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(54) SYSTEM AND METHOD FOR BLOCKCHAIN DOCUMENT ACCESS AND DISTRIBUTION CONTROL

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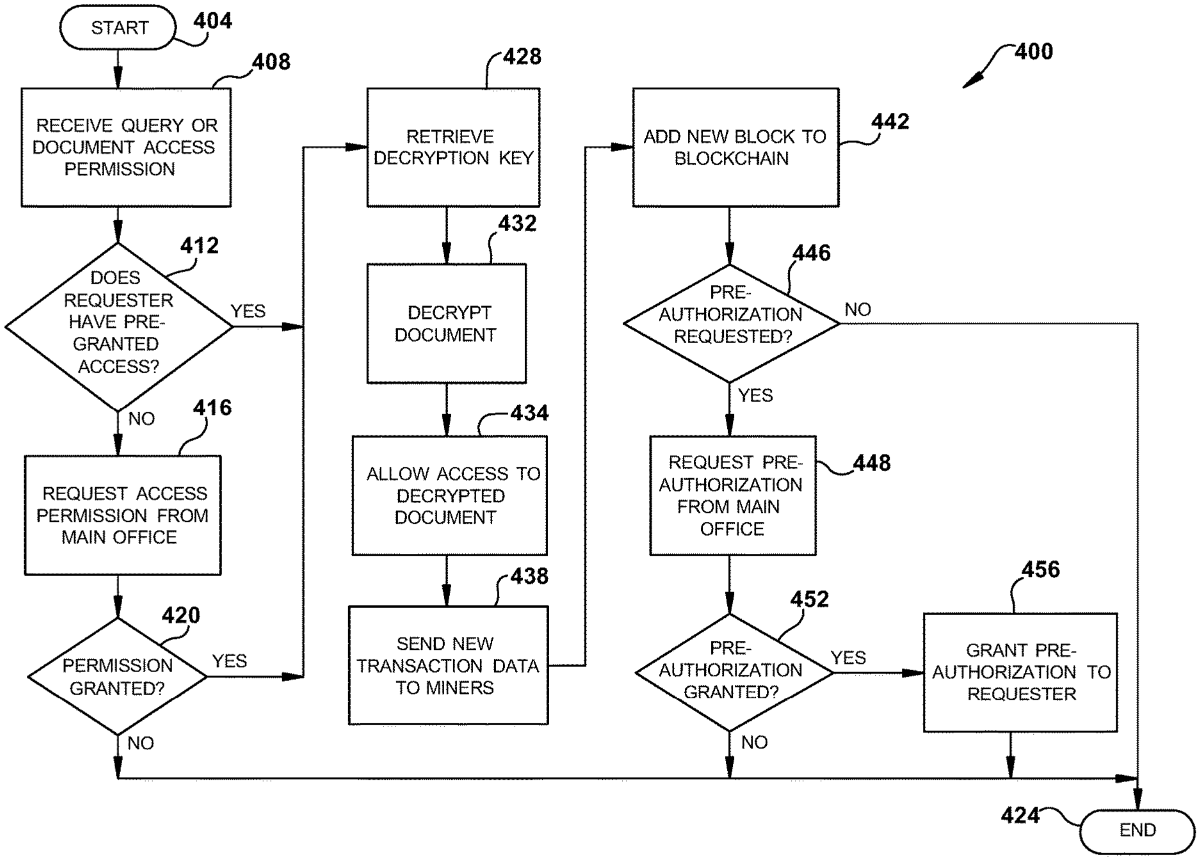
CPC ***G06F 21/6227*** (2013.01); ***H04L 9/0819*** (2013.01); *H04L 9/3247* (2013.01); ***G06F 17/30011*** (2013.01); ***G06F 17/30377*** (2013.01); ***H04L 9/0637*** (2013.01)

(57) **ABSTRACT**

A system and method for blockchain document access and distribution control includes a processor, associated memory and a network interface for data communication with a server system. An interface receives a query for access to an electronic document associated with a blockchain ledger, which query is routed to the server system via the network interface. The processor receives the identified electronic document from a storage location when access permission is granted and a corresponding update of the blockchain ledger is made.


START
404
400
RECEIVE QUERY OR DOCUMENT ACCESS PERMISSION
408
DOES REQUESTER HAVE PRE-GRANTED ACCESS?
412
YES
NO
REQUEST ACCESS PERMISSION FROM MAIN OFFICE
416
PERMISSION GRANTED?
420
YES
NO
RETRIEVE DECRYPTION KEY
428
DECRYPT DOCUMENT
432
ALLOW ACCESS TO DECRYPTED DOCUMENT
434
SEND NEW TRANSACTION DATA TO MINERS
438
ADD NEW BLOCK TO BLOCKCHAIN
442
PRE-AUTHORIZATION REQUESTED?
446
NO
YES
REQUEST PRE-AUTHORIZATION FROM MAIN OFFICE
448
PRE-AUTHORIZATION GRANTED?
452
YES
NO
GRANT PRE-AUTHORIZATION TO REQUESTER
456
424
END

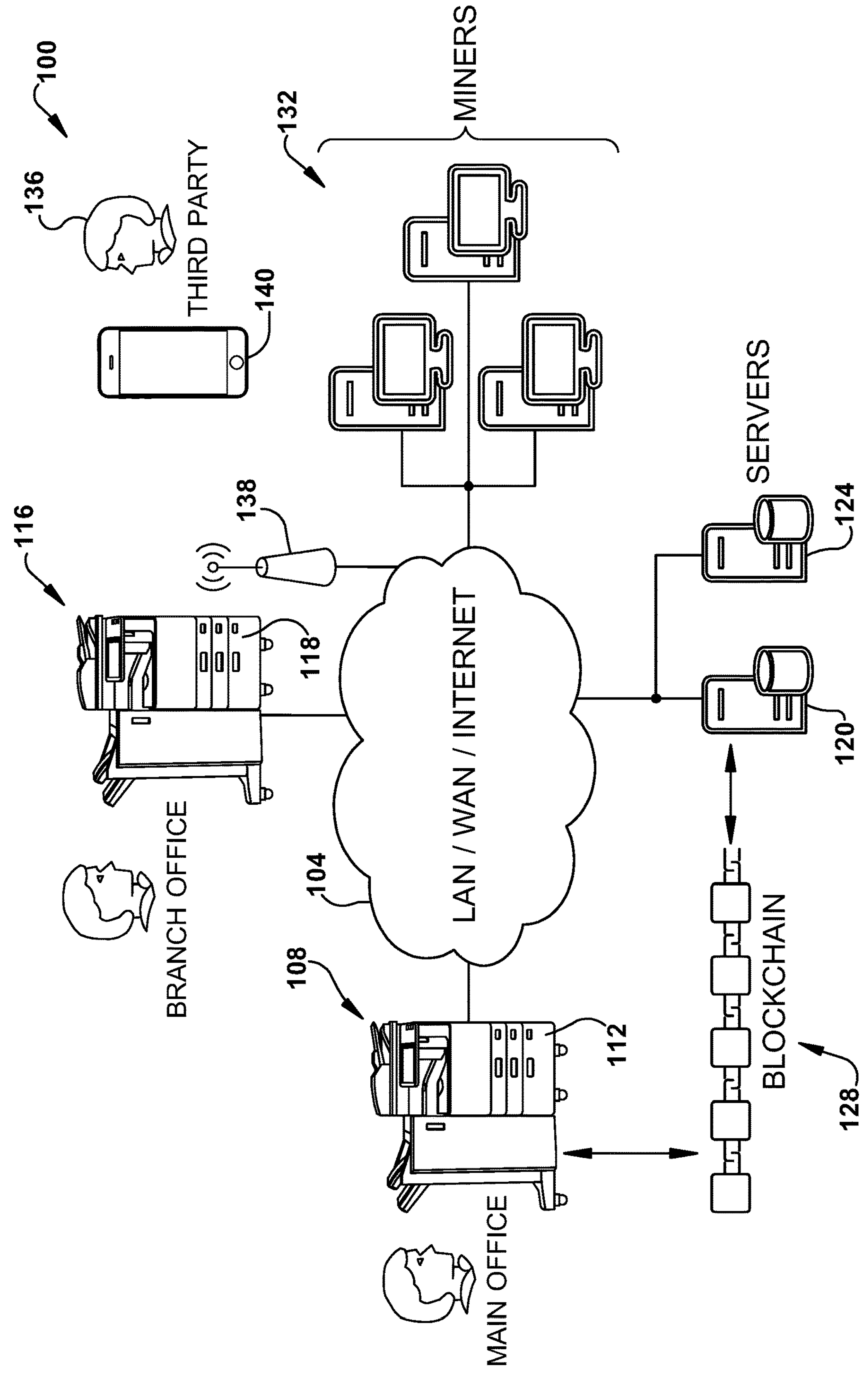

100
136
THIRD PARTY
140
132
MINERS
116
138
118
BRANCH OFFICE
104
LAN / WAN / INTERNET
SERVERS
124
120
108
112
MAIN OFFICE
BLOCKCHAIN
128

FIG. 1

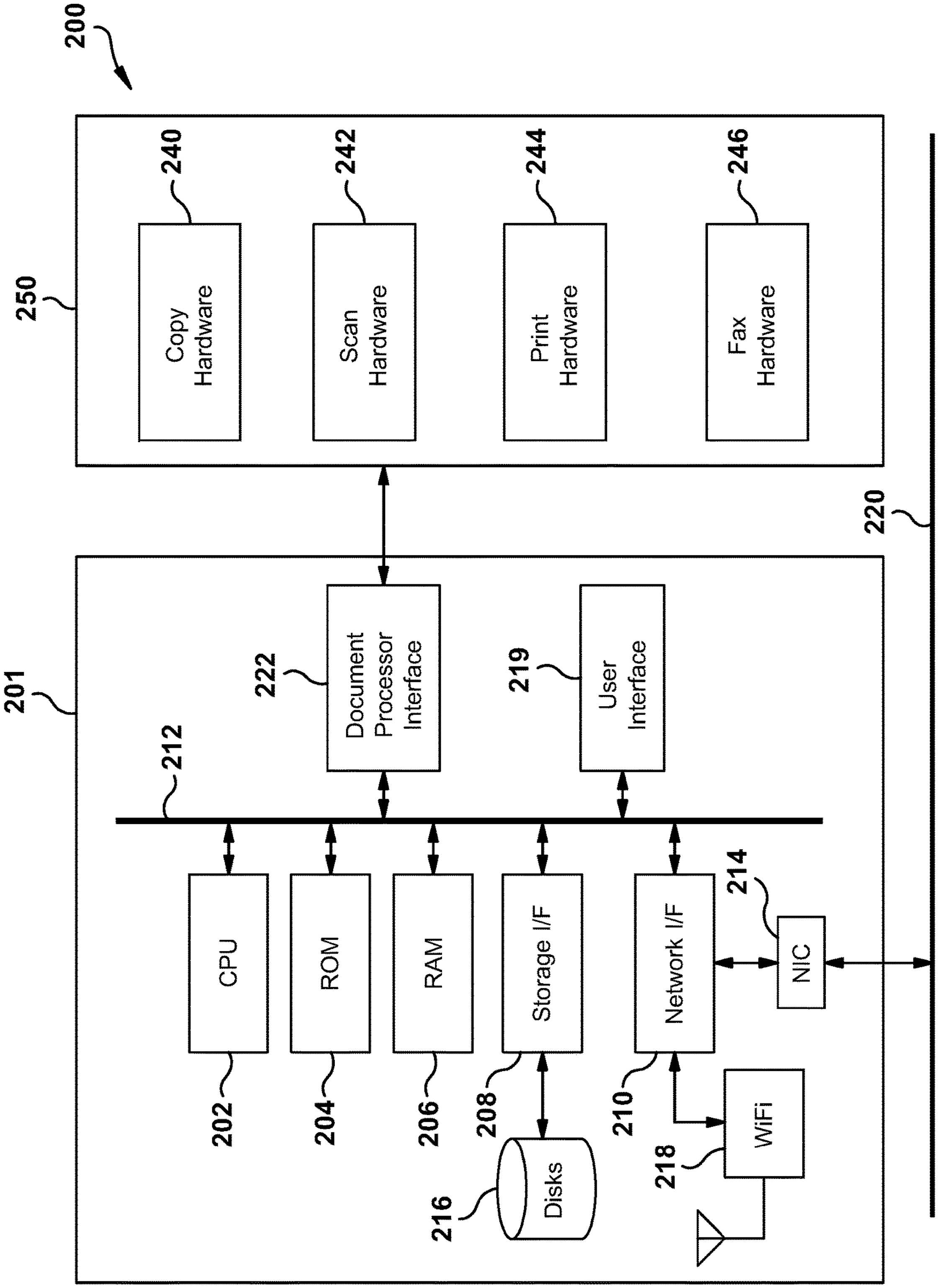

200
201
250
Copy Hardware
240
Scan Hardware
242
Print Hardware
244
Fax Hardware
246
220
222
Document Processor Interface
219
User Interface
212
CPU
202
ROM
204
RAM
206
Storage I/F
208
Network I/F
210
214
NIC
Disks
216
WiFi
218

FIG. 2

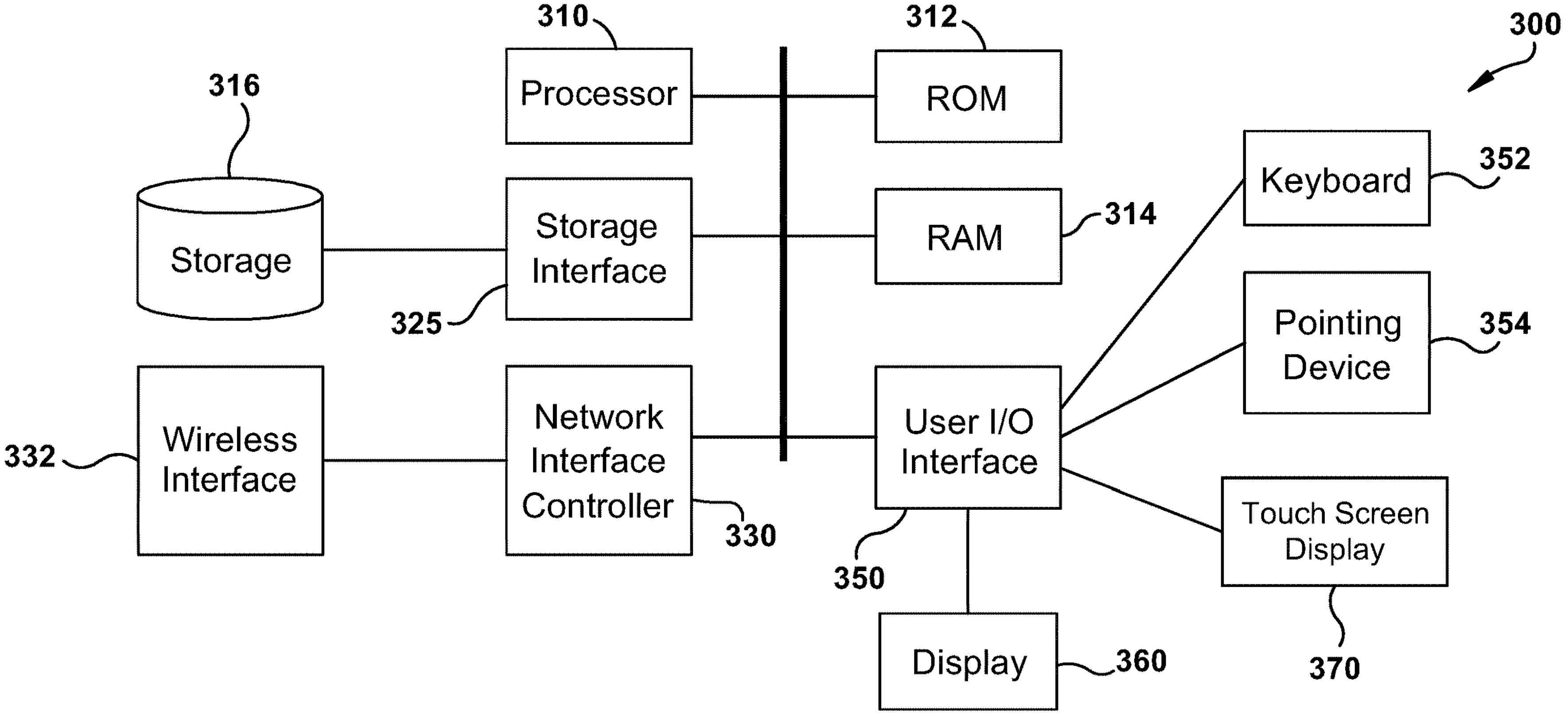

300
310
Processor
312
ROM
316
Storage
Storage
Interface
RAM
314
325
Keyboard
352
Pointing
Device
354
332
Wireless
Interface
Network
Interface
Controller
330
User I/O
Interface
350
Touch Screen
Display
370
Display
360

FIG. 3

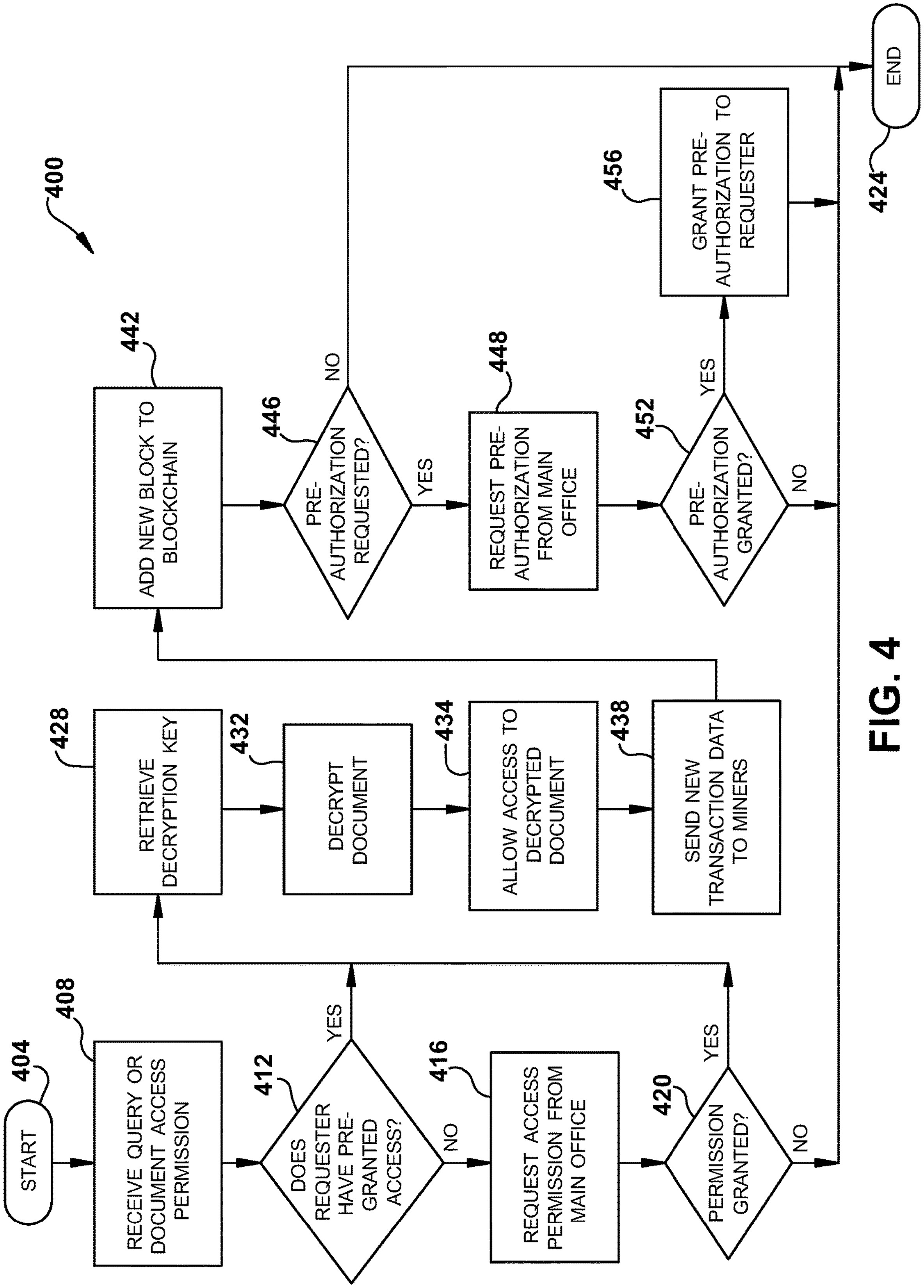

400
START
404
RECEIVE QUERY OR DOCUMENT ACCESS PERMISSION
408
DOES REQUESTER HAVE PRE-GRANTED ACCESS?
412
YES
NO
REQUEST ACCESS PERMISSION FROM MAIN OFFICE
416
PERMISSION GRANTED?
420
YES
NO
RETRIEVE DECRYPTION KEY
428
DECRYPT DOCUMENT
432
ALLOW ACCESS TO DECRYPTED DOCUMENT
434
SEND NEW TRANSACTION DATA TO MINERS
438
ADD NEW BLOCK TO BLOCKCHAIN
442
PRE-AUTHORIZATION REQUESTED?
446
YES
NO
REQUEST PRE-AUTHORIZATION FROM MAIN OFFICE
448
PRE-AUTHORIZATION GRANTED?
452
YES
NO
GRANT PRE-AUTHORIZATION TO REQUESTER
456
END
424

FIG. 4

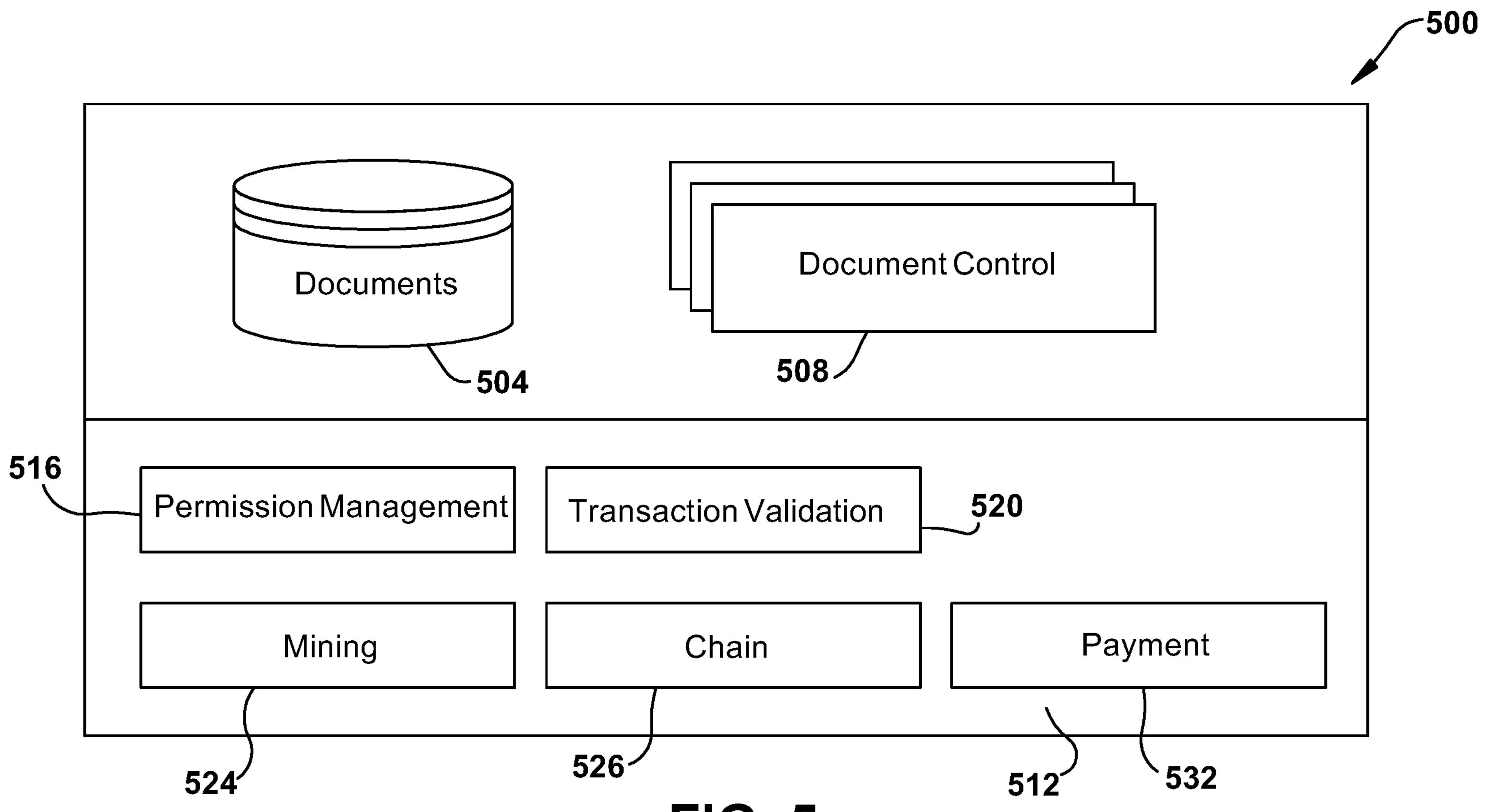

500
Documents
504
Document Control
508
516
Permission Management
Transaction Validation
520
Mining
Chain
Payment
524
526
512
532

FIG. 5

SYSTEM AND METHOD FOR BLOCKCHAIN DOCUMENT ACCESS AND DISTRIBUTION CONTROL

TECHNICAL FIELD

[0001] This application relates generally to blockchain controlled access to stored electronic documents. The application relates more particularly to securely controlling access to distributed electronic documents by use of blockchain document inventory.

BACKGROUND

[0002] Document processing devices include printers, copiers, scanners and e-mail gateways. More recently, devices employing two or more of these functions are found in office environments. These devices are referred to as multifunction peripherals (MFPs) or multifunction devices (MFDs). As used herein, MFPs are understood to comprise printers, alone or in combination with other of the afore-noted functions. It is further understood that any suitable document processing device can be used.

[0003] Given the expense in obtaining and maintain MFPs, devices are frequently shared via a data network. MFPs, while moveable, are generally maintained in a fixed location. Until more recent times, users, which may include individuals or groups such as employees, administrators or technicians administrators of networked MFPs, were also generally in relatively fixed location. A user would typically communicate documents or other information from his or her office or workstation.

[0004] Once created, electronic documents are typically stored in a user's device, on an MFP or on a networked fileserver. Stored documents may be accessible to anyone on a network. In certain situations, such in the case of documents including sensitive or personal information, access may be restricted.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] Various embodiments will become better understood with regard to the following description, appended claims and accompanying drawings wherein:

[0006] FIG. **1** is an example embodiment of a blockchain document access management and access control system;

[0007] FIG. **2** is an example embodiment of a multifunction peripheral device;

[0008] FIG. **3** is an example embodiment of a digital device;

[0009] FIG. **4** is a flowchart of an example embodiment of a secure, blockchain-based document access control and management system; and

[0010] FIG. **5** is an example embodiment of a software module for a secure, blockchain-based document access control and management system.

DETAILED DESCRIPTION

[0011] The systems and methods disclosed herein are described in detail by way of examples and with reference to the figures. It will be appreciated that modifications to disclosed and described examples, arrangements, configurations, components, elements, apparatuses, devices methods, systems, etc. can suitably be made and may be desired for a specific application. In this disclosure, any identification of specific techniques, arrangements, etc. are either related to a specific example presented or are merely a general description of such a technique, arrangement, etc. Identifications of specific details or examples are not intended to be, and should not be, construed as mandatory or limiting unless specifically designated as such.

[0012] In accordance with an example embodiment of the subject application, a system and method for blockchain document access and distribution control includes a processor, associated memory and a network interface for data communication with a server system. An interface receives a query for access to an electronic document associated with a blockchain ledger, which query is routed to the server system via the network interface. The processor receives the identified electronic document from a storage location when access permission is granted and a corresponding update of the blockchain ledger is made.

[0013] As described herein, an example embodiment includes a system comprising a processor, associated memory and a network interface for data communication with a server system comprised of at least one associated networked server. An interface receives a query for access to an electronic document associated with a blockchain ledger. The request is routed to the server system via the network interface. The processor sends an access request to the server system for access to the identified electronic document. The processor receives the identified electronic document from a storage location when access permission is obtained from the server system. The processor commences an update of the blockchain ledger relative to access to the received electronic document.

[0014] As noted above, electronic documents are frequently stored for future access. Electronic documents may take a variety of forms, including a myriad of text based file formats, image based file formats and raster based file formats, or hybridized file formats. Documents can be stored on a user's device, on one or more MFPs, or one or more fileservers. Larger enterprises may have two or more locations. Often times, each location may operate as its own subnet. A user may not be able access electronic documents that are stored in various ways at another location. In such an instance, documents may be routed to a commonly accessible fileserver. However, a company may wish to limit access to certain of these documents, such as to certain individuals, groups or locations. Decisions as to whether access is permitted can vary.

[0015] Document accessibility may depend on factors such as a requester's location, identity or title. Accessibility may also depend on time factors, such as being available during a particular time window.

[0016] In certain example embodiments described herein, electronic documents are stored in a commonly accessible location. Each document is provided with a series of electronic blocks, referred to as a blockchain, containing a cryptographic hash of a previous block, a timestamp and transaction data corresponding to a transaction performed on the electronic document. A well understood example of blockchains is by their use in connection with Bitcoin. Blockchains are distributed among a plurality of data devices to ensure consensus based access.

[0017] Unauthorized access or modification of critical defense infrastructure, such as network firmware and operating systems, could seriously compromise company security. For most companies, computer systems and defense infrastructure are distributed across different locations.

Blockchain technology distributed across multiple data centers can ensure security against attacks on important network and hardware equipment by ensuring consensus-based access for modification.

[0018] In certain example embodiments, the use of blockchains frees a main office from having to gather documents from a branch office to share with their stakeholders. A single storage location is suitably provided for all office documents which is easily accessible through granted access. This ultimately frees the main office from needing to manually manage the documents from each branch office. The main office retains access to its own company documents.

[0019] Example embodiments herein provide a blockchain solution to secure documents within an office document exchange. This will effectively deliver documents in a consistent and real-time manner, and permit access via a smart contract after main office authorization. A controlled office document exchange provides an optimized environment where document access is structured and secured. Use of digital signatures on blockchain based scanned documents allows access and printing, for example, only when authorized by multiple people who regulate availability and maintain the privacy of documents. Documents access is enabled to be in real time from anywhere. If a node/version is tampered with by any user in the network, such tampering may be readily detected so data access is transparent, consistent and secure.

[0020] In accordance with the subject application and commensurate with the forgoing, FIG. **1** illustrates an example embodiment of a blockchain document access management and access control system **100**. A data network cloud **104** is suitably comprised of any wired or wireless network, including a local area network (LAN) or wide area network (WAN), which may comprise the global Internet, or any suitable combination thereof. A main office **108**, suitably comprised of one or more data devices such as MFP **112**, communicates with one or more branch offices **116**, through a suitable digital device, such as MFP **118** via network cloud **104**. Electronic documents are suitably encrypted and stored in one or networked servers associated with one or more offices, such as server **120** or server **124**. Such servers **120**, **124** also suitably maintain blockchain **128** associatively with stored electronic documents. When someone from branch office **116** desires access to an electronic document, a request is made and routed to main office **108**. If permission is granted, the document is decrypted with a suitable key and associated blockchain **128** is updated, suitably with a block provided by one or more networked block miners **132**. One or more networked data devices are also suitably employed to maintain block ledgers to provide for confirmed transactions and block updating.

[0021] In addition to controlled and secure document access by one or more branch offices, individual requests for access may be made for third parties, such as third party **136** via any suitable data device, such as smartphone **140**. For example, the third party **136** may perform a document request from their smartphone **140** using wireless access provided by access point **138**.

[0022] As will be described further below, a requesting location, group or individual may also be suitably pre-authorized for document access to avoid a necessity of requesting permission each time access is desired. Even with pre-authorization, block chains are suitably updated to maintain an accurate access record.

[0023] Turning now to FIG. **2** illustrated is an example embodiment of a MFP device comprised of a document rendering system **200** suitably comprised within an MFP, such as with MFPs **112** or **118** FIG. **1**. Included in intelligent controller **201** are one or more processors, such as that illustrated by processor **202**. Each processor is suitably associated with non-volatile memory, such as ROM **204**, and random access memory (RAM) **206**, via a data bus **212**.

[0024] Processor **202** is also in data communication with a storage interface **208** for reading or writing to a storage **216**, suitably comprised of a hard disk, optical disk, solid-state disk, cloud-based storage, or any other suitable data storage as will be appreciated by one of ordinary skill in the art.

[0025] Processor **202** is also in data communication with a network interface **210** which provides an interface to a network interface controller (NIC) **214**, which in turn provides a data path to any suitable wired or physical network connection **220**, or to a wireless data connection via wireless network interface **218**. Example wireless connections include cellular, Wi-Fi, Bluetooth, NFC, wireless universal serial bus (wireless USB), satellite, and the like. Example wired interfaces include Ethernet, USB, IEEE 1394 (FireWire), Lightning, telephone line, or the like. Processor **202** is also in data communication with one or more sensors which provide data relative to a state of the device or associated surroundings, such as device temperature, ambient temperature, humidity, device movement and the like.

[0026] Processor **202** can also be in data communication with any suitable user input/output (I/O) interface **219** which provides data communication with user peripherals, such as displays, keyboards, mice, track balls, touch screens, or the like. Hardware monitors suitably provides device event data, working in concert with suitable monitoring systems. By way of further example, monitoring systems may include page counters, sensor output, such as consumable level sensors, temperature sensors, power quality sensors, device error sensors, door open sensors, and the like. Data is suitably stored in one or more device logs, such as in storage **216** of FIG. **2**.

[0027] Also in data communication with data bus **212** is a document processor interface **222** suitable for data communication with MFP functional units **250**. In the illustrated example, these units include copy hardware **240**, scan hardware **242**, print hardware **244** and fax hardware **246** which together comprise MFP functional hardware **250**. It will be understood that functional units are suitably comprised of intelligent units, including any suitable hardware or software platform.

[0028] Turning now to FIG. **3**, illustrated is an example embodiment of a suitable digital device **300** such server computers **120** or **124**, block miner computers **128** or smartphone **140**. Included are one or more processors, such as that illustrated by processor **310**. Each processor is suitably associated with non-volatile memory, such as read only memory (ROM) **312** and random access memory (RAM) **314**, via a data bus.

[0029] Processor **310** is also in data communication with a storage interface **325** for reading or writing to a data storage system **316**, suitably comprised of a hard disk, optical disk, solid-state disk, or any other suitable data storage as will be appreciated by one of ordinary skill in the art.

[0030] Processor **310** is also in data communication with a network interface controller (NIC) **330**, which provides a data path to any suitable wired or physical network connection via physical network interface, or to any suitable wireless data connection via wireless interface **332**, such as one or more of the networks detailed above. The system suitably uses location based services.

[0031] Processor **304** is also in data communication with a user input/output (I/O) interface **350** which provides data communication with user peripherals, such as display **360**, as well as keyboards **352**, mice, track balls, or other pointing devices **354**, touch screen **370**, or the like. It will be understood that functional units are suitably comprised of intelligent units, including any suitable hardware or software platform.

[0032] FIG. **4** is a flowchart **400** of an example embodiment of a secure, blockchain based document access control and management system. The process commences at block **404** and proceeds to block **408** when a query for document access is received. A determination is made at block **412** as to whether the requestor has pre-granted access. If not, access permission is requested from the main office at block **416**. If permission is not granted at block **420**, the process ends at block **424**. If permission is granted, a decryption key is retrieved at block **428**. If it was determined that the requester had pre-granted access at block **412**, the process proceeds directly to block **428** to retrieve the decryption key.

[0033] Once the decryption key has been obtained at block **428**, the document is decrypted at block **432** and access is allowed at block **434**. New transaction data is sent to block miners at block **438** to secure an updated block for the associated blockchain, and the new block is added at block **442**. A check is made as to whether preauthorization was requested at block **446**. If not, the process ends at block **424**. If so, permission is sought from the main office at block **448**. If permission is granted at block **452**, the requester is marked with pre-granted access at block **456** and the process then ends at block **424**. If permission is not granted, the process ends at block **424** directly from block **452**.

[0034] FIG. **5** is an example environment of a software module block diagram **500** commensurate with the forgoing. Documents **504** are controlled by document control module **508**. Blockchain connector module **512** suitably comprises permission management module **516**, transaction validation module **520**, mining module **524**, chain module **528** and payment module **532**.

[0035] The above-described modules facilitate a data flow and transaction process that provides for data security along with ease of access and efficiency on the cloud. A network process is suitably divided into three sub-procedures.

[0036] Scan (Data Input)—When branch office scans a document, an NFP connects to the cloud. The document is indexed on the cloud and keywords are matched. So while the actual documents on the branch office, the application has the indices and decryption keys to the document.

[0037] Print (Data Access)—When another branch office searches for specific categories of documents, the application search engine algorithms search the indices and fetches the source locations for the type of document the branch office queried. The branch office can then submit a request to the main office to grant the access.

[0038] Granting Permissions—When a new access request is submitted, the cloud engine reaches out to involved participants for a digital network operating center (NoC) in form of a smart contract. When the access request is approved by both the parties, the request is granted and all the asked documents are made available to the branch office.

[0039] An associated engine suitably also provides for pre-granted access rights. When a branch office joins the network, they are asked if they want to join a specified data exchange program. If they agree, their information is suitably flagged as "Always Accessible" facilitating a streamlining of future access.

[0040] Using digital signatures on blockchain-based scanned document facilitates access or printing only when authorized by multiple people which functions to regulate availability and maintain the privacy of documents. Documents can be available in real-time and worldwide.

[0041] While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the inventions. Indeed, the novel embodiments described herein may be embodied in a variety of other forms; furthermore, various omissions, substitutions and changes in the form of the embodiments described herein may be made without departing from the spirit of the inventions. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the spirit and scope of the inventions.

What is claimed is:

1. A system comprising:

a network interface configured for data communication with a server system comprised of at least one associated networked server;

an interface configured to receive a query for access to an electronic document associated with a blockchain ledger; and

a processor and associated memory,

the processor configured to route a received query to the server system via the network interface,

the processor further configured to send an access request to the server system for access to the identified electronic document,

the processor further configured to receive the identified electronic document from a storage location when access permission is obtained from the server system, and

the processor further configured to commence an update of the blockchain ledger relative to access to the received electronic document.

2. The system of claim **1** wherein the identified electronic document is digitally signed.

3. The system of claim **2** wherein the identified electronic document is encrypted.

4. The system of claim **3** wherein the processor is further configured to decrypt the electronic document in accordance with one or more decryption keys.

5. The system of claim **4** further wherein the processor is further configured to receive at least one decryption key via the network interface.

6. The system of claim **5** further comprising:

an input configured to receive an incoming electronic document, and wherein the processor is further configured to commence an indexing of content in the incoming electronic document,

wherein the processor is further configured to commence generation of an encryption key for the incoming electronic document,

wherein the processor is further configured to store the incoming electronic document, and

wherein the processor is further configured to commence an update of the blockchain ledger relative to the incoming electronic document.

7. The system of claim **6** wherein the processor is further configured to store a generated index and a generated encryption key in the server system via the network interface.

8. A method comprising:

receiving a query for access to an identified electronic document associated with a blockchain ledger;

routing a received query to a server system via a network interface;

sending an access request to the server system for access to the identified electronic document;

receiving the identified electronic document from a storage location when access permission is obtained from the server system; and

commencing an update of the blockchain ledger relative to access to the received electronic document.

9. The method of claim **8** wherein the identified electronic document is digitally signed.

10. The method of claim **9** wherein the identified electronic document is encrypted.

11. The method of claim **10** further comprising decrypting the electronic document in accordance with one or more decryption keys.

12. The method of claim **11** further comprising receiving at least one decryption key via the network interface.

13. The method of claim **12** further comprising:

receiving an incoming electronic document;

commencing an indexing of content in the incoming electronic document;

commencing generation of an encryption key for the incoming electronic document;

storing the incoming electronic document; and

commencing an update of the blockchain ledger relative to the incoming electronic document.

14. The method of claim **13** further comprising storing a generated index and a generated encryption key in the server system via the network interface.

15. A document server system comprising:

a memory storing a blockchain corresponding to a plurality of encrypted and signed electronic documents,

the memory further storing keyword data associatively with each of the electronic documents, and

the memory further storing at least one decryption key for the electronic documents;

a network interface configured to receive search query from an associated data device; and

a processor,

the processor configured to identify at least one of the electronic documents responsive to a received query,

the processor configured to output a document permission request for access to an identified electronic document, and

the processor further configured to commence an update of the blockchain relative to access to the identified document.

16. The system of claim **15** wherein the processor is further configured to access a decryption key corresponding to the identified document responsive to the query.

17. The system of claim **16** wherein the processor is further configured to pre-certify the associated data device with permission to access at least a portion of the electronic documents.

18. The system of claim **17** wherein the processor is further configured to pre-certify a plurality of associated data devices disposed at a common location.

19. The system of claim **18** wherein the processor is further configured to pre-certify the plurality of associated data devices disposed on a common subnet.

20. The system of claim **15** further comprising the processor configured to complete the update of the blockchain in accordance with a block received from an associated block miner.

* * * * *