transaction system for processing a fiat currency transaction. The fiat currency transaction system includes an application process interface (API) configured for processing the fiat currency transaction in accordance with a smart contract comprising machine-readable instructions stored in a computer memory accessible by the fiat currency transaction system for causing a processor associated with the smart contract to interface with the cryptocurrency processing device to process a cryptocurrency transaction sufficient to convert a suitable amount of cryptocurrency associated with the virtual wallet into fiat currency for satisfying the fiat currency transaction.

Another aspect of the invention relates to a transaction system configured for conducting a cryptocurrency transaction. The transaction system includes a hardware storage device having an integrated circuit comprising at least one secure element, the at least one secure element having a secure element processor, a secure element digital memory module comprising a cryptographic module, and at least one secure element wireless or contact interface. The secure element digital memory module embodies instructions readable by the at least one secure element processor for causing the at least one secure element to store a private key in an encrypted state in the digital memory, generate a public key using the private key, and perform a signature operation. The transaction system also includes a cryptocurrency transaction processing device having a user interface embodying a virtual wallet having a first cryptocurrency address associated therewith, a processing device wireless or contact interface, and a communication interface configured for connection to an exchange server of a cryptocurrency transaction network on a global communications network and for sending signed transaction information to the exchange server to initiate a cryptocurrency transaction. The transaction system further includes a fiat currency transaction system for processing a fiat currency transaction, the fiat currency transaction system including at least one payment terminal and an application process interface (API) configured for processing the fiat currency transaction in accordance with a smart contract comprising machine-readable instructions stored in a computer memory accessible by the cryptocurrency transaction network for causing an issuer associated with the smart contract to process a cryptocurrency transaction sufficient to satisfy the fiat currency transaction upon receipt of instructions from the cryptocurrency transaction network prompted by the fiat currency transaction initiated at the at least one payment terminal.

Another aspect of the invention relates to a transaction system configured for conducting a plurality of transactions. The transaction system includes a

transaction card including a hardware storage device. The hardware storage device has an integrated circuit comprising at least one secure element, the secure element having a secure element processor, a secure element digital memory module comprising a cryptographic module, and at least one secure element NFC or contact interface. The secure element digital memory module embodies instructions readable by the secure element processor for causing the secure element to store a private key in an encrypted state in the digital memory, generate a public key using the private key, and perform a signature operation. The transaction system also includes a cryptocurrency transaction processing device having a user interface embodying a virtual wallet, a processing device NFC or contact interface, and a communication interface configured for connecting to an exchange server of a cryptocurrency transaction network on a global communications network and for sending signed transaction information to the exchange server to initiate a cryptocurrency transaction. The transaction system also has a fiat currency transaction system for processing a transaction using fiat currency via a custodial account associated with the transaction card.

In some embodiments, the hardware storage device is configured to: (a) conduct cryptocurrency transactions by establishing a connection between the hardware storage device and the cryptocurrency transaction processing device using the secure element NFC or contact interface in communication with the processing device NFC or contact interface, receiving information from the processing device, retrieving the private key from the digital memory, performing signature operations using the private key, checking a chain associated with the public key to confirm that the signature conforms to a public key signature that could only have been generated using the private key, signing the transaction, and sending signed transaction information to the cryptocurrency transaction processing device; and (b) conduct fiat transactions by establishing a connection over NFC or via a contact interaction with a

card reader of the fiat currency transaction system, and authorizing a transaction processed using funds stored in the custodial account.

In some embodiments, performing step (a) converts an amount of cryptocurrency associated with the virtual wallet into fiat currency loaded into the custodial account prior to performing step (b). In still other embodiments, performing step (b) moves an amount of cryptocurrency associated with the transaction from a self-custody account of a card user to the custodial account, and step (b) includes a custodian of the custodial account converting an appropriate amount of the cryptocurrency to fiat currency and transmitting the converted fiat currency to a requesting recipient to complete the fiat currency transaction.

In some embodiments, the instructions embodied on the hardware storage device include instructions for causing the transaction system to conduct cryptocurrency transactions by establishing a connection between the hardware storage device and the cryptocurrency transaction processing device using the secure element wireless or contact interface in communication with the processing device wireless or contact interface, receiving information from the processing device, retrieving the private key from the digital memory, performing signature operations using the private key, checking a chain associated with the public key to confirm that the signature conforms to a public key signature that could only have been generated using the private key, signing the transaction, and sending signed transaction information to the cryptocurrency transaction processing device. The instructions further cause the transaction system to conduct fiat transactions by establishing a connection over wireless or via a contact interaction with a card reader of the fiat currency transaction system, and authorizing a transaction processed using funds stored in the custodial account. In some embodiments, conducting the cryptocurrency transaction causes conversion of an amount of cryptocurrency associated with the virtual wallet into fiat currency and loading of the converted fiat currency into the custodial account. In other embodiments, conducting the fiat transaction causes a transfer amount of cryptocurrency associated with the transaction to be moved from a self-custody account of a card user to the custodial account, and the custodian of the custodial account provides a transaction amount of the cryptocurrency to the requesting recipient, or converts the transaction amount of the cryptocurrency to fiat currency and transmits the converted fiat currency to the requesting recipient to complete the fiat currency transaction.

Another aspect of the invention relates to a hardware storage device having an integrated circuit comprising at least one secure element, the secure element

having a secure element processor, a secure element digital memory module comprising a cryptographic module, and at least one secure element NFC or contact interface, the secure element digital memory module embodying instructions readable by the secure element processor for causing the secure element to store a private key in encrypted state in the digital memory, generate a public key using the private key, and to perform a signature operation.

In some embodiments, the secure element digital memory module embody instructions readable by the secure element processor for causing the secure element to, in response to receipt of information from a cryptocurrency transaction processing device linked via a connection with the at least one secure element via the NFC or contact interface, perform the steps of: (a) retrieving the private key from the digital memory, define a signature using the private key, checking a chain associated with the public key to confirm that the signature conforms to a public key signature that could only have been generated using the private key, signing the transaction, and sending signed transaction information to the cryptocurrency transaction processing device; and step (b) conducting fiat transactions by establishing a connection over NFC or via a contact interaction with a card reader of a fiat currency transaction system including an API and authorizing the cryptocurrency transaction processed via the API in accordance with a smart contract comprising machine-readable instructions stored in a computer memory accessible by the fiat currency transaction system for causing a processor associated with the smart contract to interface with the cryptocurrency processing device to process a cryptocurrency transaction sufficient to convert a suitable amount of cryptocurrency associated with the virtual wallet into fiat currency for satisfying the fiat currency transaction.

In other embodiments, step (a) includes causing the at least one secure element to perform a signature operation associated with assigning to an assignee having a second cryptocurrency address associated therewith a right to transfer a designated amount of cryptocurrency in accordance with the smart contract, and step (b) includes the API approving the fiat transaction upon confirmation of sufficient funds allocated under the execution of the smart contract to complete the fiat transaction, and the assignee upon receipt of approval from the API, optionally converting the funds corresponding to the fiat transaction from cryptocurrency to fiat currency, and transmitting the appropriate amount of funds (e.g. of the converted fiat currency or of unconverted cryptocurrency) to a requesting recipient to complete the fiat currency transaction.

Yet another aspect of the invention relates to a transaction card including a hardware storage device having an integrated circuit comprising at least one secure element, the at least one secure element having a secure element processor, a secure element digital memory module comprising a cryptographic module, and at least one secure element near field communications (NFC) or contact interface, the secure element digital memory module embodying instructions readable by the secure element processor for causing the secure element to store a private key in an encrypted state in the digital memory, generate a public key using the private key, and perform a signature operation.

In some embodiments, the secure element digital memory module embodies instructions readable by the secure element processor for causing the secure element to, in response to receipt of information from a cryptocurrency transaction processing device linked via a connection with the at least one secure element via the NFC or contact interface, perform the steps of: (a) retrieving the private key from the digital memory, performing signature operations using the private key, checking a chain associated with the public key to confirm that the signature conforms to a public key signature that could only have been generated using the private key, signing the transaction, and sending signed transaction information to the cryptocurrency transaction processing device; and step (b) conducting fiat transactions by establishing a connection over NFC or via a contact interaction with a card reader of the fiat currency transaction system, and authorizing a transaction processed using funds stored in a custodial account associated with the transaction card.

In still other embodiments, performing step (a) converts an amount of cryptocurrency associated with the virtual wallet into fiat currency loaded into the custodial account prior to performing step (b). In some embodiments, performing step

(b) moves an amount of cryptocurrency associated with the transaction from a self-custody account of a card user to the custodial account, and step (b) includes a custodian of the custodial account converting an appropriate amount of the cryptocurrency to fiat currency and transmitting the converted fiat currency to a requesting recipient to complete the fiat currency transaction.

Yet another aspect includes a transaction system configured for conducting a cryptocurrency transaction, the transaction system comprising a cryptocurrency transaction processing system configured for sending instructions to an exchange server of a cryptocurrency transaction network to initiate a cryptocurrency transaction; and a fiat currency transaction system for processing a fiat currency transaction. The fiat currency transaction system includes an application process interface (API) configured for processing the fiat currency transaction in accordance with a smart contract comprising machine-readable instructions stored in a computer memory accessible by the cryptocurrency transaction network for causing an issuer associated with the smart contract to process a cryptocurrency transaction sufficient to satisfy the fiat currency transaction. In embodiments, the cryptocurrency transaction processing system further comprises a cryptocurrency transaction processing device having a user interface embodying a virtual wallet having a first cryptocurrency address associated therewith, a processing device NFC or contact interface, and a communication interface configured for connection to the exchange server of the cryptocurrency transaction network via a global communications network and for sending signed transaction information to the exchange server to initiate the cryptocurrency transaction. Embodiments further include a hardware storage device configured to perform a signature operation and to transmit the signed transaction information to the virtual wallet via a communication protocol other than via the global communications network.

Another aspect of the invention relates to a computer-implemented method for conducting a cryptocurrency transaction in satisfaction of a fiat transaction. The method includes sending instructions via a computer to a node of a cryptocurrency transaction network to initiate a cryptocurrency transaction from a first cryptocurrency address associated with a self-custody account of a user to a second cryptocurrency address in accordance with a smart contract that assigns to an assignee a right to transfer a designated amount of cryptocurrency in accordance with the smart contract. The method further includes processing a fiat currency transaction via a computer running an application process interface (API) configured for processing the fiat currency transaction by approving the fiat transaction upon confirmation of sufficient

funds allocated under execution of the smart contract to complete the fiat transaction. Upon receipt of approval from the API, the assignee transmits an appropriate amount of funds corresponding to the fiat transaction as cryptocurrency, or converts the appropriate amount of funds to cryptocurrency and transmits the converted cryptocurrency to a requesting recipient to complete the fiat currency transaction.

Another aspect of the invention relates to a method for conducting a cryptocurrency transaction. The method includes: a) providing a transaction system comprising: a hardware storage device having an integrated circuit comprising at least one secure element, the at least one secure element having a secure element processor, a secure element digital memory module comprising a cryptographic module, and at least one secure element wireless or contact interface, the secure element digital memory module further comprising a private key stored in an encrypted state therein; a cryptocurrency transaction processing device having a user interface embodying a virtual wallet having a first cryptocurrency address associated therewith, a processing device wireless or contact interface, and a communication interface; a fiat currency transaction system for processing a fiat currency transaction, the fiat currency transaction system including at least one payment terminal and an application process interface (API) configured for processing the fiat currency transaction in accordance with a smart contract comprising machine-readable instructions stored in a computer memory accessible by the cryptocurrency transaction network; b) processing an authorization cryptocurrency transaction via the API in accordance with authorization of the smart contract, including: i) establishing a connection between the wireless or contact interface of the hardware storage device and the wireless or contact interface of the cryptocurrency transaction processing device; ii) causing the hardware storage device secure element processor receiving information from the processing device, retrieving the private key from the digital memory, defining a signature using the private key, checking a chain associated with the public key to confirm that the signature conforms to a public key signature that could only have been generated using the private key, signing the transaction, and sending signed transaction information to the cryptocurrency transaction processing device; and iii) causing the cryptocurrency transaction processing device connecting via the communication interface to an exchange server of a cryptocurrency transaction network on a global communications network and sending the signed transaction information to the exchange server to initiate the authorization cryptocurrency transaction, the authorization cryptocurrency transaction comprising assigning to an assignee having a second cryptocurrency address associated therewith a right to transfer a designated amount of cryptocurrency

from the first cryptocurrency address in accordance with the smart contract. The method further includes c) initiating the fiat currency transaction at the at least one payment terminal; and d) an issuer associated with the smart contract processing a transfer authorized by the smart contract, including the API approving the fiat transaction upon confirmation of sufficient funds allocated under execution of the smart contract to complete the fiat transaction, and the assignee upon receipt of approval from the API, transfer an appropriate amount from the first cryptocurrency address to the requesting recipient to complete the fiat currency transaction.

Another aspect of the invention relates to a method for conducting cryptocurrency transactions. The method includes: a) providing a transaction system comprising: a transaction card including a hardware storage device having an integrated circuit comprising at least one secure element, the at least one secure element having a secure element processor, a secure element digital memory module comprising a cryptographic module, and at least one secure element wireless or contact interface, the at least one secure element digital memory module embodying instructions readable by the at least one secure element processor for causing the at least one secure element to store a private key in an encrypted state in the digital memory, generate a public key using the private key, and perform a signature operation; a cryptocurrency transaction processing device having a user interface embodying a virtual wallet, a processing device wireless or contact interface, and a communication interface configured for connecting to an exchange server of a cryptocurrency transaction network on a global communications network and for sending signed transaction information to the exchange server to initiate a cryptocurrency transaction; and a fiat currency transaction system for processing a transaction using fiat currency via a custodial account associated with the transaction card; b) conducting a cryptocurrency transaction by establishing a connection between the hardware storage device and the cryptocurrency transaction processing device using the secure element wireless or contact interface in communication with the processing device wireless or contact interface, receiving information from the processing device, retrieving the private key from the digital memory, performing signature operations using the private key, checking a chain associated with the public key to confirm that the signature conforms to a public key signature that could only have been generated using the private key, signing the transaction, and sending signed transaction information to the cryptocurrency transaction processing device; and c) conducting a fiat transaction by establishing a connection over wireless or via a contact interaction with a card reader of the fiat currency transaction system, and authorizing a

transaction processed using funds stored in the custodial account. In some embodiments: i) performing step b) causes conversion of an amount of cryptocurrency associated with the virtual wallet into fiat currency and loading the converted fiat currency into the custodial account; or ii) performing step c) causes a transfer amount of cryptocurrency associated with the transaction to be moved from a self-custody account of a card user to the custodial account, and step c) includes a custodian of the custodial account providing a transaction amount of the cryptocurrency to the requesting recipient or converting the transaction amount of the cryptocurrency to fiat currency and transmitting the converted fiat currency to a requesting recipient to complete the fiat currency transaction.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 depicts an exemplary system for conducting a cryptocurrency transaction in accordance with aspects of the invention.

FIG. 2 is a flowchart depicting exemplary process steps in accordance with aspects of the invention.

FIG. 3 is a flowchart depicting additional steps of FIG. 2 for a method associated with a smart contract.