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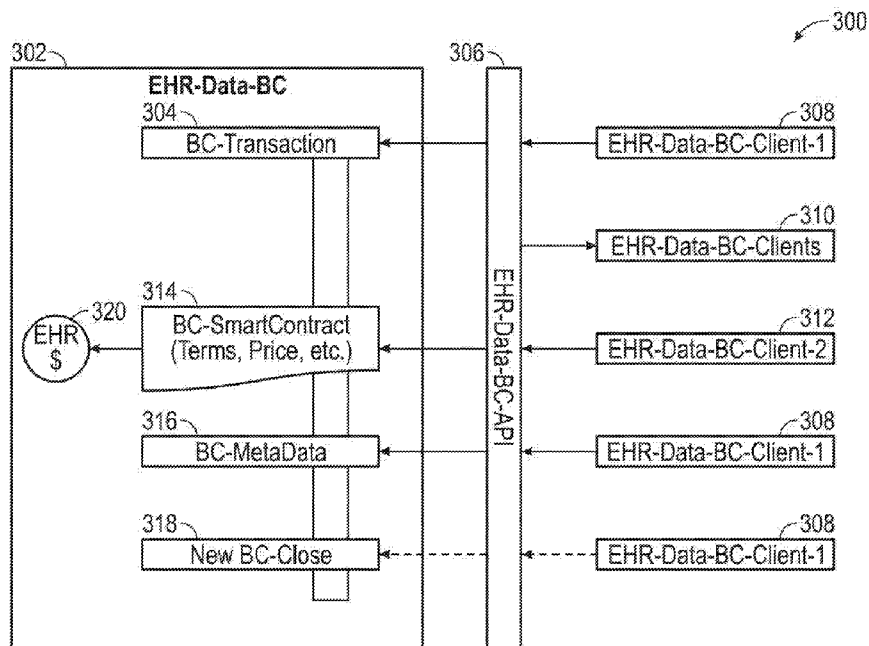


FIG. 3

(57) Abstract: An Electronic Health Record (EHR) data blockchain system configured to allow multiple entities (e.g., pharmacy industry entities that can act as data, service, product providers, and consumers) to be connected to an EHR patient transaction blockchain (e.g., EHR-DATA-BC) and an EHR Data Patient Portal (e.g., EHR-Data-PP) to provide a centralized location for messages and subsequent edits to ensure uniform message data is presented. The EHR data blockchain system can include an EHR Data API, an EHR patient transaction blockchain API, and an EHR patient transaction blockchain. The EHR Data API can access and retrieve patient identifiable information (PII) and generate a non-patient-identifiable Single Purpose Patient ID (SPPID) for a particular patient. The EHR patient transaction blockchain API (e.g., EHR-DATA-BC-API) can store the SPPID, store particular, discrete data retrieved from the EHR for a patient, execute smart contracts, and control the execution of digital currency transfers, among other functions.



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**ELECTRONIC HEALTH RECORD DATA BLOCKCHAIN SYSTEM**Technical Field

5 The present disclosure generally relates to blockchain-enabled patient data systems, and more specifically to blockchain-enabled patient data systems configured to facilitate anonymous patient data transactions between multiple entities.

Description of the Prior Art

10 In traditional electronic patient record systems, systems are configured according to the conventional client-server model, where a message is sent to a server and the server sends a response, according to standards and format promulgated by the National Council for Prescription Drug Programs (NCPDP). Many times, the client and the server can have inapposite databases, such as Oracle® and MS SQL® databases. Additionally,  
15 each message sent and received is recorded in by the client and the server. Often times, discrepancies arise between the client and the server regarding the actual contents of the messages due to system issues, etc.

In particular, pharmacy patient information messages can be edited by multiple  
20 entities as they make their way from a pharmacy to a payer for payment. As each entity in the chain edits the message, additional complexities are added that can result in additional message discrepancies. This can result in multiple databases with a message with varying message integrities. Such discrepancies result in wasted effort, time, and money directed toward resolution of the discrepancies.

25 Further, the availability of complete patient-identifiable data stored in databases affords the possibility and increased likelihood of HIPPA violations and incorrect handling of such data. Multiple systems may be required to monitor prescriptions, provide edits, provide offers, determine drug eligibility, identify fulfilment options, and finalize pricing, wasting  
30 precious resources, adding complexity, and resulting in excess costs.

Summary

The present disclosure teaches technical advantages as an Electronic Health Record (EHR) data blockchain system configured to allow multiple entities (e.g., pharmacy industry entities and healthcare providers that can act as data, service, or product providers, and consumers) to connect to an EHR patient transaction blockchain (e.g., EHR-DATA-BC) and an EHR Data Patient Portal (EHR-Data-PP) to provide a centralized location for messages and subsequent edits to ensure uniform message data. All entities can directly communicate with the EHR patient transaction blockchain through a predefined blockchain application programming interface (e.g., EHR-Data-BC-API). The system can facilitate the transfer of anonymous patient data between multiple entities, including:

- Physicians
- Pharmacies
  - Independent
  - Chain
  - Central Fill Facilities
  - Mail Order
- Drug Manufacturers
- Drug Wholesalers
- Prescription editing providers including those for:
  - Drug Utilization Review
  - Genomic
  - Pricing
- Prescription Benefit Managers
- Pharmacy Software Vendors
- National Facilitators
- Shipping Services (Federal Express, DHL, etc.)
- Delivery Services
- Prescription Call Centers
- Government Agencies
- Others

The EHR data blockchain system can include an EHR Data API, an EHR patient transaction blockchain API, and an EHR patient transaction blockchain. The EHR Data API can be configured to access and retrieve patient identifiable information (PII) and generate a non-patient-identifiable Single Purpose Patient ID (SPPID) for a particular patient for use in a discrete transaction. The EHR patient transaction blockchain API (e.g., EHR-DATA-BC-API) can be configured to store the SPPID, store particular, discrete data retrieved from the EHR for a patient, execute smart contracts, and control the execution of digital currency transactions (e.g., cryptocurrency transactions to occur using each parties' digital wallet information), among other functions.

A patient's private information, including the patient's name, address, phone number, social security number, insurance information, medical history, clinical information, and other relevant information, can be stored in an Electronic Health Record (EHR) database, such as a sometimes called Electronic Patient Outcome Record ("EPOR"), Solid POD, XML file, or other suitable data storage element. No patient identifiable information will be stored in the EHR patient transaction blockchain to thus assure the anonymity of the patient data. Instead, when a new blockchain transaction is initiated by an entity for a particular patient, the EHR database is queried to determine if the patient already has a record. If the patient has a record in the EHR database, a Single Purpose Patient ID (SPPID) can be generated and returned, along with pertinent data, to the requesting entity. The SPPID can be used for the transaction instead of any patient identifiable information. The SPPID can be used only until the transaction for the query is completed. The next time a blockchain transaction related to the patient is submitted, the patient will be issued a new SPPID, thereby ensuring that an SPPID is not indefinitely associated with the patient for all future transactions. This technique insures that even if a single SPPID is compromised, such that a patient's identifiable information (PII) can be determined, the compromise will only be limited to one transaction.

Once a transaction is completed, the SPPID can only be used to read information, associated with the transaction, from the block-chain. Based on permissions granted by the patient, EHR Data may group the transaction data, with other transactions, medical de-vice data, etc. associated with the patient, for reporting, analytics, drug research, etc. For example, a drug company may wish to understand how a specific drug affected patients' heart rates. The report sent to the drug manufacturer from EHR Data would

include all of a patient's transactions, for the specified drug, along with heart rate device data accumulated for the patient while the patient was taking the specified drug.

The EHR patient transaction blockchain can be used as a workflow space to process the transaction until the transaction completes, is signed, and is distributed for consensus. Smart contracts can be implemented to determine and define workflow processes, drug interactions, fulfillment, expected outcomes, triggering events, and pricing, among other data elements.

10 In one exemplary embodiment, a system for providing blockchain-based patient transactions, can include: one or more computer-readable storage media configured to store a blockchain; a data Application Programming Interface (API) system comprising one or more processors programmed to execute computer program instructions that, when executed, cause the data API system to: receive a request for a new blockchain  
15 transaction related to a patient, initiate a patient lookup query to determine whether a patient electronic health record exists, generate a single purpose patient ID (SPPID) associated with the patient electronic health record; a client computer programmed to execute computer program instructions that, when executed, cause the client computer to: receive a patient lookup query related to a patient from a client to determine whether  
20 the patient's electronic health record exists, receive the SPPID to initiate a new blockchain transaction related to the patient on the blockchain without patient-identifying information, determine whether an entity operating the client computer can provide data, products and/or services related to a blockchain transaction; and a blockchain API system comprising one or more processors programmed to execute computer program  
25 instructions that, when executed, cause the blockchain API system to: generate the blockchain transaction and read and write records to and from the blockchain, and associate one or more smart contracts with the blockchain transaction. The smart contract exchanges digital currency between the parties involved in the smart contract. The digital currency includes utility tokens or vouchers. The SPPID cannot be used to write  
30 information to the blockchain after a patient blockchain transaction is completed. The blockchain API system can generate a notification when the blockchain transaction is generated. The blockchain API system can transmit the notification to one or more providers. The client computer can provide information to the blockchain API system

regarding data, products and/or services related to the blockchain transaction. The blockchain API system can edit the blockchain transaction on the blockchain.

In another exemplary embodiment, a method of providing blockchain-based electronic health record data patient transactions, the method being implemented by a server system comprising one or more processors executing computer program instructions that, when executed, perform the method, can include: associating a single purpose patient ID (SPPID) with the electronic health record; providing the SPPID to the client so the client can initiate a new blockchain patient transaction related to the patient on the blockchain without patient-identifying information; receiving a patient transaction from a pharmacy; writing the patient transaction to the blockchain; notifying one or more client devices of the patient transaction; receiving one or more offers for data, products, or services related to the patient transaction; generating a smart contract related to the patient transaction and the one or more offers; and modifying the patient transaction based on the execution of the smart contract. The smart contract exchanges digital currency between the parties involved in the smart contract. The digital currency includes utility tokens or vouchers. The SPPID cannot be used to write information to the blockchain after the patient blockchain transaction is completed. Further comprising generating a notification when the patient transaction is generated. Further comprising transmitting the notification to one or more providers. The patient transaction is modified on the blockchain. The patient transaction can be modified on the blockchain in real-time.

In another exemplary embodiment, a system for providing electronic health record data for blockchain-based patient transactions, can include: one or more computer-readable storage media configured to store a blockchain; a data Application Programming Interface (API) system comprising one or more processors programmed to execute computer program instructions that, when executed, cause the data API system to: receive a request for a new blockchain transaction related to a patient, initiate a patient lookup query to determine whether a patient electronic health record exists, retrieve the patient electronic health record from one or more databases, and generate a single purpose patient ID (SPPID) associated with the patient electronic health record; and a blockchain API system comprising one or more processors programmed to execute computer program instructions that, when executed, cause the blockchain API system to: generate the blockchain transaction and read and write records to and from the blockchain, and

associate one or more smart contracts with the blockchain transaction. The smart contract exchanges digital currency between the parties involved in the smart contract. The digital currency includes utility tokens or vouchers. The blockchain API system edits the prescription transaction on the blockchain based on input from one or more providers.

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#### Brief Description of the Drawings

FIG. 1 shows a schematic view of an electronic health record data blockchain system, in accordance with one or more exemplary embodiments of the present disclosure;

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FIG. 2 shows a schematic illustrating the types of third-parties that can access the blockchain system, in accordance with one or more exemplary embodiments of the present disclosure;

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FIG. 3 shows a block diagram of an electronic health record data blockchain system transaction, in accordance with one or more exemplary embodiments of the present disclosure;

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FIG. 4A-4E shows a block diagram of an electronic health record data blockchain system RxNew transaction, in accordance with one or more exemplary embodiments of the present disclosure; and

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FIG. 5 shows a block diagram of an electronic health record data blockchain system process flow 500, in accordance with one or more exemplary embodiments of the present disclosure.

#### Description of the Preferred Embodiment

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The preferred version of the disclosure presented in the following written description and the various features and advantageous details thereof, are explained more fully with reference to the non-limiting examples included in the accompanying drawings and as detailed in the description, which follows. Descriptions of well-known components have been omitted so to not unnecessarily obscure the principle features described herein. The examples used in the following description are intended to facilitate an understanding of

the ways in which the disclosure can be implemented and practiced. Accordingly, these examples should not be construed as limiting the scope of the claims.

FIG. 1 illustrates an Electronic Health Record (EHR) data blockchain (EHR-DATA-BC) system 100, in accordance with one or more exemplary embodiments of the present disclosure. The EHR-DATA-BC system 100 can include a server 102, third party databases 106, a distributed ledger 125, a network 130, and external systems 140.

The server 102 can include one or more processors (or cores) 104, a memory 106, and machine-readable instructions 108. In one exemplary embodiment, the machine-readable instructions 108 can include an EHR Data API 110, a transaction blockchain API 112, a pre- and post-edit module 114, an interaction analysis module 116, an eligibility analysis module 118, and a payment module 120. Additionally, the server 102 can host an EHR Data Patient Portal (EHR-Data-PP) that can provide a patient with access to the system 100 after an authenticated login. The server 102 can be implemented in hardware, software, or a suitable combination of hardware and software therefor, and may comprise one or more software systems operating on one or more servers, having one or more processors, with access to memory. Server(s) can include electronic storage, one or more processors, and/or other components. Server(s) can include communication lines, or ports to enable the exchange of information with a network and/or other computing platforms. Server(s) can also include a plurality of hardware, software, and/or firmware components operating together to provide the functionality attributed herein to server(s). For example, server(s) can be implemented by a cloud of computing platforms operating together as server(s). Additionally, the server can include memory 106.

Server(s) can include electronic storage, one or more processors, and/or other components. Server(s) can include communication lines, or ports to enable the exchange of information with a network and/or other computing platforms. Server(s) can also include a plurality of hardware, software, and/or firmware components operating together to provide the functionality attributed herein to server(s). For example, server(s) can be implemented by a cloud of computing platforms operating together as server(s).

Memory 106 can comprise electronic storage that can include non-transitory storage media that electronically stores information. The electronic storage media of electronic

storage may include one or both of system storage that can be provided integrally (i.e., substantially non-removable) with server(s) and/or removable storage that can be removably connectable to server(s) via, for example, a port (e.g., a USB port, a firewire port, etc.) or a drive (e.g., a disk drive, etc.). Electronic storage may include one or more  
5 of optically readable storage media (e.g., optical disks, etc.), magnetically readable storage media (e.g., magnetic tape, magnetic hard drive, floppy drive, etc.), electrical charge-based storage media (e.g., EEPROM, RAM, etc.), solid-state storage media (e.g., flash drive, etc.), and/or other electronically readable storage media. Electronic storage can include one or more virtual storage resources (e.g., cloud storage, a virtual private  
10 network, and/or other virtual storage resources). Electronic storage can store machine-readable instructions, software algorithms, information determined by processor(s), information received from server(s), information received from computing platform(s), and/or other information that enables server(s) to function as described herein. The electronic storage can also be accessible via a network connection.

15

Processor(s) 104 can be configured to provide information processing capabilities in server(s). As such, processor(s) can include one or more of a digital processor, an analog processor, a digital circuit designed to process information, an analog circuit designed to process information, a state machine, and/or other mechanisms for electronically  
20 processing information, such as FPGAs or ASICs. The processor(s) can be a single entity or include a plurality of processing units. These processing units can be physically located within the same device or represent the processing functionality of a plurality of devices operating in coordination or software functionality.

25

The processor(s) 104 can be configured to execute machine-readable instructions 108 or learning modules by software, hardware, firmware, some combination of software, hardware, firmware, and/or other mechanisms for configuring processing capabilities on processor(s). As used herein, the term "machine-readable instruction" may refer to any  
30 component or set of components that perform the functionality attributed to the machine-readable instruction component. This can include one or more physical processors during execution of processor readable instructions, the processor readable instructions, circuitry, hardware, storage media, or any other components.

The server 102 can be configured with machine-readable instructions 108 having one or more functional modules. The machine-readable instructions can be implemented on one or more servers, having one or more processors, with access to memory. The machine-readable instructions can be a single networked node, or a machine cluster, which can include a distributed architecture of a plurality of networked nodes. The machine-readable instructions can include control logic for implementing various functionality, as described in more detail below. The machine-readable instructions can include certain functionality associated with an EHR Data Patient Portal (EHR-Data-PP), EHR Data API (first server-side computer system) 110, EHR patient transaction blockchain API (second server-side computer system), pre- and post-edit module 114, interaction analysis module 116, eligibility analysis module 118, and payment module 120. External databases 106 and external systems 140, as well as an EHR Data Blockchain client (client computer system) can also be implemented on one or more servers 102, having one or more processors 104, with access to memory 106.

In one exemplary embodiment, the EHR Data API 110 can provide an interface that defines interactions between multiple software components. For example, EHR Data API 110 can define the kinds of calls or requests that can be made, how to make them, the data formats that should be used, the conventions to follow, and other suitable functionality. In another exemplary embodiment, the EHR Data API 110 can access and retrieve patient identifiable information (PII) and generate a non-patient-identifiable Single Purpose Patient ID (SPPID) for a particular patient.

In one exemplary embodiment, the EHR patient transaction blockchain API 112 (e.g., EHR-DATA-BC-API) can provide an interface that defines interactions between multiple software components. For example, EHR patient transaction blockchain API 112 can define the kinds of calls or requests that can be made, how to make them, the data formats that should be used, the conventions to follow, and other suitable functionality. In another exemplary embodiment, the transaction blockchain API 112 can be configured to store the SPPID, as well as particular, discrete data retrieved from the EHR for a patient, execute smart contracts, and control the execution of digital currency transfers, among other functions.

In one exemplary embodiment, a pre- and post-edit module 114 can edit received distributed ledger transactions according to input received from external systems 140, third-party databases 106, or other suitable systems. In another exemplary embodiment, the transactions can be processed in real-time while a pharmacy is filling a prescription.

5 For example, "pre-edit" and post-edit" processing can be used by pharmacies and payers in the industry to examine prescription claims for accuracy and consistency using predetermined data and rules for processing claims. In another exemplary embodiment, the pre- and post-edit module 114 can analyze the patient clinical data in the context of the submitted prescription and information about the prescribed pharmaceuticals and  
10 complete the pre-editing process. For example, the module 114 can receive patient clinical data from third party databases 106 and correlate the prescription information with the patient clinical data to determine whether the incorrect dosage or timing is prescribed, given the patient's height, weight, or other patient factors. In another exemplary embodiment, the EHR Data API 110 can be operably coupled to the pre- and post-edit  
15 module 114 to provide relevant patient information related to the transaction to the pre- and post-edit module 114. In another exemplary embodiment, the EHR patient transaction blockchain API 112 can be operably coupled to the pre- and post-edit module 114 to store the particular, discrete data retrieved from the EHR for a patient related to the transaction.

20

In one exemplary embodiment, an interaction analysis module 116 can receive information related to potential drug interactions and read and write that data to the distributed ledger 125. For example, the interaction analysis module 116 can analyze  
25 transaction information with patient clinical data extracted from the third-party databases 106, including at least one or more of information about potential drug interactions with other drugs and patient risk factors, including information selected from the group consisting of patient laboratory data, genomic data, immunizations, and allergies. In one exemplary embodiment, an eligibility analysis module 118 can make patient eligibility determinations related to the transaction. For example, the eligibility analysis module 118  
30 can receive a patient's insurance information and correlate that information with the transaction data to determine eligibility for discounts, and other relevant content.

In one exemplary embodiment, the payment module 120 can determine if a smart contract was utilized during prescription filling and may result in the exchange of digital currency

(e.g., EHRCash™, Bitcoin®, etc.), utility tokens, vouchers, or other suitable notes, between the parties involved in the smart contract. For example, the exchange of EHRCash™ tokens can be immediate (sub-millisecond delay) and can eliminate the need for standard accounting processes (i.e. invoicing, statements, accounts receivable and accounts payable) in order to collect money from trading partners. In another exemplary embodiment, a Utility Token called EHRCash™, and a smart contract platform can be used to streamline payments between stakeholders and patients, eliminating the need for accounts receivable and accounts payable systems. EHRCash™ can exist in multiple forms, but a specific form can be used for a specific transaction. In another exemplary embodiment, EHRCash™ can be native to an underlying payment blockchain (BSV) or based on a FIAT Stable coin (e.g., USD, EUR, GBP, etc). In another exemplary embodiment, the payment module 120 can utilize stored digital wallet information to effect the digital currency transactions. The modules described herein can be executed, called, or otherwise implemented via server, control logic, API, or other suitable means.

The distributed ledger 125 can be one or more EHR Data blockchains implemented on one or more platforms, including BigChainDB, nChain, Ethereum, Hyperledger, R3, Ripple, EOS, or other suitable blockchain platform. The EHR Data blockchain can be a public blockchain, accessible to the general public, or a private blockchain, accessible only by those parties credentialed for access. In another exemplary embodiment, all data can be stored on the blockchain as a graph/hierarchy structure. Each node can contain specific information (e.g., patient name, address, medication, etc.) in the graph/heirarchy that can be encrypted with its own encryption key. This graph/heirarchy structure may not be visible on the blockchain and thereby provide an obfuscation of the data structure. In another exemplary embodiment, only the master private key for the patient/user can understand the structure.

The aforementioned system components, APIs, and modules, can be communicably coupled to each other via the Internet, intranet, system bus, or other suitable network 130.

The communication can be encrypted, unencrypted, over a VPN tunnel, or other suitable communication means. The network 130 can be a WAN, LAN, PAN, or other suitable network. The network communication between the system components 102, 104, 106, 108, 110, and 112, can be encrypted using PGP, Blowfish, AES, 3DES, HTTPS, or other suitable encryption. The network communication can occur via application programming

interface (API), health level 7 (HL7) standard, ANSI-X12, Ethernet, PCI, PCIe, InfiniBand, Wi-Fi, Bluetooth, or other suitable communication protocol.

5 Third party databases 106 can be operably coupled to the system components via the network 130. In one exemplary embodiment, the third-party databases 106 can include an electronic medical record system (EMR), an Electronic Patient Outcome Record (EPOR) database, pharmacy databases, a plurality of patient databases, a clinical database, a genomic database, a laboratory database, a disease database, a standardized drug database, a research database, and other suitable databases. In  
10 another exemplary embodiment, the third-party databases can function as archival nodes. The archival nodes can keep a real-time (sub-millisecond) encrypted copy of the distributed ledger 125. The archival node can provide fault tolerance and makes the contents of the distributed ledger 125 readily available to a host so that additional data processing, reporting, and analytics can be achieved. Instead of having to traverse the  
15 EHR Data API 110, the host can query its own machines to acquire the data. Any third party can host a drug archival node. In another exemplary embodiment, the archival node can provide data restoration to the distributed ledger 125. In another exemplary embodiment, the archival node can keep the older distributed ledger data accessible in a non-production system, so that the production distributed ledger can direct its full  
20 capabilities toward current transactions. In another exemplary embodiment, the distributed ledger can be transferred to the archival node once a distributed ledger transaction closes.

External systems 140 can be operably coupled to the system components via the network  
25 130. External systems 140 can include patient devices, pharmacy devices, payer devices, financial institution devices, insurance devices, medical devices, IoT devices, or other suitable systems or devices. Such systems and devices can include smart phones, tablets, wearable devices, laptops, desktops, servers, appliances, or other suitable devices. In one exemplary embodiment, an external system 140 can be EHR-Data-BC-  
30 Client.

FIG. 2 shows a schematic 200 illustrating the types of third-parties that can access the blockchain system 100, in accordance with one or more exemplary embodiments of the present disclosure. The EHR Data blockchain system 100 can allow pharmacy industry

entities (which act as data, service, product providers) and consumers to connect to the EHR-DATA-BC 125 and the EHR Data Patient Portal (EHR-Data-PP) hosted on the server 102 using the EHR Data API (a predefined application programming interface) 202. An example of the types of entities that can connect include:

- 5           • Physicians 216;
- Pharmacies 218, including:
  - Independent,
  - Chain,
  - Central Fill, and
  - 10           ○ Mail Order;
- Drug Manufacturers 214;
- Drug Wholesalers;
- Prescription editing providers 210, including:
  - Drug Utilization Review,
  - 15           ○ Genomic, and
  - Pricing;
- Prescription Benefit Managers 212;
- Pharmacy Software Vendors;
- National Facilitators;
- 20           • Shipping Services (Federal Express®, DHL®, etc.);
- Delivery Services 206;
- Prescription Call Centers;
- Government Agencies; and
- Other relevant entities 208.

25

### **Blockchain Operations**

In one exemplary embodiment, when interacting with the EHR-Data-BC 125 the entities can use EHR Data blockchain clients (EHR-Data-BC-Client) to initiate operations using the EHR-Data-BC-API. Such operations can include:

- 30           • Creating a new *Transaction*, such as:
  - RxNew – a transaction to indicate a new prescription,
  - RxRefill – a transaction to indicate that a prescription is being filled,

- RxTransfer – a transaction to indicate that a prescription has been transferred to a different store,
- RxComplete – a transaction to indicate a prescription has been finalized,
- RxDeactivate – a transaction to indicate that a prescription has been deactivated, and
- RxUpdate – a transaction to indicate a prescription has been updated;
- Attaching a *Smart Contract* to an existing *Transaction*;
- Attaching a Parent Smart Contract to an existing Smart Contract;
- Attach a Child Smart Contract to an existing Smart Contract;
- Attaching *Meta-Data* to an existing *Transaction*, such meta-data can be used to modify the original transaction or add new data elements to the existing transaction. The specifics of the meta-data can be unique to the type of the original transaction and can be controlled by the API; and
- Closing an existing contract.

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### Process Flow

FIG. 5 shows a block diagram of an electronic health record data blockchain system process flow 500, in accordance with one or more exemplary embodiments of the present disclosure. In one exemplary embodiment, before a new transaction can be placed on the EHR Data Blockchain (EHR-Data-BC) 125 it may be necessary to associate the transaction with a patient. In another exemplary embodiment, the EHR-Data-BC-Client 902 can be an external device 140. In another exemplary embodiment, the EHR-Data-BC-API 110 is operably coupled to the EHR-Data-BC 125 to access, store, and process data on and relate to the EHR-Data-BC 125. The EHR-Data-BC-API 110 can access the EHR-Data-BC 125 through network 130, as in a public blockchain, or directly via server 102, as in a private blockchain. In another exemplary embodiment, EHR-Data-PP-API 906 can provide a user interface to the EHR-Data-BC-Client 902, by which the EHR-Data-BC-Client 902 can send and receive data to and from server 102, the EHR-Data-PP-API 906, the EHR-Data-BC-API 110, and the EHR-Data-BC 125.

30

### *Determine Single Purpose Patient ID (SPPID)*

In another exemplary embodiment, the EHR-Data-BC 125 can be publicly viewable. Accordingly, no patient identifiable information (PII) may be stored in the EHR-Data-BC 125. In another exemplary embodiment, storage of PII can be avoided by the issuance of

an API call via EHR-Data-BC-Client 902 to EHR-Data-PP-API 906 to determine the identity of a patient. This API call can include general query data 904 about the patient (e.g., first name, last name, phone numbers, address, identification numbers, etc.) and can be used to determine if the patient has a record stored in the system. If the patient  
5 has a record in the system, pertinent patient data can be returned along with a *'single purpose patient ID'* (SPPID) 912. As its name indicates, the SPPID 912 can be a temporary ID associated with the patient. In one exemplary embodiment, the SPPID 912 can be a decimal, hexadecimal, text value, or other suitable ID, randomly generated by the server 102 or the EHR-Data-PP-API 906. In another exemplary embodiment, a new  
10 SPPID 912 can be generated per session. In another exemplary embodiment, a new SPPID 912 can be generated periodically (hourly, daily, weekly, or other suitable period). In another exemplary embodiment, a new SPPID 912 can be generated based on the satisfaction of a metric associated with the patient (the number of queries, the number of transactions, or other suitable metric). The SPPID 912 can be stored in the EHR-Data-  
15 BC 125 with or associated with a transaction. Once an SPPID 912 has been generated and stored in the transaction, EHR-DATA-BC-Client 902 can use the SPPID 912 to retrieve information about the patient (e.g., genomic information, allergy information, prescription profile, etc.) without revealing the identity of the patient.

#### 20 *New Patient Record*

In one exemplary embodiment, if the server 102 determines that the patient does not have a data record, the EHR-Data-BC-Client 902 can request that the server 102 generate a new patient record. For example, a new patient record can be created by the server 102 via the EHR-Data-PP-API 906, and an SPPID 912 can be returned to the  
25 EHR-Data-BC-Client 902 for that patient.

In one exemplary embodiment, the EHR-Data-BC-Client 902 can generate and submit a query 904 to the EHR-Data-PP-API 906, the EHR-Data-PP-API 906 can request and/or generate an SPPID 912 and return SPPID 912 to EHR-Data-BC-Client 902. The EHR-  
30 Data-PP-API 906 can retrieve a patient record stored in the memory 106 of server 102 or retrieve a record in a third-party database 106 via the network 130. In another exemplary embodiment, the EHR-Data-PP-API 906 can provide the SPPID 912 to the EHR-Data-BC-API 110 to store the SPPID 912 in the EHR-Data-BC 125. In another exemplary embodiment, the EHR-Data-BC-Client 902 can provide a transaction generated by the

EHR-Data-BC-Client 902 to the EHR-Data-BC-API 110 to store the transaction in the EHR-Data-BC 125.

#### *Patient Information*

5 The patient record can contain various types of information related to the patient. In one exemplary embodiment, the patient record can include: First Name, Last Name, Middle Name(s), Address(s), Date of Birth, Physical Attributes, Identification Numbers, Phone Numbers, Allergy Information, Genomic Information, Prescription Profile, Prescription History, Prescription Transaction History, Physician(s) Information, Address History,  
10 among other relevant information.

FIG. 3 illustrates a flow chart diagram 300 exemplifying control logic embodying features of an electronic health record data blockchain system transaction, in accordance with one or more exemplary embodiments of the present disclosure. The transaction control logic  
15 306 can be implemented as an algorithm on a server, a machine learning module, or other suitable system or component. The transaction control logic 306 can be implemented with software, hardware, an application programming interface (API), a network connection, a network transfer protocol, HTML, DHTML, JavaScript, Dojo, Ruby, Rails, other suitable applications, or suitable combinations thereof. Transaction-related  
20 data can flow between one or more EHR-Data-BC-Clients and the EHR-Data-BC 302 via EHR-Data-BC-API 306. In one exemplary embodiment, the server 102 can permission and authenticate one or more EHR-Data-BC-Client to access the EHR-Data-BC 302. For example, the server 102 can establish and verify a username/password, or other suitable means for authenticating a user or device. The server can also grant read/write/execute  
25 permissions to a user or device for one or more functions described herein. In one exemplary embodiment, each entity can have a portal which can allow the entity to grant permission to a third party to use a specific data item or range of data items contained in the blockchain. In another exemplary embodiment, an 'Authorization Token' (e.g., authToken) can be created on behalf of the user/entity, after the user/entity has granted  
30 permission for read and/or write access to specific data elements of their EHR Data. For example, the 'authToken' can have a specific lifespan (or Time-to-Live) and can only be renewed with authorization from the user/entity.

The transaction control logic 306 can leverage the ability of a computer platform to spawn multiple processes and threads by processing data simultaneously. The speed and efficiency of the transaction control logic 300 is greatly improved by instantiating more than one process to generate and process a transaction having a patient's data. However, one skilled in the art of programming will appreciate that use of a single processing thread may also be utilized and is within the scope of the present invention. In one exemplary embodiment, the transaction control logic 306 can be the EHR-Data-BC-API 306. In another exemplary embodiment, the transaction control logic 306 can instantiate various modules of the server 102.

#### *BC-Transaction Add*

The transaction control logic 306 process flow of the present embodiment begins when the control logic 306 receives a new BC-Transaction 304. In one exemplary embodiment, a first EHR-Data-BC-Client 308 has permission to add a new BC-Transaction 304 to the EHR-Data-BC 302. In another exemplary embodiment, a BC-Transaction 302 can be transmitted to the control logic 306 by a Physician's Practice Management Software, an eScripts Software Agent, or a Pharmacy's Prescription Filling Software. In another exemplary embodiment, the first EHR-Data-BC-Client 308 can generate a new BC-Transaction 304, such as a new e-prescription, and transmit the BC-Transaction 304 to the control logic 306 via the network 130. The control logic 306 can then store the BC-Transaction 304 on the EHR-Data-BC 302.

#### *BC-Transaction Detection*

The transaction control logic 306 can detect and generate a notification of a new BC-Transaction 304 on the EHR-Data-BC 302. In one exemplary embodiment, various pharmacy industry entities can receive a notification from the EHR-Data-BC 302 upon the occurrence of an event, such as a new BC-Transaction 304 being stored on the EHR-Data-BC 302. The control logic 306 can notify one or more EHR-Data-BC-Clients 310 when a BC-Transaction 304, BC-MetaData, a BC-SmartContract, or a BC-Close has been added or linked to the EHR-Data-BC 302. In another exemplary embodiment, when a notification is received, the EHR-Data-BC-Clients 310 can determine whether the transaction type qualifies for any data, products, and/or services in which the vendor can provide. The EHR-Data-BC-Clients 310 can correlate the transaction information with previously stored offerings to determine whether there is a match. In one exemplary

embodiment, the transaction information can have information such as drug type, insurance information, or other suitable data. In another exemplary embodiment, the transaction information can include codes representative of the information related to the transaction, such that the codes can be quickly correlated by the EHR-Data-BC-Clients 5 310 to determine whether there is a product/service match. The notification can be an e-mail, text message, software alert, or other suitable notification.

#### *Add Smart Contract*

The transaction control logic 306 can generate a smart contract related to the BC-Transaction 304. In one exemplary embodiment, if one of the EHR-Data-BC-Clients 10 310 receiving a notification of a new BC-Transaction 304 determines that it (a second EHR-Data-BC-Client 312) has data, products, and/or services that the second EHR-Data-BC-Client 312 can provide related to the BC-Transaction 304, the second EHR-Data-BC-Client 312 can transmit information to the control logic 306 so that the control logic 306 15 can generate a BC-SmartContract 314 for the BC-Transaction 304.

In one exemplary embodiment, the BC-SmartContract 314 can be operably coupled to the BC-Transaction 304 and can specify (in programmatic terms and also in human-readable summary) the data, product, or service that it can provide along with a specified 20 price. In another exemplary embodiment, the BC-SmartContract 314 can be a computer program or a transaction protocol, respectively, that can be intended to automatically execute, control, or document respectively legally relevant events and actions according to the terms of a contract, of an agreement, or of a negotiation. In another exemplary embodiment, the BC-SmartContract 314 can be a computer program or a transaction 25 protocol, respectively, that can execute, control, or document based on user input (or multi-user input). In another exemplary embodiment, the BC-SmartContract 314 can trigger the exchange of digital currency 320 (e.g., EHR Cash) between parties.

Smart contract types can include:

- 30 • SC\_DrugOfferPatient – a smart contract to offer a coupon to patient for selecting the drug.
- SC\_EditDUR – a smart contract to indicate that a Drug Utilization Review edit has determined that the patient has some form of interaction with the drug selected.

- SC\_EditClinical – a smart contract to indicate that a Clinical edit has determined that the patient has some form of interaction with the drug selected. (e.g., patient can't metabolize the drug selected, etc.).
- SC\_FillCentral – a smart contract to indicate that the prescription can be centrally filled.

5

#### *Add Meta Data*

The transaction control logic 306 can memorialize the terms of the BC-SmartContract 314, if accepted. In one exemplary embodiment, the first EHR-Data-Client 308 can transmit a determination of whether or not to accept the offer from the second EHR-Data-Client 312 to utilize the data, product, or service offered by the second EHR-Data-Client 312. In another exemplary embodiment, a plurality of BC-SmartContract 314 can be accepted by the first EHR-Data-Client 308. In another exemplary embodiment, the control logic can send a notification to the first EHR-Data-Client 308 via the network 130 to accept or decline the BC-SmartContract 314. In another exemplary embodiment, the control logic 306 can received pre-determined decisions based upon the patient's preferences (stored in the patient's record or transmitted with the determination). In another exemplary embodiment, the control logic 306 can add *Meta-Data* (BC-MetaData 316) to the EHR-Data-BC and associate it with the original BC-Transaction 304.

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Meta-Data types can include:

- MD\_DrugDetermine – a prescription is ready for drug determination. A physician's software can add this MetaData type to solicit drug recommendations from drug manufacturers.
- MD\_DrugRecommend – added to recommend a drug for a prescription. A physician's software can add this MetaData type to solicit drug dosage recommendations.
- MD\_DosageDetermine – a prescription is ready for dosage determination.
- MD\_DosageRecommend – added to recommend a dosage for a prescription.
- MD\_Eligible – added by a payer to indicate that a patient is eligible to receive the selected drug or a recommended drug.
- MD\_Acquired – added by a pharmacy to indicate that it has acquired the prescription.

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*Add BC-Close*

The transaction control logic 306 can finalize and close the BC-Transaction 304. In one exemplary embodiment, when the first EHR-Data-BC-Client 308 determines to close the BC-Transaction 304 it can trigger the control logic to write a BC-Close 318 statement to the EHR-Data-BC 302. The BC-Close 318 statement can prevent any additional actions from occurring for the BC-Transaction 304 and can trigger the control logic 305 to execute the BC-SmartContract 314.

*Contract Execution*

The transaction control logic 306 can determine which BC-Smart Contracts 314 should be executed and can cause a digital currency transaction to occur between the first EHR-Data-Client 308 and the second EHR-Data-Client 312. In one exemplary embodiment, when the first EHR-Data-BC-Client 308 closes the BC-Transaction 304 by writing a BC-Close 318 to the EHR-Data-BC 302, the control logic 306 can determine whether any contracts associated with the BC-Transaction 304 can be executed by checking the automatic or user-received input. In another exemplary embodiment, if a BC-Smart Contract 314 is to be executed, the control logic 306 can cause a digital currency transaction to occur using each parties' digital wallet information. In another exemplary embodiment, the EHR Data Patient Portal (EHR-Data-PP) can maintain a patient's digital currency account, for use in association with the system 100.

**EXAMPLES**

The following embodiments illustrate examples of typical EHR Data Blockchain (EHR-DATA-BC) RxNew Transaction workflows.

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*RxNew Process Flow*

New prescriptions can be created by physicians by one of the following:

- 1) Physicians through their Practice Management Software. This software can contain EHR-Data-BC-Client software which can operably couple it with the EHR-Data-BC.
- 2) An eScripts agent, which can retrieve the prescription from the eScripts network and using the EHR-Data-BC-Client software, add a BC-Transaction (RxNew) to the EHR-Data-BC.

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FIGs. 4A - 4E illustrate a flow chart diagram 400 exemplifying control logic embodying features of an electronic health record data blockchain system RxNew transaction, in accordance with one or more exemplary embodiments of the present disclosure. The RxNew transaction control logic 306 can be implemented as an algorithm on a server, a machine learning module, or other suitable system or component. The RxNew transaction control logic 306 can be implemented with software, hardware, an application programming interface (API), a network connection, a network transfer protocol, HTML, DHTML, JavaScript, Dojo, Ruby, Rails, other suitable applications, or suitable combinations thereof. Transaction-related data can flow between one or more EHR-Data-BC-Clients and the EHR-Data-BC 302 via control logic 306. In one exemplary embodiment, the server 102 can permission and authenticate one or more EHR-Data-BC-Client to access the EHR-Data-BC 302. For example, the server 102 can establish and verify a username/password, or other suitable means for authenticating a user or device. The server can also grant read/write/execute permissions to a user or device for one or more functions described herein.

#### *BC-Transaction Add*

As shown in FIG. 4A, the RxNew transaction control logic 306 process flow of the present embodiment begins when the control logic 306 receives a new BC-Transaction 404 for a new prescription. In one exemplary embodiment, a BC-Transaction 404 can be transmitted to the control logic 306 by a Physician's Practice Management Software, an eScripts Software Agent, a Pharmacy's Prescription Filling Software, or other suitable software. In another exemplary embodiment, the first EHR-Data-BC-Client 402 can generate a new BC-Transaction 404, such as a new e-prescription, and transmit the BC-Transaction 404 to the control logic 306 via the network 130. The control logic 306 can then store the BC-Transaction 404 on the EHR-Data-BC 302.

#### *Physician - Adds New Transaction*

In one exemplary embodiment, a Physician can generate a new prescription, using their Practice Management Software (PMS). The PMS can utilize the EHR-Data-BC-Client 402 to add a BC-Transaction (RxNew) 404 to the EHR-Data-BC 302. In another exemplary embodiment, the EHR-Data-BC-Client 402 can be integrated into the PMS. In another exemplary embodiment, the EHR-Data-BC-Client 402 can be standalone software.

*Add Smart Contracts*

The RxNew transaction control logic 306 can receive one or more BC-SmartContracts from one or more EHR-Data-BC-Clients that have determined that they can supply data, product, or service related to the RxNew Transaction 404. In one exemplary embodiment, a plurality of pharmacy industry entities can monitor the EHR-Data-BC 302 using EHR-Data-BC-Clients 406 and can provide data, product, or service related to the RxNew Transaction 404. To indicate such capability, each entity can create a BC-SmartContract to describe their product/service, terms/conditions, and an execution price. In one exemplary embodiment, a drug code (e.g., NDC-G-1) can be included in the RxNew Transaction 404. For example:

- a generic drug manufacturer (e.g., DM-1) can provide a generic drug (e.g., NDC-G-1) that is equivalent to the brand drug (e.g., NDC-B-1) written in the prescription, and can initiate a BC-SmartContract 410 that can indicate in programmatic terms the generic drug code (e.g., NDC-G-1) and a coupon value (e.g., \$5) if the drug is substituted for the brand drug (e.g., NDC-B-1) when the prescription has been filled via EHR-Data-BC-Client 408.
- a generic drug manufacturer (e.g., DM-2) can provide a generic drug (e.g., NDC-G-2) that is equivalent to the brand drug (e.g., NDC-B-1) written in the prescription, and can initiate a BC-SmartContract 414 that can indicate in programmatic terms the generic drug code (e.g., NDC-G-2) and a coupon value (e.g., \$4) if the drug is substituted for the brand drug (e.g., NDC-B-1) when the prescription has been filled via EHR-Data-BC-Client 412.
- A DUR Edit Service (e.g., DURES-1) can detect that the patient is allergic to the generic drug (e.g., NDC-G-1) offered by DM-1 and can initiate a BC-SmartContract 418 that can indicate in programmatic terms the details of this interaction via EHR-Data-BC-Client 416.
- A Clinical Edit Service (CES-1) can detect that the patient cannot metabolize the brand drug (NDC-B-1) and can initiate a BC-SmartContract 422 that can indicate in programmatic terms the details of this interaction via EHR-Data-BC-Client 420. The payer can be informed that the patient can't metabolize the generic drug, which can be on the payer formulary.
- A Central Fill (CF-1) can detect that they stock the indicated drugs and can fill the prescription at a central facility and ship the filled prescription to the pharmacy or directly to the patient, and can initiate a BC-SmartContract 426

that can indicate in programmatic terms the details of this fulfilment via EHR-Data-BC-Client 424.

In another exemplary embodiment, the control logic 306 can generate the BC-SmartContracts that are initiated by the respective EHR-Data-BC-Clients.

*Prescription Benefit Manager – Adds Patient Eligibility Meta Data*

As shown in FIG. 4B (continuing from FIG. 4A), in one exemplary embodiment, a Prescription Benefit Manager (PBM) has detected that it can supply prescription benefits to the patient indicated in RxNew Transaction 404 and can initiate a BC-MetaData 508 transaction to the EHR-Data-BC 302 to indicate that the patient is eligible for certain benefits, via the EHR-Data-BC-Client 502. In another exemplary embodiment, the control logic 306 can generate the BC-MetaData 508 transaction initiated by the EHR-Data-BC-Client 502 and write it to the EHR-Data-BC 302.

15

*Pharmacy - Acquires Prescription*

In one exemplary embodiment, the patient can enter a pharmacy and indicate that they would like to have their prescription filled. Using its EHR-Data-BC-Client 506, the pharmacy can initiate a BC-MetaData 508 transaction to the EHR-Data-BC 302 indicating that it has acquired the prescription and started the fill process. In another exemplary embodiment, the pharmacy can indicate in the EHR-Data-BC-Client 502 that it has verified the identity of the individual to satisfy any legal requirements.

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*Pharmacy – Selects Drug and Prices Prescription*

In one exemplary embodiment, based on the DUR BC-SmartContract 418 outcome and the Clinical BC-SmartContract 422 edit output, the pharmacy can select a generic drug (e.g., NDC-G-2) from Drug Manufacturer 2 (DM-2), price the prescription (e.g., \$22), and initiate a BC-MetaData 512 transaction to the EHR-Data-BC 302, via EHR-Data-BC-Client 510. In one exemplary embodiment, alternative equivalent drugs can be selected instead.

30

*Pricing Edit – Adds Smart Contract*

In one exemplary embodiment, a prescription drug pricing service (PE-1) has detected that the pharmacy has priced the prescription incorrectly (\$22) and has initiated a BC-

SmartContract 516 to the EHR-Data-BC 302 that can indicate, in programmatic terms, the reason for the pricing error, the correct price (e.g., \$48), and the contract execution price (\$.05), if the recommended price is used, via EHR-Data-BC-Client 514.

5 *Pharmacy - Fixes Price - Adds Meta Data*

In one exemplary embodiment, the pharmacy fixed the pricing issue, changed the price of the prescription, and initiated a BC-MetaData 520 transaction to the EHR-Data-BC 302, via EHR-Data-BC-Client 518.

10 *Pharmacy – Ready for Adjudication*

As shown in FIG. 4C (continuing from FIG. 4B), in one exemplary embodiment, the pharmacy can initiate a new BC-MetaData 604 transaction to the EHR-Data-BC indicating that it is ready for adjudication, via EHR-Data-BC-Client 602.

15 *Pharmacy Benefit Manager – Adjudicates – Adds Smart Contract*

In one exemplary embodiment, the Pharmacy Benefit Manager (PBM) can adjudicate the prescription and initiate a BC-SmartContract 608 indicating that it is willing to pay an amount (e.g., \$46) for the prescription, via EHR-Data-BC-Client 606.

20 *Pharmacy – Accepts Adjudication – Adds Meta Data*

In one exemplary embodiment, the pharmacy can initiate a BC-MetaData 612 transaction to the EHR-Data-BC indicating that it has accepted the adjudicated price (e.g., \$46), via EHR-Data-BC-Client 610.

25 *Pharmacy – Ready for Dispensing – Adds Meta Data*

In one exemplary embodiment, the pharmacy can initiate a BC-MetaData 616 transaction to the EHR-Data-BC 302 indicating that it is ready for dispensing, via EHR-Data-BC-Client 614.

30 *Pharmacy Pill Counter – Dispensing Complete – Add Meta Data*

In one exemplary embodiment, the pharmacy can incorporate an automated pill counter that automatically dispenses the prescription. When complete the pharmacy can initiate a BC-MetaData 620 transaction to the EHR-Data-BC 302, via EHR-Data-BC-Client 618.

*Pharmacy -Ready for Quality Control – Adds Meta Data*

As shown in FIG. 4C (continuing from FIG. 4B), in one exemplary embodiment, the pharmacy can initiate a BC-MetaData 704 transaction to the EHR-Data-BC 302 indicating that the prescription is ready for quality control review, via EHR-Data-BC-Client 702.

5

*Pharmacy – Quality Control Complete – Adds Meta Data*

In one exemplary embodiment, the pharmacy can initiate a BC-MetaData 708 transaction to the EHR-Data-BC 302 indicating that the quality control review is complete, accepted, and signed for by a pharmacist, via EHR-Data-BC-Client 706.

10

*Pharmacy – Ready for Pickup – Adds Meta Data*

In one exemplary embodiment, the pharmacy can initiate a BC-MetaData 712 transaction to the EHR-Data-BC 302 indicating that the prescription is ready for pickup, via EHR-Data-BC-Client 710.

15

*Patient – Will Pick up – Adds Meta Data*

In one exemplary embodiment, the application patient's electronic device, such as a smart phone, tablet, laptop, or other suitable device can receive a notification that the prescription is ready for pickup. In another exemplary embodiment, the patient can transmit an acknowledgement that they will pick up the prescription via a user device (e.g., smartphone). The user device can then initiate a BC-MetaData 716 transaction, indicating that the patient will pick up prescription, via EHR-Data-BC-Client 714.

20

*Patient – Crypto Checkout – Adds Smart Contract*

In one exemplary embodiment, the patient can choose to pay for the copay associated with the prescription using the balance in their EHR Data Patient Portal (EHR-Data-PP) digital currency account. The patient can use their smart phone to complete the transaction, via EHR-Data-BC-Client 718. The patient's smart phone can initiate a BC-SmartContract 720 related to the EHR-Data-BC 302.

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*Pharmacy – Patient Picked Up Prescription – Adds Meta Data*

As shown in FIG. 4C (continuing from FIG. 4B), in one exemplary embodiment, after the patient has paid for the prescription using their crypto currency account, the pharmacy

can initiate a BC-MetaData 804 transaction on the EHR-Data-BC 302 indicating that the patient has picked up the prescription, via EHR-Data-BC-Client 802.

*Pharmacy – Closes Prescription - Adds BC-MetaData*

- 5 In one exemplary embodiment, the patient can pick up the prescription, and thus the pharmacy can initiate a BC-MetaData 808 transaction indicating that the prescription is now closed and the prescription filling process is complete, via EHR-Data-BC-Client 806.

*Contract Execution*

- 10 In one exemplary embodiment, following the close of the BC-Transaction 404 the control logic 306 can initiate crypto currency payments 812 for the executed SmartContracts 810. The system thus generates an immutable record of the transaction for subsequent review and auditing.

- 15 The present disclosure achieves at least the following advantages:

1. improves the performance of traditional systems by utilizing the EHR patient transaction blockchain as a workflow space to process a transaction until the transaction completes, is signed, and is distributed for consensus.
2. implements smart contracts to determine and define workflow processes, drug interactions, fulfillment, expected outcomes, triggering events, and pricing,  
20 among other data elements;
3. reduces the utilization of additional processing resources and network utilization from computationally-expensive data storage, data bottlenecks, and system queries;
- 25 4. generates an immutable record of the transaction for subsequent review and auditing;
5. provides a platform for providing easy and efficacious prescription editing, processing, and payment, leveraging cryptocurrencies and APIs to facilitate transactions; and
- 30 6. accesses and retrieves patient identifiable information (PII) and generates a non-patient-identifiable Single Purpose Patient ID (SPPID) for a particular patient for use in a discrete transaction.

Persons skilled in the art will readily understand that these advantages (as well as the advantages indicated in the summary) and objectives of this system would not be possible without the particular combination of computer hardware and other structural components and mechanisms assembled in this inventive system and described herein. It will be  
5 further understood that a variety of programming tools, known to persons skilled in the art, are available for implementing the control of the features and operations described in the foregoing material. Moreover, the particular choice of programming tool(s) may be governed by the specific objectives and constraints placed on the implementation plan selected for realizing the concepts set forth herein and in the appended claims. In  
10 particular, the integration of commercial-off-the-shelf (COTS) equipment may be utilized in the new and unconventional manner described herein to achieve one or more aspects of the claims.

The description in this patent document should not be read as implying that any particular  
15 element, step, or function can be an essential or critical element that must be included in the claim scope. Also, none of the claims can be intended to invoke 35 U.S.C. § 112(f) with respect to any of the appended claims or claim elements unless the exact words "means for" or "step for" are explicitly used in the particular claim, followed by a participle phrase identifying a function. Use of terms such as (but not limited to) "mechanism,"  
20 "module," "device," "unit," "component," "element," "member," "apparatus," "machine," "system," "processor," "processing device," or "controller" within a claim can be understood and intended to refer to structures known to those skilled in the relevant art, as further modified or enhanced by the features of the claims themselves, and can be not intended to invoke 35 U.S.C. § 112(f).

25  
The disclosure may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. For example, each of the new structures described herein, may be modified to suit particular local variations or requirements while retaining their basic configurations or structural relationships with each other or while performing  
30 the same or similar functions described herein. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive. Accordingly, the scope of the inventions can be established by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein. Further, the individual elements of

the claims are not well-understood, routine, or conventional. Instead, the claims are directed to the unconventional inventive concept described in the specification.

## Claims:

1. A system for providing blockchain-based patient transactions, the system comprising:
  - 5 one or more computer-readable storage media configured to store a blockchain;  
a data Application Programming Interface (API) system comprising one or more processors programmed to execute computer program instructions that, when executed, cause the data API system to:
    - 10 receive a request for a new blockchain transaction related to a patient,  
initiate a patient lookup query to determine whether a patient electronic health record exists,  
generate a single purpose patient ID (SPPID) associated with the patient electronic health record;  
a client computer programmed to execute computer program instructions that,  
15 when executed, cause the client computer to:
      - receive a patient lookup query related to a patient from a client to determine whether the patient's electronic health record exists,  
receive the SPPID to initiate a new blockchain transaction related to the patient on the blockchain without patient-identifying information,  
20 determine whether an entity operating the client computer can provide data, products and/or services related to a blockchain transaction; and  
a blockchain API system comprising one or more processors programmed to execute computer program instructions that, when executed, cause the blockchain API system to:
        - 25 generate the blockchain transaction and read and write records to and from the blockchain, and  
associate one or more smart contracts with the blockchain transaction.
2. The system of Claim 1, wherein the smart contract exchanges digital currency  
30 between the parties involved in the smart contract.
3. The system of Claim 2, wherein the digital currency includes utility tokens or vouchers.

4. The system of Claim 1, wherein the SPPID cannot be used to write information to the blockchain after a patient blockchain transaction is completed.
5. The system of Claim 1, wherein the blockchain API system can generate a notification when the blockchain transaction is generated.
6. The system of Claim 1, wherein the blockchain API system can transmit the notification to one or more providers.
7. The system of Claim 1, wherein the client computer can provide information to the blockchain API system regarding data, products and/or services related to the blockchain transaction.
8. The system of Claim 1, wherein the blockchain API system edits the blockchain transaction on the blockchain.
9. A method of providing blockchain-based electronic health record data patient transactions, the method being implemented by a server system comprising one or more processors executing computer program instructions that, when executed, perform the method, the method comprising:
  - associating a single purpose patient ID (SPPID) with the electronic health record;
  - providing the SPPID to the client so the client can initiate a new blockchain patient transaction related to the patient on the blockchain without patient-identifying information;
  - receiving a patient transaction from a pharmacy;
  - writing the patient transaction to the blockchain;
  - notifying one or more client devices of the patient transaction;
  - receiving one or more offers for data, products, or services related to the patient transaction;
  - generating a smart contract related to the patient transaction and the one or more offers; and
  - modifying the patient transaction based on the execution of the smart contract.
10. The method of Claim 9, wherein the smart contract exchanges digital currency between the parties involved in the smart contract.

11. The method of Claim 10, wherein the digital currency includes utility tokens or vouchers.

12. The method of Claim 9, wherein the SPPID cannot be used to write information to the blockchain after the patient blockchain transaction is completed.

13. The method of Claim 9, further comprising generating a notification when the patient transaction is generated.

14. The method of Claim 13, further comprising transmitting the notification to one or more providers.

15. The method of Claim 9, wherein the patient transaction is modified on the blockchain.

16. The method of Claim 15, wherein the patient transaction is modified on the blockchain in real-time.

17. A system for providing electronic health record data for blockchain-based patient transactions, the system comprising:

one or more computer-readable storage media configured to store a blockchain;  
a data Application Programming Interface (API) system comprising one or more processors programmed to execute computer program instructions that, when executed, cause the data API system to:

receive a request for a new blockchain transaction related to a patient,  
retrieve the patient electronic health record from one or more databases, and  
generate a single purpose patient ID (SPPID) associated with the patient electronic health record; and

a blockchain API system comprising one or more processors programmed to execute computer program instructions that, when executed, cause the blockchain API system to:

generate the blockchain transaction and read and write records to and from the blockchain, and

associate one or more smart contracts with the blockchain transaction.

18. The system of Claim 17, wherein the smart contract exchanges digital currency between the parties involved in the smart contract.

19. The system of Claim 18, wherein the digital currency includes utility tokens or  
5 vouchers.

20. The system of Claim 17, wherein the blockchain API system edits the prescription transaction on the blockchain based on input from one or more providers.

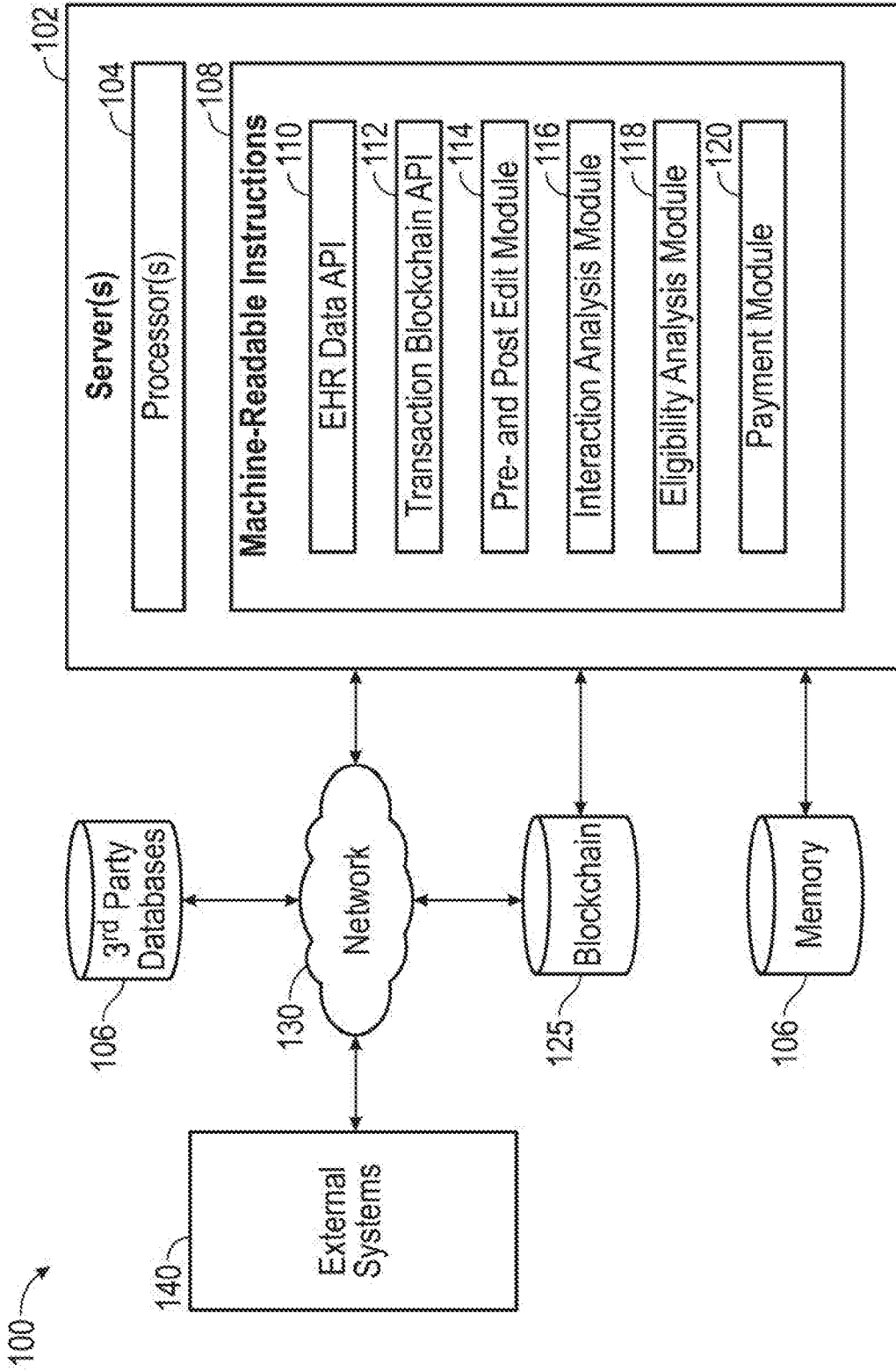


FIG. 1

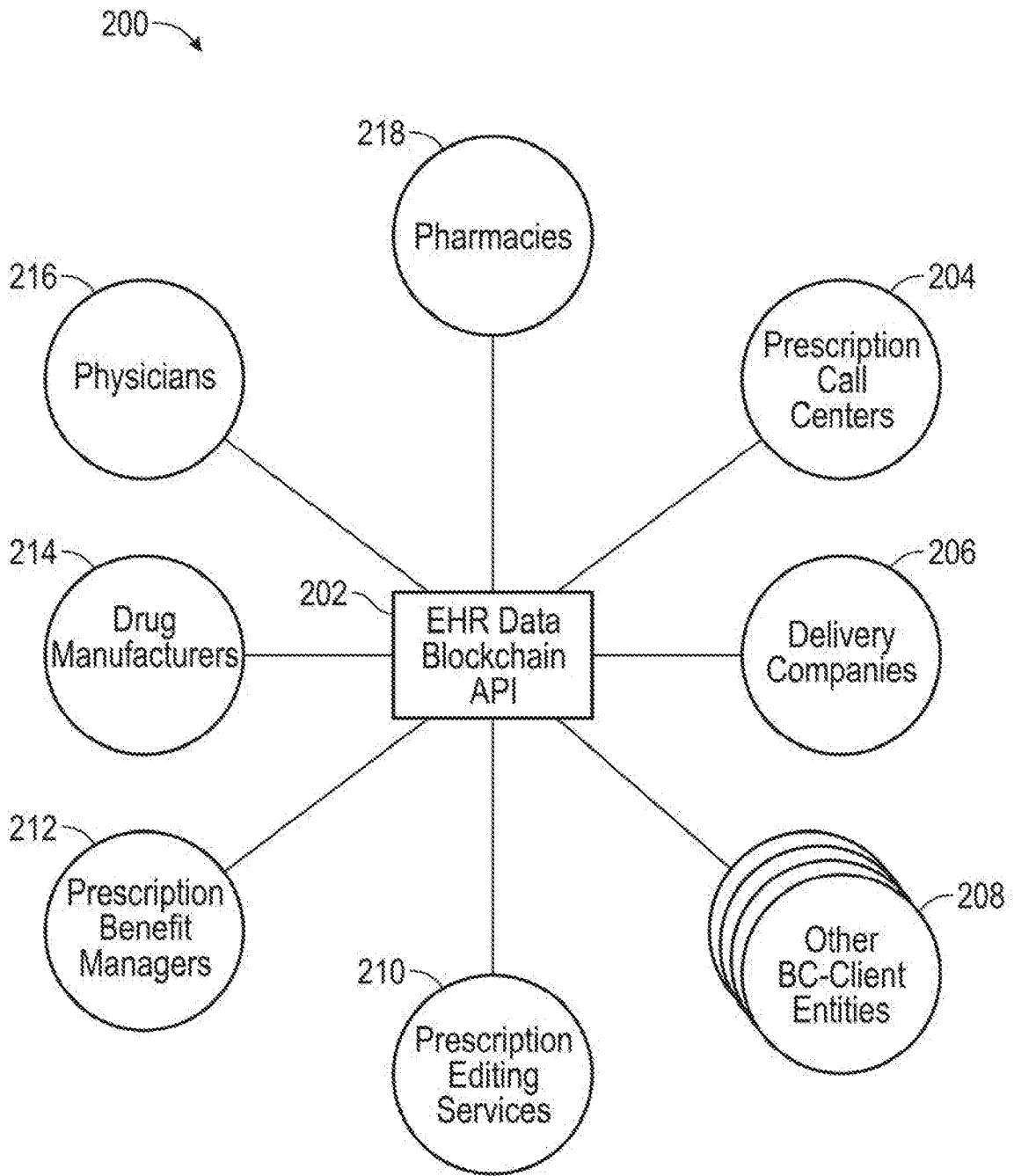


FIG. 2

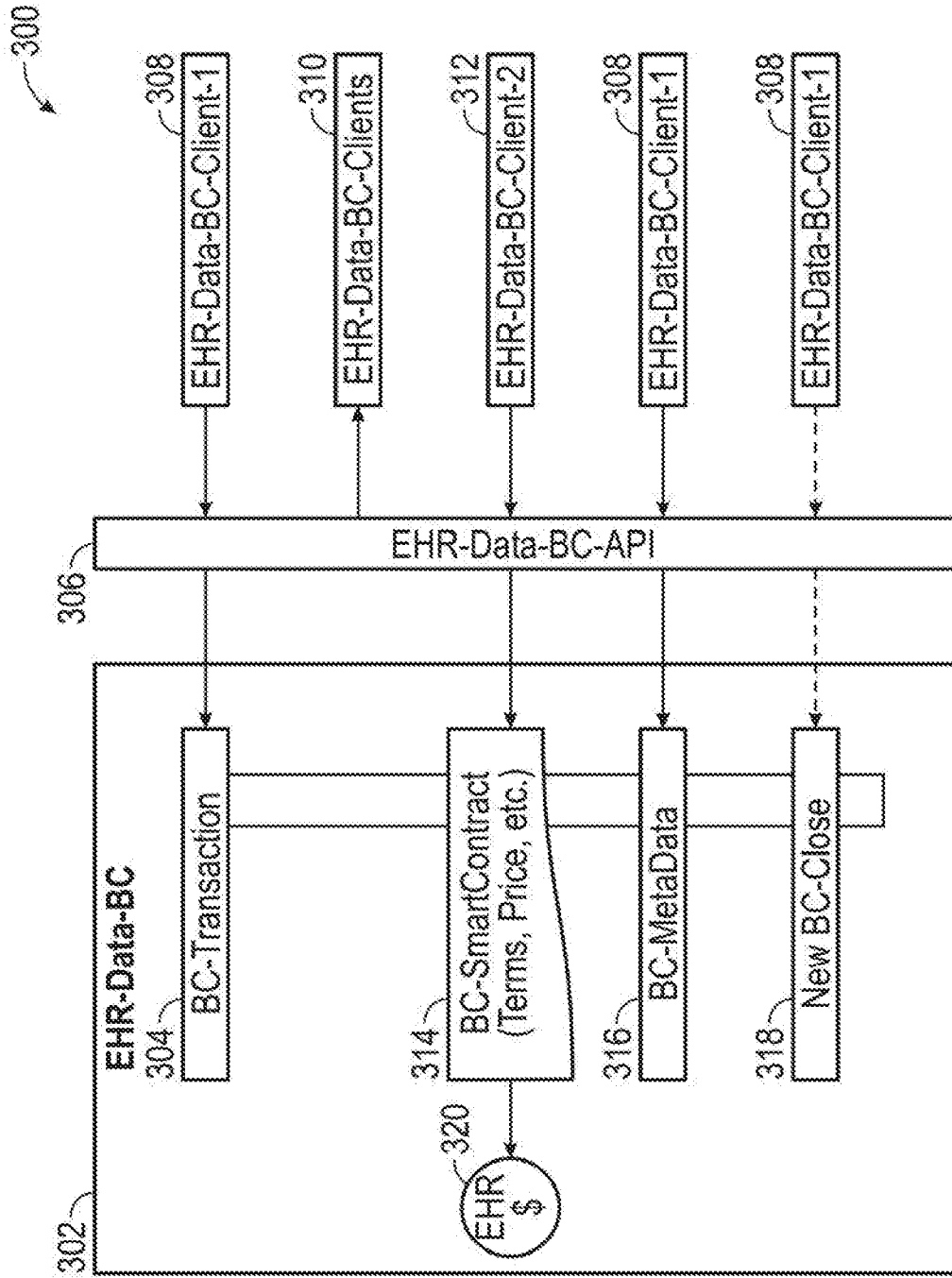


FIG. 3

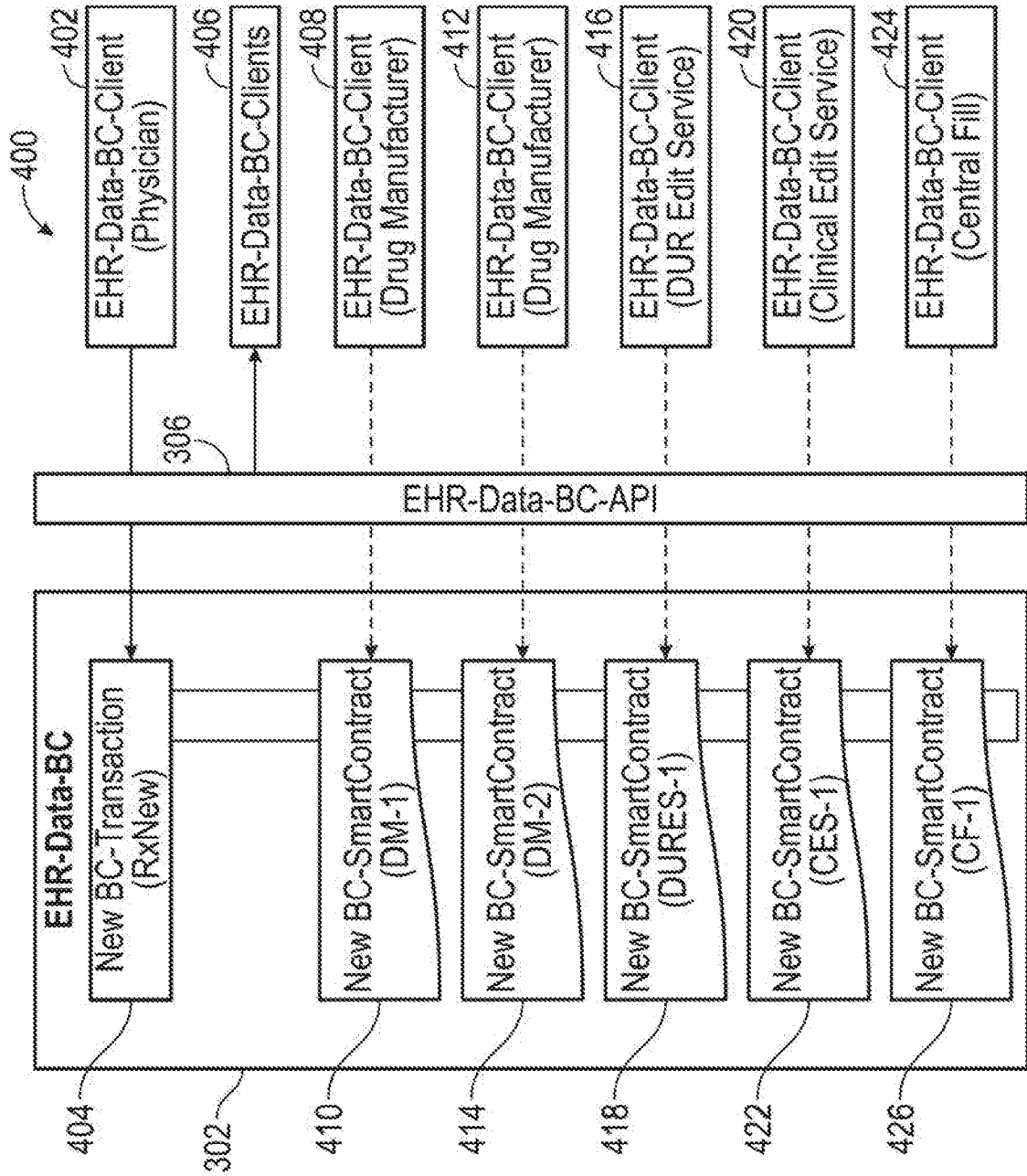


FIG. 4A

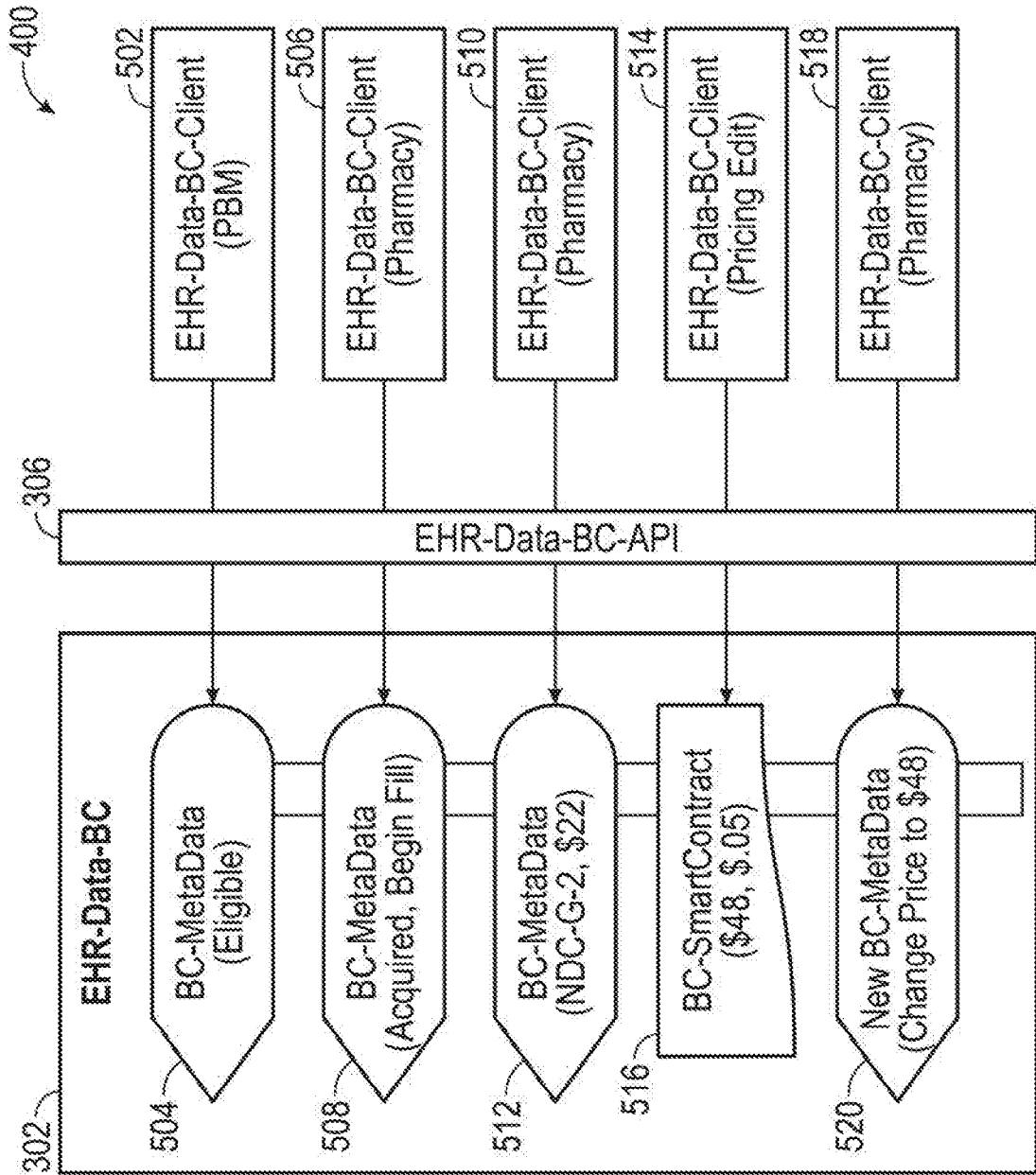


FIG. 4B

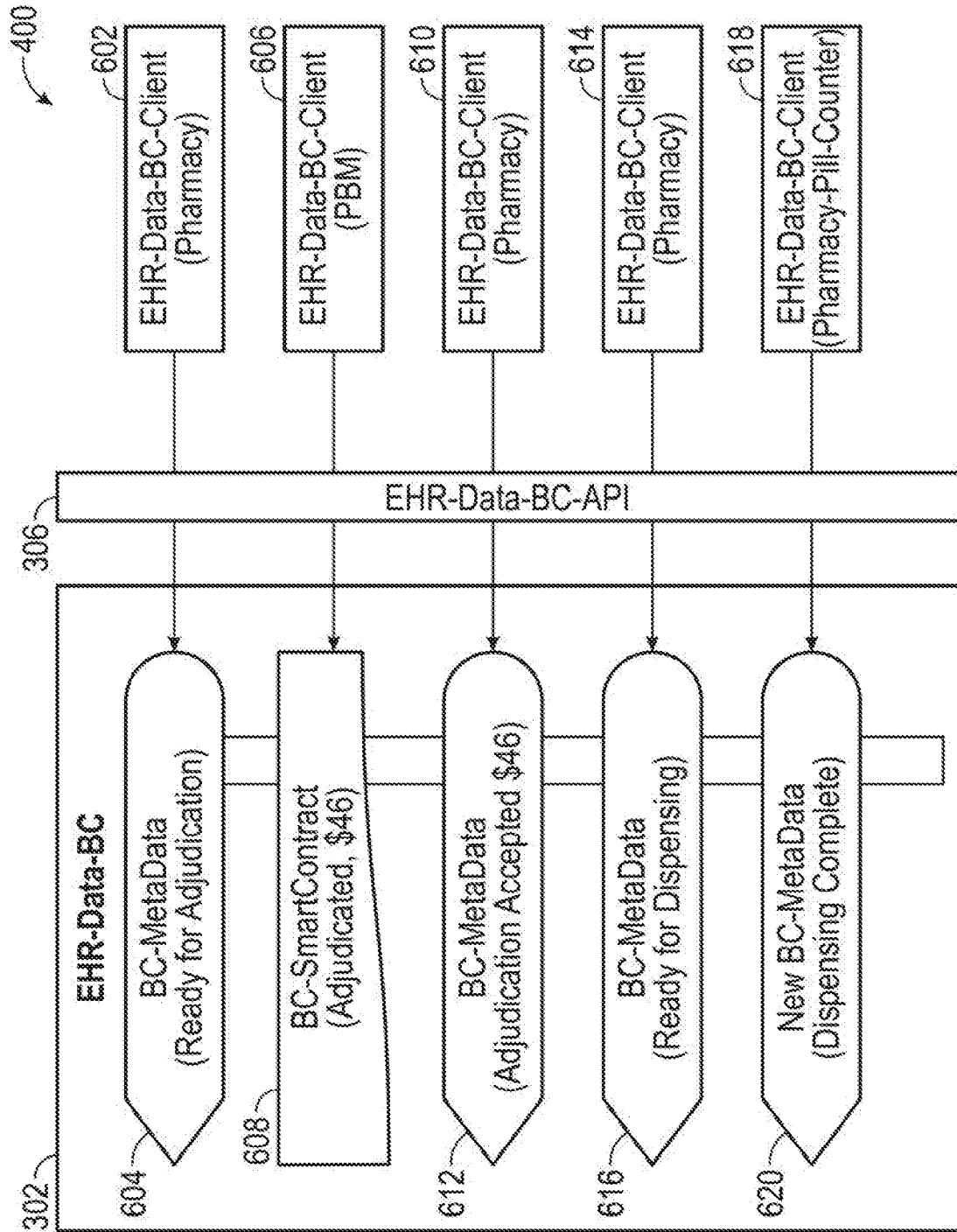


FIG. 4C

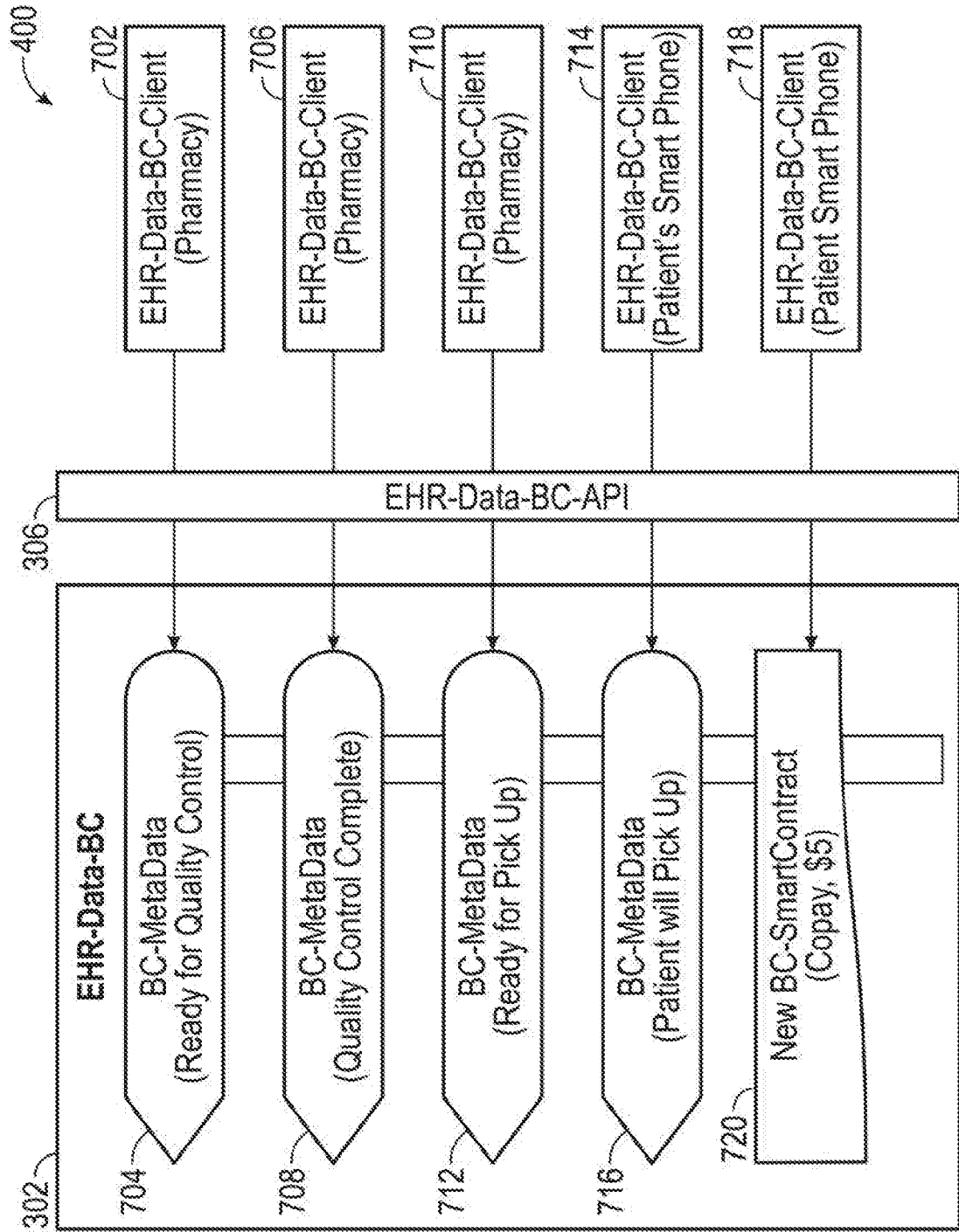


FIG. 4D

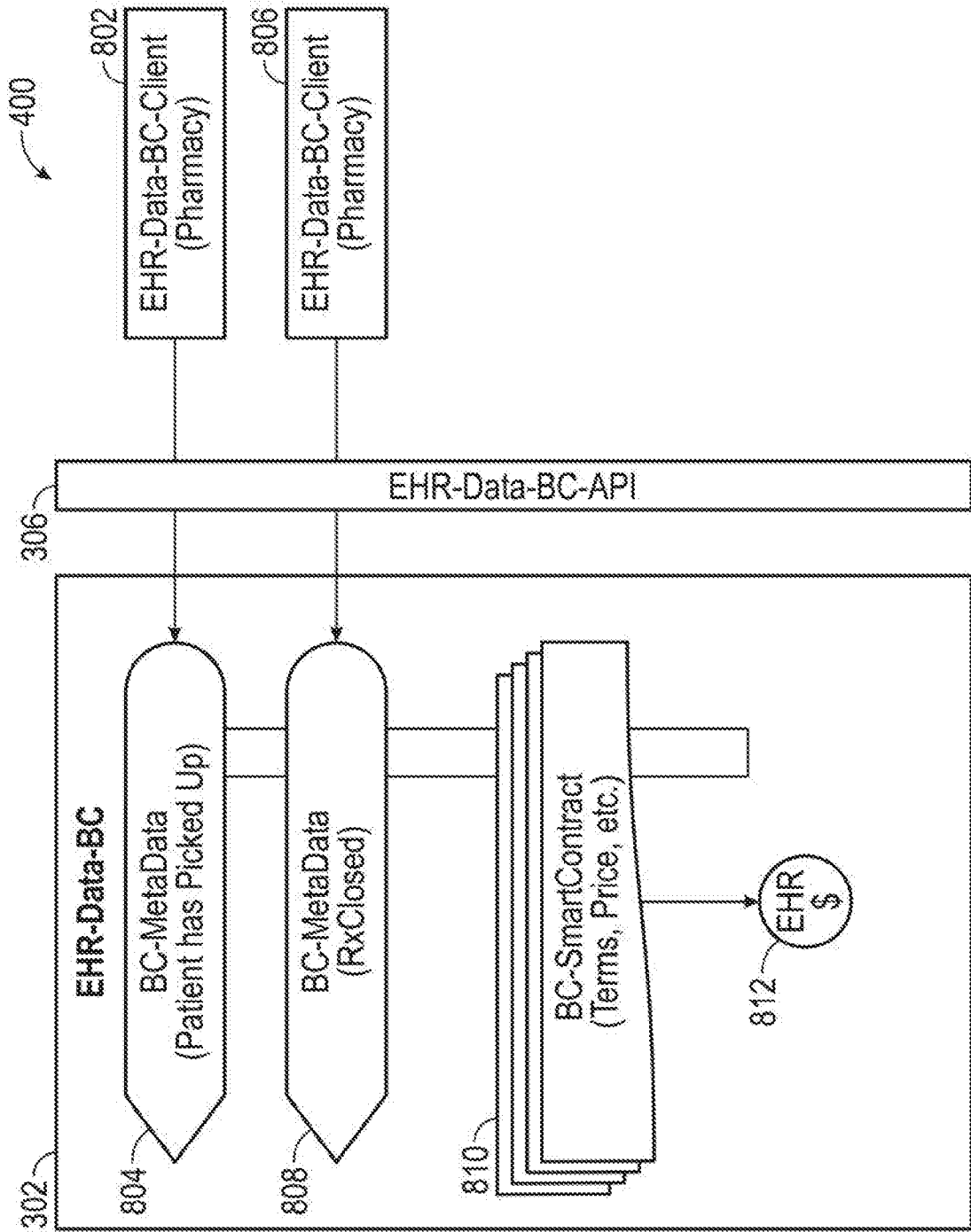


FIG. 4E

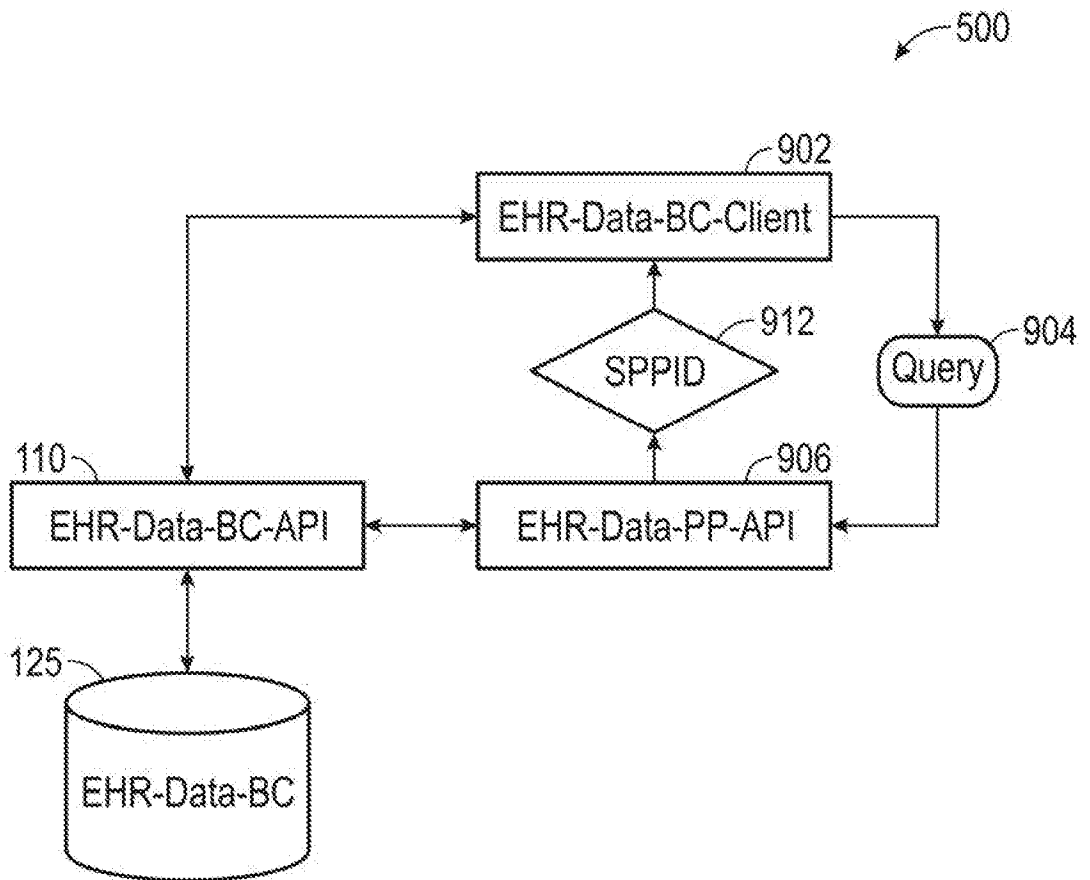


FIG. 5

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2020/038781

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - G16H 10/60; G16H 10/00; G16H 10/65; G16H 20/00; G16H 20/10 (2020.01)

CPC - G16H 10/60; G16H 10/00; G16H 10/65; G16H 20/00; G16H 20/10 (2020.08)

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

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

see Search History document

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

see Search History document

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

see Search History document

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2016/0117471 A1 (BELT et al) 28 April 2016 (28.04.2016) entire document	1-20
Y	US 2018/0326291 A1 (TRAN) 15 November 2018 (15.11.2018) entire document	1-20
A	US 2017/0364655 A1 (AFTECHMOBILE INC. (D/B/A MOBRISE INC.)) 21 December 2017 (21.12.2017) entire document	1-20
A	US 2019/0096534 A1 (JOAO) 28 March 2019 (28.03.2019) entire document	1-20
A	US 2015/0332283 A1 (NANT HOLDINGS IP, LLC) 19 November 2015 (19.11.2015) entire document	1-20

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

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

Date of the actual completion of the international search

12 August 2020

Date of mailing of the international search report

28 AUG 2020

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