and a second transmitting device for transmitting data via the Internet. The transmitting device 220 may electronically transmit data signals that have data superimposed that may be

parsed by a receiving computing device. In some instances, the transmitting device 220 may include one or more modules for superimposing, encoding, or otherwise formatting data into data signals suitable for transmission.

[0049] The transmitting device 220 may be configured to electronically transmit data signals to payment networks 112 that are superimposed or otherwise encoded with transaction messages, such as authorization responses, for fiat payment transactions, which may be transmitted using payment rails associated with the payment network 112. The transmitting device 220 may also be configured to electronically transmit data signals to payment networks 112 and exchange servers 114, which may be superimposed or otherwise encoded with exchange requests, which may request exchange rate and blockchain address data therefrom. The transmitting device 220 may be further configured to receive data signals electronically transmitted by blockchain networks 116, such as from nodes thereof, that may be superimposed or otherwise encoded with notifications and other data regarding blockchain transactions processed thereby.

[0050] The issuer processing server 102 may also include a memory 226. The memory 226 may be configured to store data for use by the issuer processing server 102 in performing the functions discussed herein, such as public and private keys, symmetric keys, etc. The memory 226 may be configured to store data using suitable data formatting methods and schema and may be any suitable type of memory, such as read-only memory, random access memory, etc. The memory 226 may include, for example, encryption keys and algorithms, communication protocols and standards, data formatting standards and protocols, program code for modules and application

programs of the processing device, and other data that may be suitable for use by the issuer processing server 102 in the performance of the functions disclosed herein as will be apparent to persons having skill in the relevant art. In some embodiments, the memory 226 may be comprised of or may otherwise include a relational database that utilizes structured query language for the storage, identification, modifying, updating, accessing, etc. of structured data sets stored therein. The memory 226 may be configured to store, for example, cryptographic keys, salts, nonces, communication information for blockchain nodes and blockchain networks 116, address generation and validation algorithms, digital signature generation and validation algorithms, cryptocurrency exchange rates, transaction message formatting standards, payment rail routing data, etc.

Process for Acceptance of Blockchain Payments

[0051] FIGS. 3A and 3B illustrates a process in the system 100 for the acceptance of blockchain payment for a fiat payment transaction at a traditional point of sale device 108 through processing by the issuer processing server 102 and use of an exchange server 114.

[0052] In step 302, the payment network 112 may receive an authorization request for fiat payment transaction from the acquirer processing server 110, which it may route to the issuer processing server 102 using payment rails associated with the payment network 112. The authorization request may be a specially formatted transaction message and may include at least a transaction account number, transaction amount, and any other transaction data used in the processing of fiat payment transactions. In step 304, the receiving device 202 of the issuer processing server 102 may receive the

authorization request. In step 306, the querying module 214 of the issuer processing server 102 may execute a query on the account database 206 of the issuer processing server 102 to identify an account profile 208 associated with a transaction account used in the fiat payment transaction using the transaction account number included in the authorization request, where the account profile 208 may include an indication of acceptance of blockchain payment.

[0053] In step 308, the transmitting device 220 of the issuer processing server 102 may electronically transmit an exchange information request to the exchange server 114 using a suitable communication network and method. In step 310, the exchange server 114 may receive the exchange information request. In step 312, the exchange server 114 may identify an exchange rate for exchange between the fiat currency and a cryptocurrency utilized by the exchange server 114 and a destination blockchain address, such as may be generated using a public key of the exchange server's blockchain wallet for the blockchain that is used for the cryptocurrency. In step 314, the exchange server 114 may electronically transmit the exchange rate and blockchain address back to the issuer processing server 102.

[0054] In step 316, the receiving device 202 of the issuer processing server 102 may receive the exchange rate and blockchain address. In step 318, the generation module 216 of the issuer processing server 102 may generate a new blockchain transaction. The blockchain transaction may include a digital signature generated using a private key of the blockchain wallet from which payment is being made (e.g., of the issuer processing server 102, such as stored in the memory 226 thereof, or of the consumer 104, such as stored in the identified account profile 208), the blockchain

address received from the exchange server 114, and a cryptocurrency amount based on the transaction amount from the authorization request and the exchange rate. In step 320, the transmitting device 220 of the issuer processing server 102 may electronically transmit the new blockchain transaction to a node in the blockchain network 116 using a suitable communication network and method.

[0055] In step 322, the receiving device 202 of the issuer processing server 102 may receive a transaction identifier for the blockchain transaction from a node in the blockchain network 116, which may be directly transmitted therefrom or identified in blockchain data received therefrom, such as identified in a new blockchain data value stored in a block that has been added to the blockchain. In step 324, the transmitting device 220 of the issuer processing server 102 may electronically transmit an authorization response (e.g., generated by the generation module 216 or transaction processing module 218 of the issuer processing server 102) for the fiat payment transaction to the payment network 112 using payment rails associated therewith. The authorization response may be formatted using the same standard(s) as the authorization request and include a response code stored in a data element thereof, the response code indicating approval of the fiat payment transaction.

[0056] In step 326, the payment network 112 may receive the authorization response from the issuer processing server 102 using the payment rails. In step 328, the payment network 112 may route the authorization response to the point of sale device 108 through the acquirer processing server 110 and any other intermediate systems. The merchant may, based on a notification from the point of sale device 108, finalize the fiat payment transaction with the consumer 104.

[0057] In step 330, the exchange server 114 may identify the blockchain transaction for payment of the cryptocurrency amount from the issuer processing server 102 to the exchange server 114. In some cases, the exchange server 114 may identify the blockchain transaction by identifying use of its blockchain address as a recipient in a blockchain transaction. In other cases, the issuer processing server 102 may provide the transaction identifier to the exchange server 114 for use thereof in identifying the blockchain transaction in the blockchain. In step 332, the exchange server 112 may settle with the issuer processing server 102 by making a payment of fiat currency to the issuer processing server 102 for an amount based on the cryptocurrency amount and the exchange rate, where the payment may vary from the transaction amount included in the authorization request. In step 334, the issuer processing server 102 may receive the payment and, in step 336, may make its own settlement payment the acquirer, which may be a payment for the transaction amount included in the authorization request.

Exemplary Method for Acceptance of Blockchain Payments at a Traditional Point of Sale

[0058] FIG. 4 illustrates a method 400 for the acceptance of a blockchain cryptocurrency as payment for a fiat payment transaction that is conducted at a traditional point of sale device through the use of processing by an issuing financial institution involved in the fiat payment transaction.

[0059] In step 402, an authorization request for a fiat payment transaction originating from a point of sale device (e.g., point of sale device 108) and routed through a payment network (e.g., payment network 112) may be received by a receiver (e.g.,

receiving device 202) of a processing server (e.g., issuer processing server 102), wherein the authorization request includes at least a transaction account number and a transaction amount. In step 404, blockchain payment acceptance may be identified by a processor (e.g., querying module 214) of the processing server for a transaction account associated with the transaction account number. In step 406, a destination address may be received by the receiver of the processing server for an electronic wallet associated with a blockchain network (e.g., blockchain network 116).

[0060] In step 408, a new blockchain transaction may be transmitted by a transmitter (e.g., transmitting device 220) of the processing server to a blockchain node in the blockchain network, the new blockchain transaction including at least the destination address, a cryptocurrency amount based on the transaction amount, a digital signature, and one or more unspent transaction outputs. In step 410, a transaction identifier may be received by the receiver of the processing server from the blockchain node. In step 412, an authorization response for the fiat payment transaction may be transmitted by the transmitter of the processing server to the payment network for routing to the point of sale device, wherein the authorization response includes an indication of approval of the fiat payment transaction and the transaction identifier.

[0061] In one embodiment, the method 400 may further include transmitting, by the transmitter of the processing server, a routing message to an exchange server, wherein the destination address is received from the exchange server in response to the routing message. In a further embodiment, the routing message may be formatted pursuant to one or more standards used in formatting the authorization request and the authorization response. In another further embodiment, the response to the

routing message may further include an exchange rate, and the cryptocurrency amount may be based on the exchange rate and the transaction amount.

[0062] In some embodiments, the method 400 may also include: identifying, by the processor of the processing server, a private key of a cryptographic key pair; and generating, by the processor of the processing server, the digital signature using the private key. In one embodiment, the authorization response may be formatted pursuant to a standard governing the exchange of financial transaction messages. In a further embodiment, the standard may be ISO 8583. In another further embodiment, the transaction identifier may be stored in a data element reserved for private use as specified in the standard.

Computer System Architecture

[0063] FIG. 5 illustrates a computer system 500 in which embodiments of the present disclosure, or portions thereof, may be implemented as computer-readable code. For example, the issuer processing server 102, acquirer processing server 110, payment network 112, exchange server 114, and blockchain network 116 of FIG. 1 may be implemented in the computer system 500 using hardware, non-transitory computer readable media having instructions stored thereon, or a combination thereof and may be implemented in one or more computer systems or other processing systems. Hardware may embody modules and components used to implement the methods of FIGS. 3A, 3B, and 4.

[0064] If programmable logic is used, such logic may execute on a commercially available processing platform configured by executable software code to become a specific purpose computer or a special purpose device (e.g., programmable logic

array, application-specific integrated circuit, etc.). A person having ordinary skill in the art may appreciate that embodiments of the disclosed subject matter can be practiced with various computer system configurations, including multi-core multiprocessor systems, minicomputers, mainframe computers, computers linked or clustered with distributed functions, as well as pervasive or miniature computers that may be embedded into virtually any device. For instance, at least one processor device and a memory may be used to implement the above described embodiments.

[0065] A processor unit or device as discussed herein may be a single processor, a plurality of processors, or combinations thereof. Processor devices may have one or more processor “cores.” The terms “computer program medium,” “non-transitory computer readable medium,” and “computer usable medium” as discussed herein are used to generally refer to tangible media such as a removable storage unit 518, a removable storage unit 522, and a hard disk installed in hard disk drive 512.

[0066] Various embodiments of the present disclosure are described in terms of this example computer system 500. After reading this description, it will become apparent to a person skilled in the relevant art how to implement the present disclosure using other computer systems and/or computer architectures. Although operations may be described as a sequential process, some of the operations may in fact be performed in parallel, concurrently, and/or in a distributed environment, and with program code stored locally or remotely for access by single or multi-processor machines. In addition, in some embodiments the order of operations may be rearranged without departing from the spirit of the disclosed subject matter.

[0067] Processor device 504 may be a special purpose or a general purpose processor device specifically configured to perform the functions discussed herein. The processor device 504 may be connected to a communications infrastructure 506, such as a bus, message queue, network, multi-core message-passing scheme, etc. The network may be any network suitable for performing the functions as disclosed herein and may include a local area network (LAN), a wide area network (WAN), a wireless network (e.g., WiFi), a mobile communication network, a satellite network, the Internet, fiber optic, coaxial cable, infrared, radio frequency (RF), or any combination thereof. Other suitable network types and configurations will be apparent to persons having skill in the relevant art. The computer system 500 may also include a main memory 508 (e.g., random access memory, read-only memory, etc.), and may also include a secondary memory 510. The secondary memory 510 may include the hard disk drive 512 and a removable storage drive 514, such as a floppy disk drive, a magnetic tape drive, an optical disk drive, a flash memory, etc.

[0068] The removable storage drive 514 may read from and/or write to the removable storage unit 518 in a well-known manner. The removable storage unit 518 may include a removable storage media that may be read by and written to by the removable storage drive 514. For example, if the removable storage drive 514 is a floppy disk drive or universal serial bus port, the removable storage unit 518 may be a floppy disk or portable flash drive, respectively. In one embodiment, the removable storage unit 518 may be non-transitory computer readable recording media.

[0069] In some embodiments, the secondary memory 510 may include alternative means for allowing computer programs or other instructions to be loaded into the

computer system 500, for example, the removable storage unit 522 and an interface 520. Examples of such means may include a program cartridge and cartridge interface (e.g., as found in video game systems), a removable memory chip (e.g., EEPROM, PROM, etc.) and associated socket, and other removable storage units 522 and interfaces 520 as will be apparent to persons having skill in the relevant art.

[0070] Data stored in the computer system 500 (e.g., in the main memory 508 and/or the secondary memory 510) may be stored on any type of suitable computer readable media, such as optical storage (e.g., a compact disc, digital versatile disc, Blu-ray disc, etc.) or magnetic tape storage (e.g., a hard disk drive). The data may be configured in any type of suitable database configuration, such as a relational database, a structured query language (SQL) database, a distributed database, an object database, etc. Suitable configurations and storage types will be apparent to persons having skill in the relevant art.

[0071] The computer system 500 may also include a communications interface 524. The communications interface 524 may be configured to allow software and data to be transferred between the computer system 500 and external devices. Exemplary communications interfaces 524 may include a modem, a network interface (e.g., an Ethernet card), a communications port, a PCMCIA slot and card, etc. Software and data transferred via the communications interface 524 may be in the form of signals, which may be electronic, electromagnetic, optical, or other signals as will be apparent to persons having skill in the relevant art. The signals may travel via a communications path 526, which may be configured to carry the signals and may be

implemented using wire, cable, fiber optics, a phone line, a cellular phone link, a radio frequency link, etc.

[0072] The computer system 500 may further include a display interface 502. The display interface 502 may be configured to allow data to be transferred between the computer system 500 and external display 530. Exemplary display interfaces 502 may include high-definition multimedia interface (HDMI), digital visual interface (DVI), video graphics array (VGA), etc. The display 530 may be any suitable type of display for displaying data transmitted via the display interface 502 of the computer system 500, including a cathode ray tube (CRT) display, liquid crystal display (LCD), light-emitting diode (LED) display, capacitive touch display, thin-film transistor (TFT) display, etc.

[0073] Computer program medium and computer usable medium may refer to memories, such as the main memory 508 and secondary memory 510, which may be memory semiconductors (e.g., DRAMs, etc.). These computer program products may be means for providing software to the computer system 500. Computer programs (e.g., computer control logic) may be stored in the main memory 508 and/or the secondary memory 510. Computer programs may also be received via the communications interface 524. Such computer programs, when executed, may enable computer system 500 to implement the present methods as discussed herein. In particular, the computer programs, when executed, may enable processor device 504 to implement the methods illustrated by FIGS. 3A, 3B, and 4, as discussed herein. Accordingly, such computer programs may represent controllers of the computer system 500. Where the present disclosure is implemented using software, the software may be stored in a computer program product and loaded into the computer

system 500 using the removable storage drive 514, interface 520, and hard disk drive 512, or communications interface 524.

[0074] The processor device 504 may comprise one or more modules or engines configured to perform the functions of the computer system 500. Each of the modules or engines may be implemented using hardware and, in some instances, may also utilize software, such as corresponding to program code and/or programs stored in the main memory 508 or secondary memory 510. In such instances, program code may be compiled by the processor device 504 (e.g., by a compiling module or engine) prior to execution by the hardware of the computer system 500. For example, the program code may be source code written in a programming language that is translated into a lower level language, such as assembly language or machine code, for execution by the processor device 504 and/or any additional hardware components of the computer system 500. The process of compiling may include the use of lexical analysis, preprocessing, parsing, semantic analysis, syntax-directed translation, code generation, code optimization, and any other techniques that may be suitable for translation of program code into a lower level language suitable for controlling the computer system 500 to perform the functions disclosed herein. It will be apparent to persons having skill in the relevant art that such processes result in the computer system 500 being a specially configured computer system 500 uniquely programmed to perform the functions discussed above.

[0075] Techniques consistent with the present disclosure provide, among other features, systems and methods for acceptance of blockchain payment at a traditional point of sale device through issuer processing. While various exemplary embodiments

of the disclosed system and method have been described above it should be understood that they have been presented for purposes of example only, not limitations. It is not exhaustive and does not limit the disclosure to the precise form disclosed. Modifications and variations are possible in light of the above teachings or may be acquired from practicing of the disclosure, without departing from the breadth or scope.