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(54) **DE-IDENTIFYING MEDICAL HISTORY INFORMATION FOR MEDICAL UNDERWRITING**

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(60) Provisional application No. 61/222,428, filed on Jul. 1, 2009.
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H04L 9/32 (2006.01)
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G06F 19/00 (2018.01)
G06F 21/00 (2013.01)
(52) **U.S. Cl.**
CPC **G16H 10/60** (2018.01); **G06F 19/322** (2013.01)
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CPC H04L 63/08
USPC 380/28–30, 255–283; 713/150–154, 713/160–167, 189–193
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,900,245 B1	3/2011	Geddes
9,665,685 B1	5/2017	Paris, III
2002/0188869 A1	12/2002	Patrick
2004/0143403 A1	7/2004	Brandon et al.
2005/0234739 A1	10/2005	Schoenberg
2005/0261941 A1	11/2005	Scarlat
2006/0004772 A1	1/2006	Hagan et al.
2006/0020611 A1	1/2006	Gilbert et al.
2006/0184524 A1	8/2006	Pollanz
2006/0229919 A1*	10/2006	Pugh G06Q 50/22 705/3
2007/0043594 A1	2/2007	Lavergne
2007/0192140 A1	8/2007	Gropper
2007/0219824 A1	9/2007	Rawlings et al.
2008/0010254 A1	1/2008	Settimi
2008/0120296 A1	5/2008	Kariathungal et al.
2008/0133273 A1	6/2008	Marshall
2008/0147554 A1	6/2008	Stevens et al.
2008/0306872 A1	12/2008	Felsner

(Continued)

OTHER PUBLICATIONS

“Group,” The American Heritage Dictionary, 2014 Houghton Mifflin Harcourt, Retrieved online: <https://ahdictionary.com/word/search.html?q=group> (accessed Oct. 23, 2014), 3 pages.

(Continued)

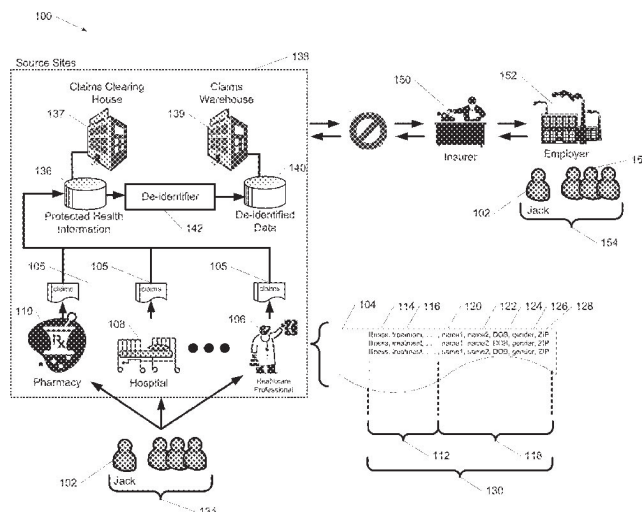
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(57) **ABSTRACT**

A computer-implemented method includes producing information that characterizes a group of individuals from a set of private data representing characteristics of the individuals. The identity of the individuals is unattainable from the produced information. The method also includes providing the produced information to report the characteristics of the group.

22 Claims, 7 Drawing Sheets



(56)

References Cited

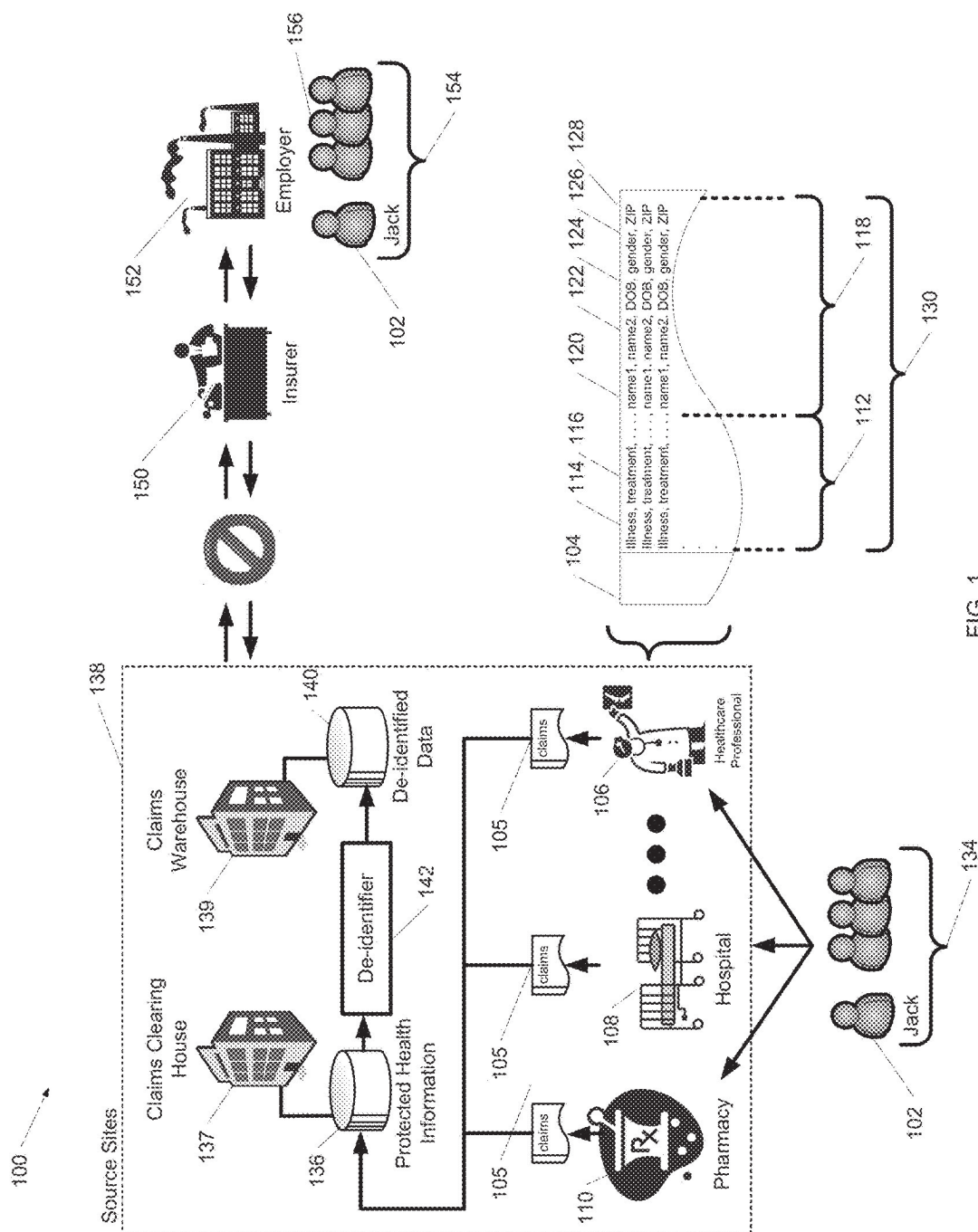
U.S. PATENT DOCUMENTS

2009/0024416	A1 *	1/2009	McLaughlin	G06Q 50/22 705/3
2009/0070146	A1	3/2009	Haider et al.	
2009/0112769	A1	4/2009	Dicks	
2009/0287502	A1	11/2009	Roberts et al.	
2010/0162355	A1	6/2010	Zimmerman et al.	
2010/0287190	A1	11/2010	Anderson	
2011/0184748	A1	7/2011	Fierro et al.	
2011/0191767	A1	8/2011	Pinsky	
2011/0191822	A1	8/2011	Pinsky	
2011/0225007	A1	9/2011	Theis	
2011/0258000	A1	10/2011	Green et al.	
2013/0246334	A1	9/2013	Ahuja	
2014/0053252	A1	2/2014	Kelsey	
2015/0046192	A1	2/2015	Raduchel	

OTHER PUBLICATIONS

"Health Information Privacy: Business Associates," U.S. Department of Health and Human Services, Apr. 3, 2003, Retrieved online: <http://www.hhs.gov/ocr/privacy/hipaa/understanding/coveredentities/businessassociates.html>, (accessed Oct. 9, 2014), 2 pages.

* cited by examiner



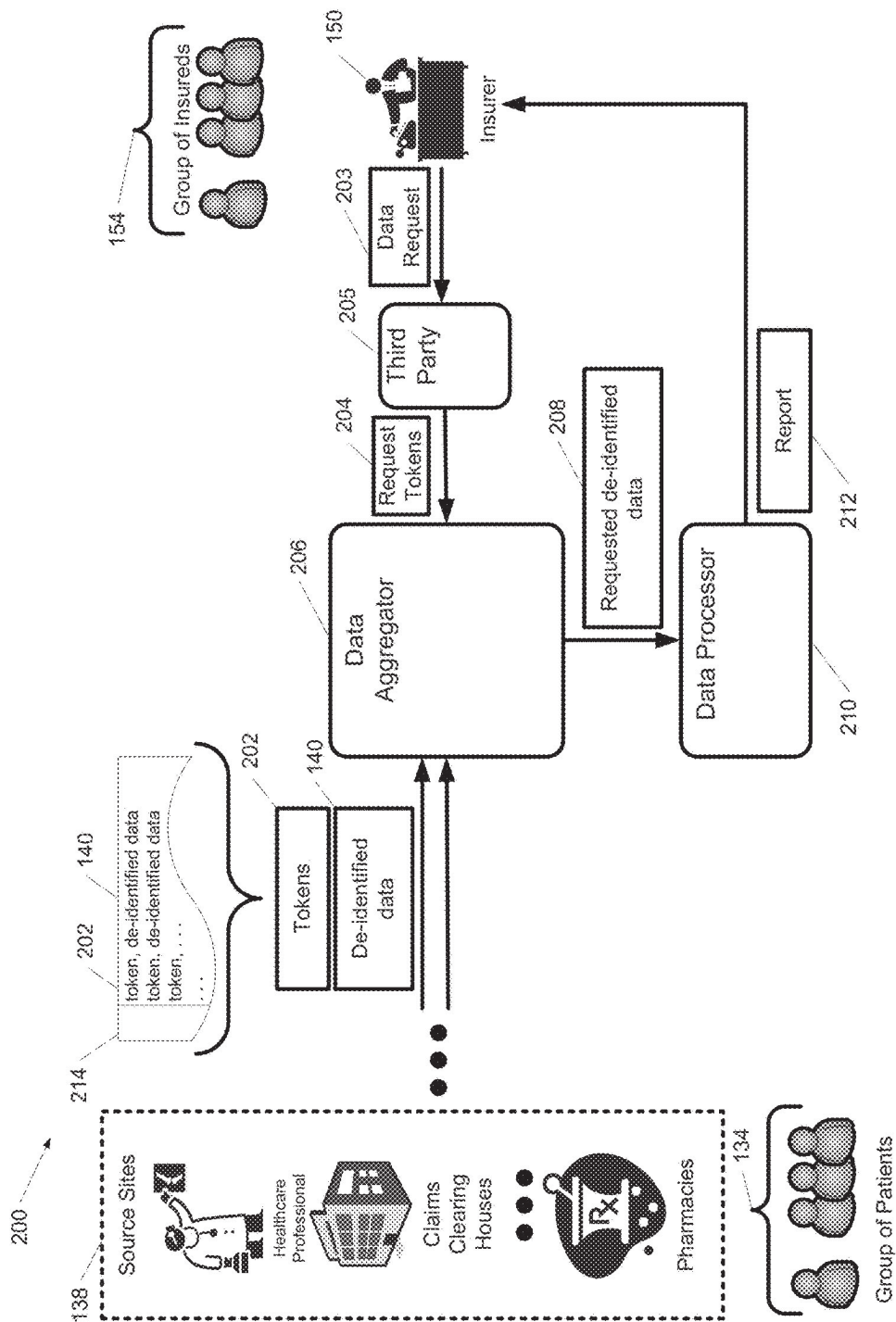


FIG. 2

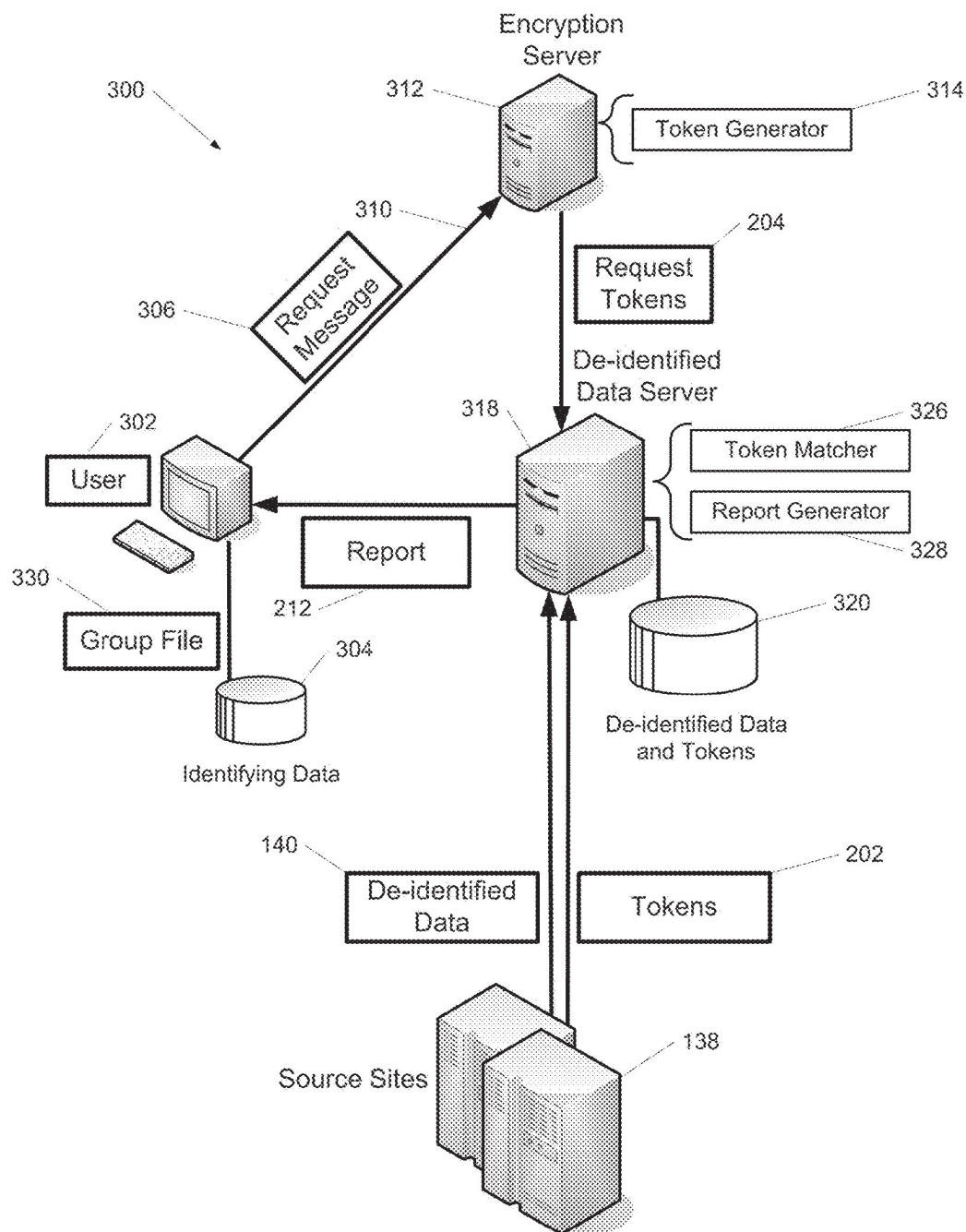


FIG. 3

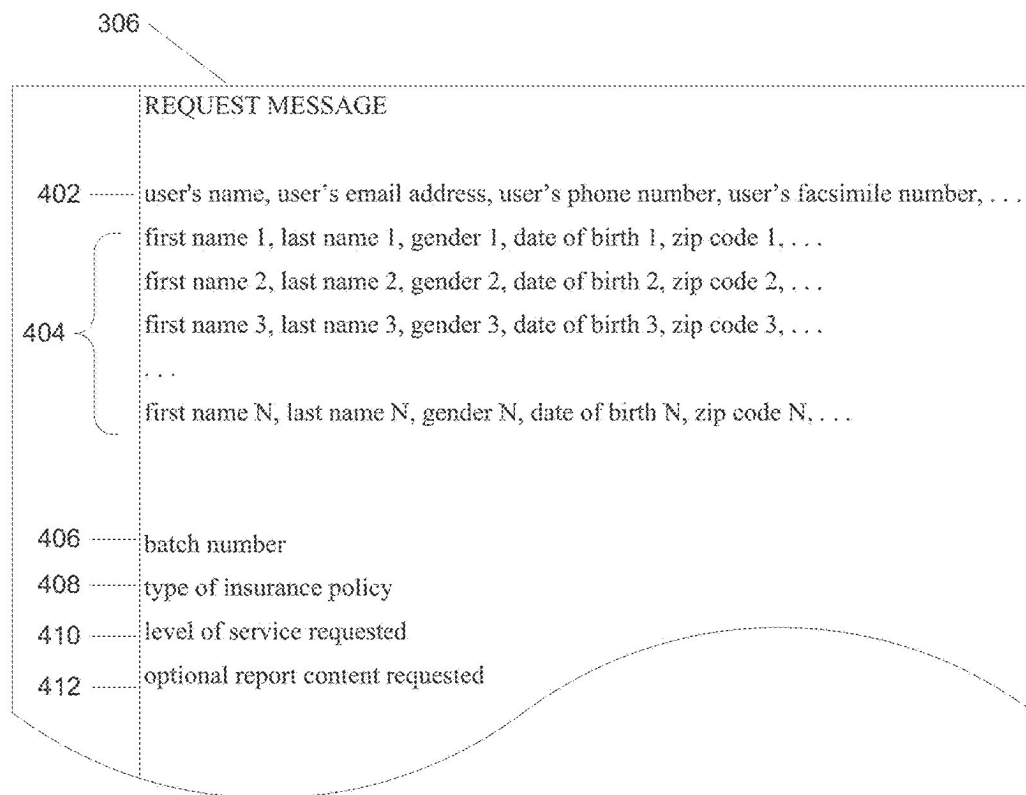


FIG. 4

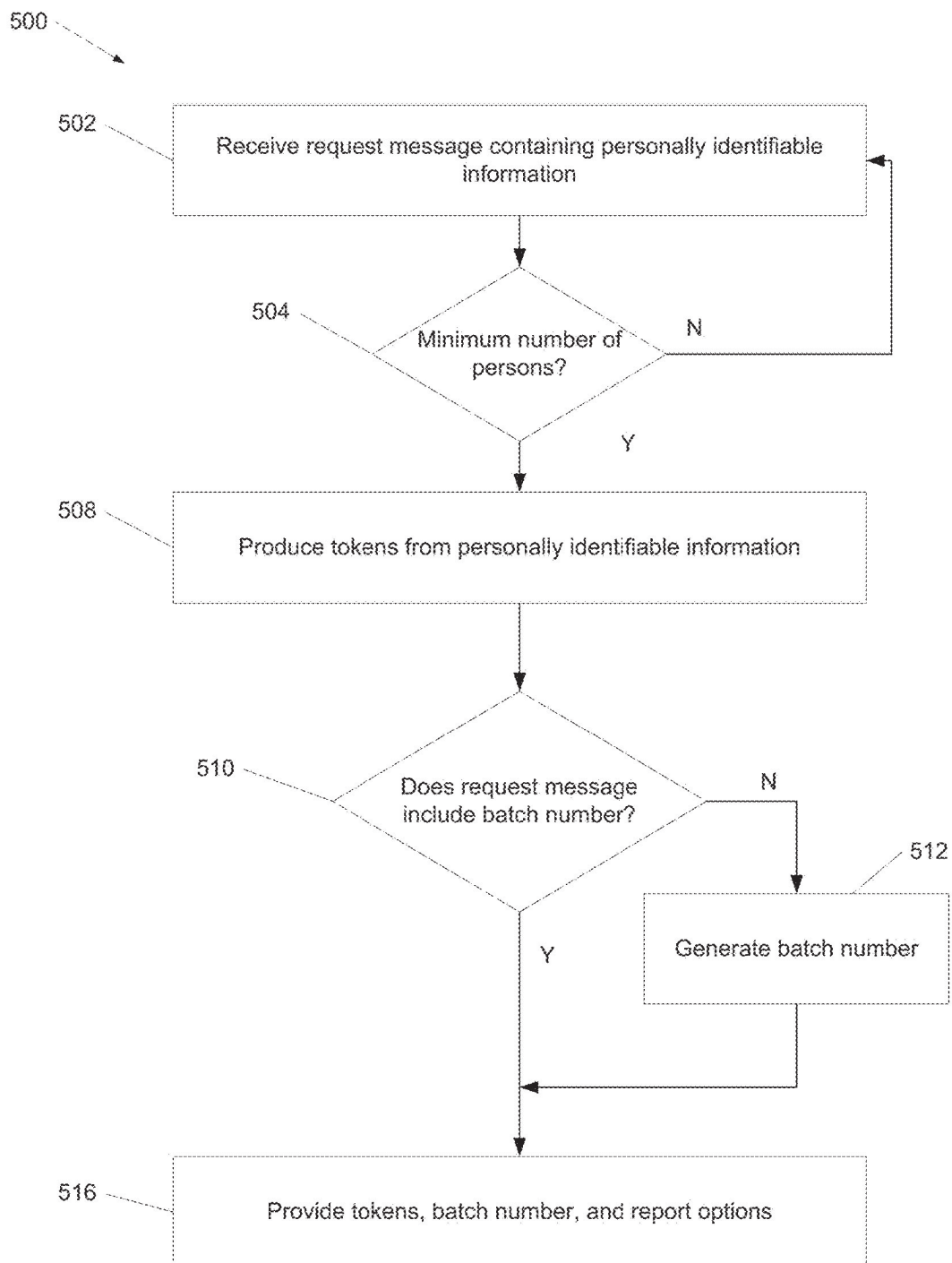


FIG. 5

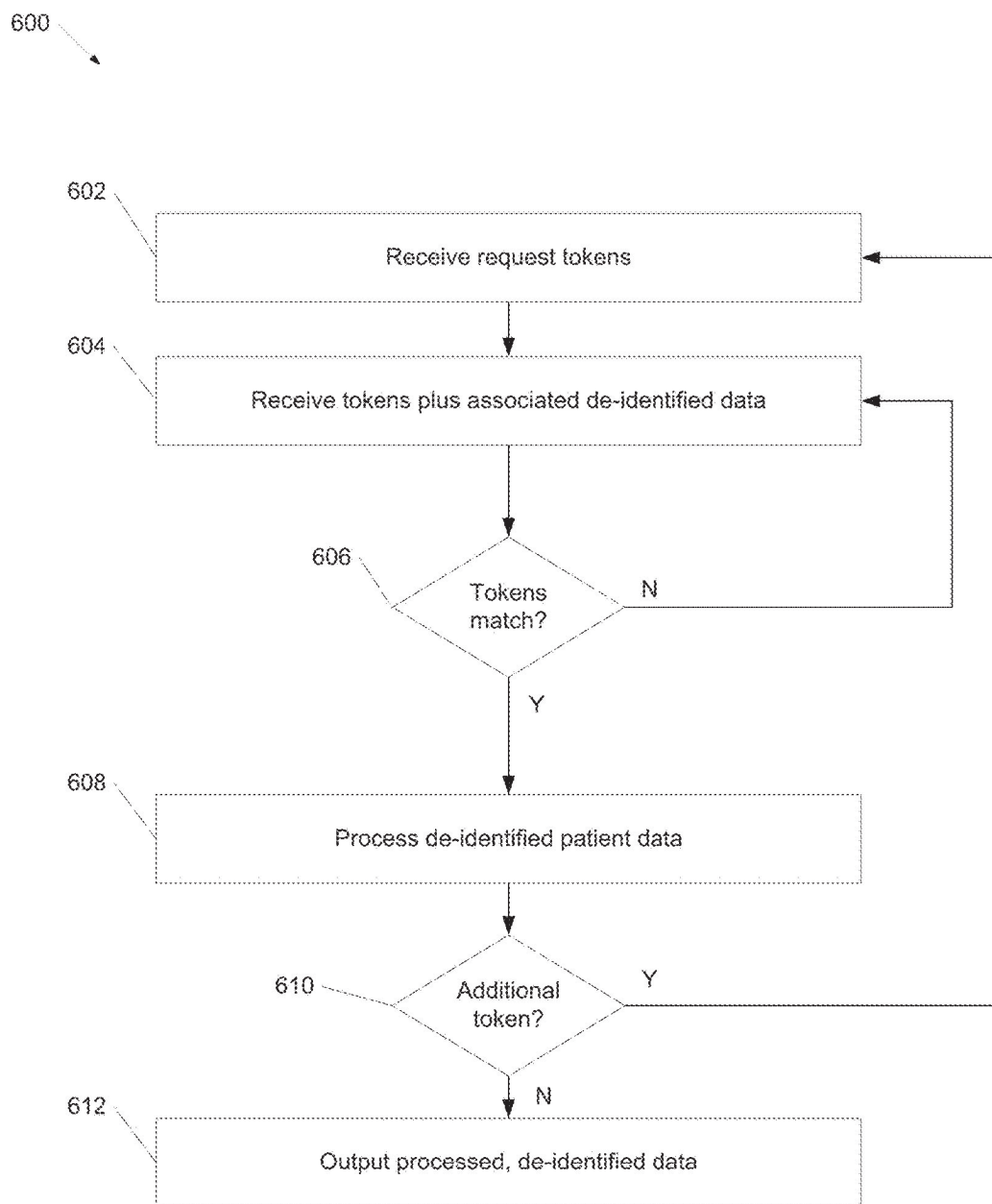


FIG. 6

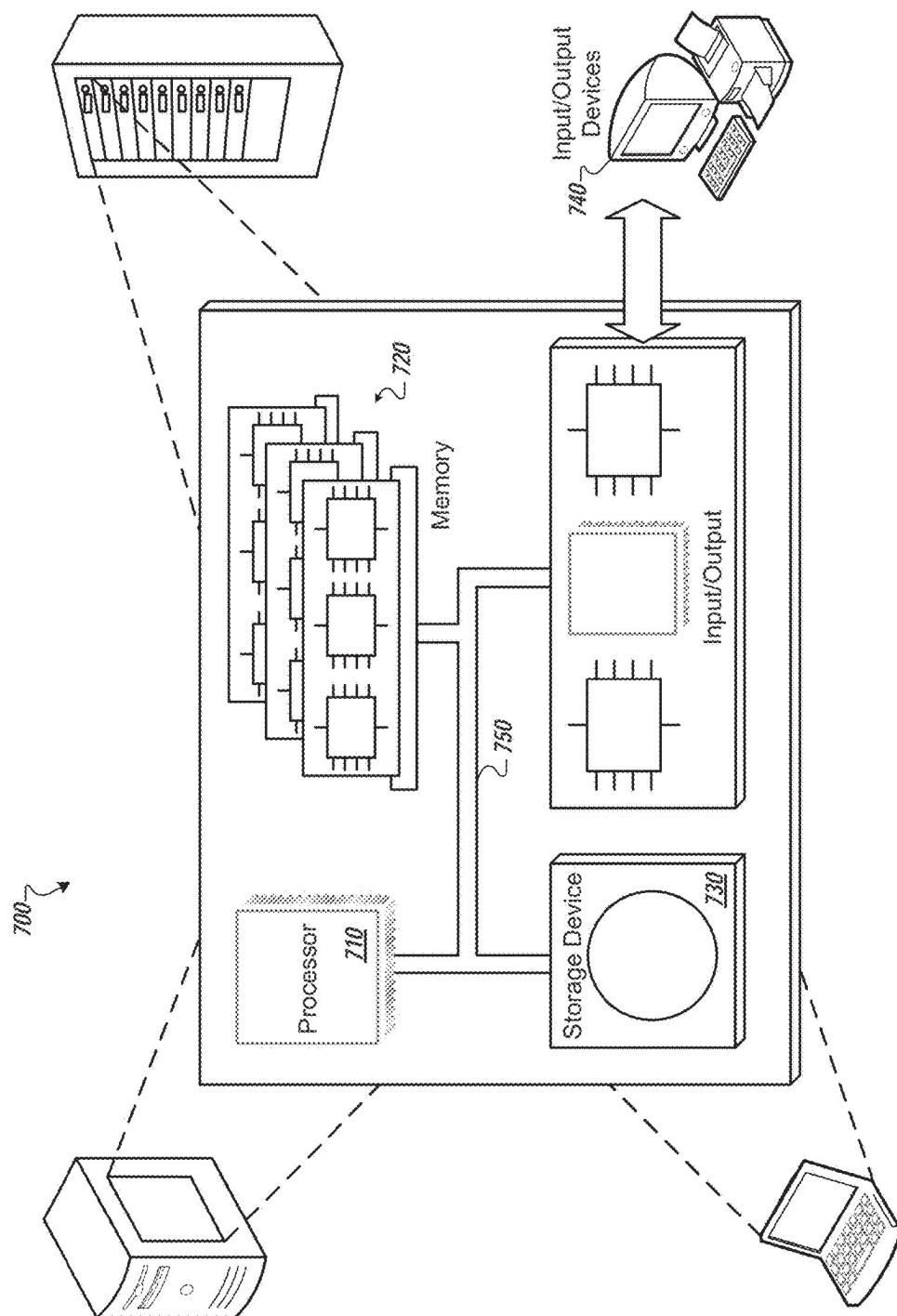


FIG. 7

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DE-IDENTIFYING MEDICAL HISTORY INFORMATION FOR MEDICAL UNDERWRITING

CLAIM OF PRIORITY

This application is a continuation application and claim priority under 35 USC § 120 to U.S. application Ser. No. 12/827,745, filed on Jun. 30, 2010, which claims benefit to U.S. Provisional Application Ser. No. 61/222,428, filed on Jul. 1, 2009, the entire contents of both which are hereby incorporated by reference.

BACKGROUND

The present disclosure relates to processing and transmitting personal data, the dissemination of which is restricted by federal law.

Due to federal privacy laws, companies that offer health insurance to small and midsize groups (containing 10-1000 individuals) are often unable to obtain the health history data they need to estimate the risk of insuring such groups commonly referred to as "experience rating". This frequently leads to less than optimal pricing for the companies, the groups, or both. Healthcare providers such as pharmacies and hospitals generate private healthcare data about patients, including medical and prescription drug history, and administrative healthcare claims data. Data that associates patient identity with health information is known as protected health information (PHI). Healthcare providers can store protected health information in electronic databases for future use in patient care and insurance claims processing. Insurance companies have developed techniques to estimate their risk from insuring a group of people by processing the protected health information about the group. Federal privacy laws, however, prevent the insurance companies from obtaining protected health information without individual authorizations from the each person in the group.

SUMMARY

The systems and techniques described here relate to de-identifying medical history information.

In one aspect, a computer-implemented method includes producing information that characterizes a group of individuals from a set of private data representing characteristics of the individuals. The identity of the individuals is unattainable from the produced information. The method also includes providing the produced information to report the characteristics of the group.

Implementations may include any of all of the following features. Producing information that characterizes the group may include producing a request token for each individual included in the group. Producing such a request token for each individual may include encrypting respective data that identifies each individual. Producing information that characterizes the group may include comparing the request tokens to tokens associated with the information to be produced. The tokens associated with the information to be produced and the request tokens may be similarly encrypted. Producing information that characterizes the group may include determining if the comparison provides at least a minimum number of matches. Producing information that characterizes the group may include requesting a predefined portion of the information. Additionally, producing information that characterizes the group may include determining if the group includes at least a minimum number of individuals. The private data may represent medical related information associated with the individuals of the group.

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viduals. The private data may represent medical related information associated with the individuals of the group.

In another aspect a system includes an encryption server for producing a request token of each individual included in a group identified in a request for information that characterizes the group. The system may also include a data server for producing the information that characterizes the group from a set of private data representing characteristics of the individuals. The identity of the individuals is unattainable from the produced information. The data server is also configured to provide the produced information to report the characteristics of the group.

Implementations may include any of all of the following features. The data server may provide a request token for each individual included in the group to produce the information that characterizes the group. The request token for each individual may represent encrypted data that identifies the corresponding individual. The data server may be configured to compare the request tokens to tokens associated with the information to be produced. The tokens associated with the information to be produced and the request tokens may be similarly encrypted. The data server may be configured to determine if the comparison provides at least a minimum number of matches. The request may represent a predefined portion of information to use for producing the information that characterizes the group. The encryption server may be configured to determine if the group includes at least a minimum number of individuals. The private data may represent medical related information associated with the individuals of the group.

In another aspect, one or more computer readable media storing instructions that are executable by a processing device, and upon such execution cause the processing device to perform operations that include producing information that characterizes a group of individuals from a set of private data representing characteristics of the individuals. The identity of the individuals is unattainable from the produced information. The operations also include providing the produced information to report the characteristics of the group.

Implementations may include any of all of the following features. Producing information that characterizes the group may include producing a request token for each individual included in the group. Producing such a request token for each individual may include encrypting respective data that identifies each individual. Producing information that characterizes the group may include comparing the request tokens to tokens associated with the information to be produced. The tokens associated with the information to be produced and the request tokens may be similarly encrypted. Producing information that characterizes the group may include determining if the comparison provides at least a minimum number of matches. Producing information that characterizes the group may include requesting a predefined portion of the information. Additionally, producing information that characterizes the group may include determining if the group includes at least a minimum number of individuals. The private data may represent medical related information associated with the individuals of the group.

The details of one or more embodiments of the invention are set forth in the accompanying drawings and the description below. Other features, objects, and advantages of the invention will be apparent from the description and drawings, and from the claims.

DESCRIPTION OF DRAWINGS

FIG. 1 illustrates exemplary circumstances in which protected health information is stored by healthcare providers, claims clearing houses, and other source sites, and requested by an insurer.

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FIG. 2 illustrates an exemplary method and system that enables an insurer to obtain medical information about a group of people without violating the privacy of persons in the group.

FIG. 3 illustrates an exemplary system incorporating an encryption server and a de-identified data server to enable a user who is not permitted to obtain the private data of a group of people to instead obtain a report that characterizes the group as a whole.

FIG. 4 illustrates an exemplary message requesting de-identified data about a group of people.

FIG. 5 is a flowchart that represents exemplary operations of a token generator.

FIG. 6 is a flowchart that represents exemplary operations of a token matcher.

FIG. 7 represents a computer system and related components.

Like reference symbols in the various drawings indicate like elements.

DETAILED DESCRIPTION

Referring to FIG. 1, when a doctor treats Jack 102 for high blood pressure, a surgeon removes Jack's gallstones, and a pharmacist fills Jack's prescription for insulin, Jack leaves a trail of electronic records 104 with healthcare professionals (e.g., healthcare profession 106), in their offices (e.g., doctor's office, nurse's station, etc.), in healthcare facilities (e.g., a hospital 108, a pharmacy 110, a nursing home, etc.) and the like. The electronic records 104 contain medical data 112 about Jack, for example his illnesses 114 and treatments 116. Each piece of medical data 112 is associated with personally identifiable information 118 that identifies Jack and distinguishes him from all other patients, such as his first name 120, last name 122, date of birth 124, gender 126, and zip code 128. Together, the pieces of medical data 112 and the personally identifiable information 118 make up Jack's protected health information (PHI) 130.

Each of Jack's healthcare providers may submit health insurance claims 105 containing PHI 130, as well as additional PHI 130, to a claims clearing house 137. The claims clearing house 137 may store the PHI 130 of many patients 134, including Jack, in a PHI database 136. A de-identifier 142 can process the PHI 136 to generate irreversibly de-identified data 140 by removing all personally identifiable information 118 or otherwise transforming the PHI 130 so that it cannot be associated with a particular person. A claims warehouse 139 stores de-identified data 140 about many patients 134. Claims clearing houses 137 and claims warehouses 139 are optimized for retrieving and providing PHI 136 and de-identified data 140 for use in further processing, but health care providers such as healthcare professional 106 and pharmacies 110 may also serve as source sites 138 for de-identified data in a distributed system.

By searching for Jack's personally identifiable information 118 in its electronic records 104, the pharmacy 110 is able to look up the various drugs in Jack's PHI 130 and, for example, check for bad interactions among them. Jack does not object to this use of his PHI 130 because it improves the quality of his healthcare. On the other hand, Jack would object to the pharmacy 110 giving his PHI 130 to third parties without his permission because that would disclose personal, private information about him that Jack's potential employers, for example, might use to discriminate against him.

Federal laws, such as the Health Insurance Portability and Accountability Act (HIPAA), protect Jack by prohibiting the

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source sites 138 possessing Jack's PHI 130 from releasing it to third parties without Jack's permission. Under HIPAA, the source sites 138 can release only irreversibly de-identified data 140 without Jack's permission.

A health insurer 150, for example, may be interested in the medical history information contained in Jack's PHI 130. Jack's employer 152 may like to buy a group health insurance policy for the group 154 made up of Jack 102 and his coworkers 156. If the group 154 is too small, the insurance company 150 will not have the knowledge to fully understand the potential risk from future medical claims for the group 154 and need to set the rate to cover this unknown risk. In that case, the insurer 150 would like to use the PHI 136 from the group 154 to assess the risk of claims and set the group health insurance premium appropriately. Unfortunately, the group 154 may also be too large for the insurance company 150 to practically obtain permission from each person in the group, without which HIPAA prohibits the healthcare providers 138 from releasing the PHI 136 to the insurer 150. The de-identified data 140, which the healthcare providers or other source sites 138 could release without permission, is not useful to the insurer 150 because the insurer has no way to know whether it corresponds to the people in the group 154. With no way to obtain medical history data for the group, the insurer 150 cannot set the group insurance premium acceptably.

Referring to FIG. 2, to provide the insurer 150 with the medical history information necessary to calculate the insurance premium for the group 154, without revealing the protected health information of persons in the group 154, the exemplary system 200 associates unique tokens 202 with the irreversibly de-identified data 140. The tokens 202 correspond to persons treated by healthcare providers but do not reveal the identities of the treated individuals. The insurer 150 can send a data request 203 to a third party 205, who in turn can generate request tokens 204, one for each person in the group 154. The third party 205 can send the request tokens 204 to a data aggregator 206. The data aggregator 206 stores de-identified data 140 and associated tokens 202. By searching for the request tokens 204 among the stored tokens 202, the data aggregator 206 can process the de-identified data to generate requested de-identified data 208 that corresponds to the group 154. A data processor 210 can process the requested de-identified data 208 to generate a report 212 containing metrics such as underwriting scores that are useful to the insurer 150 in assessing the overall risk of insuring the group 154.

By using the tokens 202 and request tokens 204, no parties other than the authorized source sites 138 can associate de-identified data 140 with the identity of any person in the group of patients 134 or insureds (e.g., the group 154). The insurer 150 requesting the report 212 can never receive data associated with individuals. Further, the information in the report 212 may be processed into metrics that characterize a large group and cannot be used to infer information about individuals. De-identified data records may be provided to the data processor 210 (e.g., a third part data processor), but that third party may not have access to any personally identifiable information 118 about the group 154. Nor may any party with access to the de-identified data 140, other than the healthcare providers 138, also have access to the de-identifier 142. These features of the system 200 maintain the privacy of the protected health information 130.

While we describe a system in which an insurer 150 needs to estimate the risk of insuring a group of potential customers, the system 200 can work for applications in which

information characterizing a group needs to be generated from the private data of group members. In one arrangement, the system may implement Microsoft Windows-based computers in connection with internet-based components. However, other implementations may use other types of components that support the processing of medical history information from healthcare databases.

Referring to FIG. 3, in an exemplary system 300, a user 302 specifies a group of people using identifying data for each group member. Referring briefly to FIG. 4, an exemplary set of identifying data 404 is illustrated. Returning to FIG. 3, the user may obtain the personally identifiable information from a database 304 by retrieving it in the form of a group file 330. The user 302 generates a request message, which may be a computer file, which uniquely identifies each member of the group using the identifying data 304. Typically, the group contains at least a minimum number of unique members. A request message 306 may be generated at a remote computer operated by the user 302.

The request message 306 contains a set of identifying data 404 (see FIG. 4) for each group member, as well as data that identifies a user 402 (see FIG. 4), such as the user's name, email address, phone number and facsimile number, and a batch number that identifies the request. The group members' identifying data 404 (see FIG. 4) may include first name, last name, date of birth, gender, and zip code as well as other identifiers, such as social security number, that may be added to ensure that members are uniquely identified. In some examples, fewer identifiers may be used. The request message 306 may also include optional indications that the user 302 requests a particular type of report 212 or requests additional processing to enhance the value of the report.

The request message 306 is sent over a communications network 310 (e.g., the Internet, a LAN, etc.) to an encryption server 312. If the request message 306 contains a minimum number of group members, the encryption server 312 creates a unique token, or identifier, for each person in the message 306. The encryption server creates each token by applying a token generator 314 that encrypts the personally identifiable information of each group member. The set of tokens corresponding to all the group members constitutes a batch of request tokens 204. The minimum number of group members, for example ten, is chosen to make it effectively impossible to associate individual group members with individual tokens in the batch of request tokens 204.

The encryption server 312 provides the request tokens 204 to the de-identified data server 318. The de-identified data server 318 stores records of de-identified data and corresponding tokens 320 obtained from source sites 138 such as pharmacies, healthcare professionals and electronic claims clearing houses. Each token obtained from the source sites 138 may have been created using the same token generator 314 used by the encryption server 312, or using any other means that generates the identical token for the same personally identifiable information.

For example, a pharmacy tracks the prescription histories of the patients being served. De-identified prescription histories and corresponding tokens are sent to the de-identified data server 318. At the request of a user 302, such as an insurance company, the encryption server 312 generates tokens identical to the patients' tokens using the same personally identifiable information. A unique token corresponding to the same personally identifiable information permits the pharmacy and the insurance company to refer to the same anonymous people without the insurance company ever associating protected health information with a particular person. To produce tokens and request tokens, one or

more encryption techniques may be utilized, for example, hash functions and other methodologies may be implemented.

A token matcher 326, executed by the de-identified data server 318, performs a look-up in the de-identified database 320 to find all tokens in the database that match the tokens sent from the encryption server 312. All available data for matched tokens, the requested de-identified data 208, is retrieved for use in the report generator 328. The de-identified data may include, for example, prescription history, medical claims, and hospital claims. The de-identified data server 318, or the data processor 210 may use the report generator 328 to process the requested de-identified data 208 in a way that leaves it irreversibly de-identified. An example of such processing is an underwriting algorithm that transforms the data into an underwriting assessment. The report generator formats the processed data into an electronic or hardcopy report 212 that is returned to the user.

While the report 212 is described as generated on a computer system, it may also be generated in part or entirely outside the computer system. For example, the report 212 could be conveyed to the user via regular mail or other similar technique. In particular, the report may be generated and printed at the site of the de-identified data server 318 and subsequently communicated to the user 302 without using the computer network. The report generator 328 may also reside in the data processor 210 separate from the de-identified data server 318.

In one arrangement, once the relevant information and options have been selected, the user 302 submits the request by clicking a submit button. The request message 306 may be encrypted prior to being transmitted over a computer network 310. At the encryption server 312, the request message 306 is unencrypted and stored. The encryption server 312 may send an optional confirmation message to the user 302. The confirmation message may include the time and date that the message was received, and may indicate the service level and options selected by the user 302.

Referring to FIG. 4, the user 302 can input the user's identifying information 402, including name, email address, phone number and/or facsimile number, in the first record, or set of fields, of the request message 306. The user can then input the personally identifiable information 404 for each of the group members, including first name, last name, gender, date of birth, and zip code. Equivalently, the user can incorporate the group file 330 into the request message 306. Information about the insurance policy 408 for which the group has applied, or other insurance purpose for which the report 212 is being requested may also be included in the request message 306. The format of the request message 306 may be adjusted based on the user's 302 needs.

The request message 306 may also include information about the level of service 410 requested by the user 302, for example the quantity, quality or type of information. A first level of service may request up to six months of medical history; a second level may request up to twelve months of history; and a third level may request a two year medical history. Alternatively, instead of providing the user 302 with a variety of service level options 410, the system 300 may simply retrieve all of the medical history information available for the group.

The user 302 may also request additional, optional information 412. For example, the user 302 may request information regarding the drug categories and drug indications associated with the drugs in the de-identified data. Drug indications include the medical conditions associated with

each drug. Drug categories include the type of drug. This data can be passed to the data processor **210** to include in the report **212**. Alternatively, this data may be returned as part of every report **212**.

Referring to FIG. 5, a flowchart **500** represents a particular arrangement of operations of a token generator (e.g., the token generator **314** shown in FIG. 3). Operations include receiving **502** the request message (e.g., request message **306**) containing the personally identifiable information of each person in the group (e.g., such as the group **154** shown in FIG. 1). Upon receiving the request message, operations may also include determining **504** whether the message includes the minimum number of persons. If the message does not include the minimum number of persons, the token generator returns to receive **502** a request message. A limit on the minimum number of persons ensures that a report (e.g., the report **212**) covers enough people such that it is difficult (if not impossible) to infer any association between particular persons and the information in the report. If the message does include the minimum number of people, operations of the token generator include producing **508** tokens from the identifying data of each person. Producing the tokens may include applying an encryption algorithm to the identifying data of each person. The tokens uniquely identify each person in the group **154**.

Operations also include determining **510** if the request message includes a batch number. If the message does not include a batch number, operations include generating **512** a batch number. Operations also include providing **516** the tokens, batch number and report options. The individual tokens are placed in a batch file and may be encrypted before being transmitted over the network.

Each batch file of request tokens **204** also specifies the information needed for the report **212**. The request tokens are transmitted to the de-identified data server **318**, unencrypted and processed using rules for searching, matching, and retrieving healthcare data.

Referring to FIG. 6, a flowchart **600** represents a particular arrangement of operations of a token matcher (e.g., the token matcher **326** shown in FIG. 3). Operations include receiving **602** request tokens (e.g., such as the request tokens **204** shown in FIG. 2). Operations may also include receiving **604** a token (e.g., such as the token **202**) and associated de-identified data (e.g., such as the de-identified data **140**), typically from source sites (e.g., such as the source site **138** shown in FIG. 1). Upon receiving a request token, de-identified data and a token, operations include determining **606** whether the request token matches the token. If no match is found, operations include returning to receive **604** more tokens and de-identified data. If a match is found, operations include processing **608** the de-identified data. Processing may include storage for later retrieval. In some arrangements, operations may also include determining whether a minimum number of matches has been detected. If such a minimum number of matches has not occurred in comparing the request tokens and the tokens, action may be taken (e.g., pause or restart processing) until the predefined number of matches has been detected (e.g., so as not to increase the probability of one or more individuals being identified by a process of elimination).

The de-identified data (e.g., such as the de-identified data **140**) may include a list of drugs prescribed over the requested period for the members of the group (e.g., such as the group **154**). The list of drugs prescribed may include the drug name, form, strength, days supplied, and date dispensed. As part of processing **608** the de-identified data, operations may include determining the drug category and

drug indications for each drug prescribed. Operations may also include accessing a database relating the drug category and indications to each possible drug. The database may be maintained within the de-identified data server **318** database, or may be accessed on a remote server maintained by a third party.

Upon processing the de-identified data, operations also include determining **610** if additional tokens remain in the batch of request tokens (e.g., such as the request tokens **204**). If additional tokens remain, operations include receiving **602** more request tokens. If there are no additional request tokens, operations may include outputting **612** the processed, de-identified data.

Operations may also include providing the number of tokens submitted, the number matched, and the overall match rate. The collected data covers the interval of historical data according to the level of service requested (e.g., as represented by the level of service **410** in FIG. 4). De-identified diagnosis and procedures data may also be included from administrative medical claims from a doctor's office (e.g., office **106**) or a healthcare facility (e.g., the hospital **108**).

In addition to accessing and incorporating drug indication information for each drug prescribed to persons in the group (e.g., such as group **154**), operations may include further processing of the requested de-identified data. For instance, operations may include determining the probability that a particular drug indicates a particular condition. In this example, in addition to providing the possible indications, the requested de-identified data would include the likelihood that anonymous individuals associated with the request tokens (e.g., such as request tokens **204**) have each of the conditions indicated by the prescribed drugs. Operations may also include using expert rule systems to provide health status information based on the prescription drug history information. Alternatively, operations may include using diagnosis codes from medical claims data to assess health status.

The requested de-identified data **208** may be sent for further processing to a third party data processor (e.g., data processor **210**) who may apply proprietary algorithms, modify the data format, or generate additional reports, provided that no re-identifiable information is transmitted to the user **302**. Third parties may not have access to the request message **306** and the group file **330** so that no association may be inferred between the de-identified data **140** and particular persons in the group **154**.

The report **212** provides the insurer **150** with information for making an immediate, informed decision about the insurance related risks. In particular, the insurer **150** may accept, reject or adjust the group's insurance rating depending on the information in the report **212**. Actuarial tables and formulas may be used to determine which of the insurance actions are taken. The report **212** may be used alone to make decisions about the insurability of the group **154**, or may simply indicate that additional investigation is needed.

FIG. 7 is a schematic diagram of a generic computer system **700**. The system **700** can be used for the operations described in association with any of the computer-implemented methods described previously, according to one implementation. The system **700** includes a processor **710**, a memory **720**, a storage device **730**, and an input/output device **740**. Each of the components **710**, **720**, **730**, and **740** are interconnected using a system bus **750**. The processor **710** is capable of processing instructions for execution within the system **700**. In one implementation, the processor **710** is a single-threaded processor. In another implementa-

tion, the processor 710 is a multi-threaded processor. The processor 710 is capable of processing instructions stored in the memory 720 or on the storage device 730 to display graphical information for a user interface on the input/output device 740.

The memory 720 stores information within the system 700. In some implementations, the memory 720 is a computer-readable medium. The memory 720 is a volatile memory unit in some implementations and is a non-volatile memory unit in other implementations.

The storage device 730 is capable of providing mass storage for the system 700. In one implementation, the storage device 730 is a computer-readable medium. In various different implementations, the storage device 730 may be a floppy disk device, a hard disk device, an optical disk device, or a tape device.

The input/output device 740 provides input/output operations for the system 700. In one implementation, the input/output device 740 includes a keyboard and/or pointing device. In another implementation, the input/output device 740 includes a display unit for displaying graphical user interfaces.

The features described can be implemented in digital electronic circuitry, or in computer hardware, firmware, software, or in combinations of them. The apparatus can be implemented in a computer program product tangibly embodied in an information carrier, e.g., in a machine-readable storage device, for execution by a programmable processor; and method steps can be performed by a programmable processor executing a program of instructions to perform functions of the described implementations by operating on input data and generating output. The described features can be implemented advantageously in one or more computer programs that are executable on a programmable system including at least one programmable processor coupled to receive data and instructions from, and to transmit data and instructions to, a data storage system, at least one input device, and at least one output device. A computer program is a set of instructions that can be used, directly or indirectly, in a computer to perform a certain activity or bring about a certain result. A computer program can be written in any form of programming language, including compiled or interpreted languages, and it can be deployed in any form, including as a stand-alone program or as a module, component, subroutine, or other unit suitable for use in a computing environment.

Suitable processors for the execution of a program of instructions include, by way of example, both general and special purpose microprocessors, and the sole processor or one of multiple processors of any kind of computer. Generally, a processor will receive instructions and data from a read-only memory or a random access memory or both. The essential elements of a computer are a processor for executing instructions and one or more memories for storing instructions and data. Generally, a computer will also include, or be operatively coupled to communicate with, one or more mass storage devices for storing data files; such devices include magnetic disks, such as internal hard disks and removable disks; magneto-optical disks; and optical disks. Storage devices suitable for tangibly embodying computer program instructions and data include all forms of non-volatile memory, including by way of example semiconductor memory devices, such as EPROM, EEPROM, and flash memory devices; magnetic disks such as internal hard disks and removable disks; magneto-optical disks; and CD-ROM and DVD-ROM disks. The processor and the

memory can be supplemented by, or incorporated in, ASICs (application-specific integrated circuits).

To provide for interaction with a user, the features can be implemented on a computer having a display device such as a CRT (cathode ray tube) or LCD (liquid crystal display) monitor for displaying information to the user and a keyboard and a pointing device such as a mouse or a trackball by which the user can provide input to the computer.

The features can be implemented in a computer system that includes a back-end component, such as a data server, or that includes a middleware component, such as an application server or an Internet server, or that includes a front-end component, such as a client computer having a graphical user interface or an Internet browser, or any combination of them. The components of the system can be connected by any form or medium of digital data communication such as a communication network. Examples of communication networks include, e.g., a LAN, a WAN, and the computers and networks forming the Internet.

The computer system can include clients and servers. A client and server are generally remote from each other and typically interact through a network, such as the described one. The relationship of client and server arises by virtue of computer programs running on the respective computers and having a client-server relationship to each other.

A number of implementations have been described. Nevertheless, it will be understood that various modifications may be made without departing from the spirit and scope of the following claims.

What is claimed is:

1. A computer-implemented method comprising:

receiving a request message for healthcare information that characterizes a group composed of a number of individuals, wherein the request message for healthcare information is sent to an encryption server that is configured to determine if the number of individuals in the request is at least a defined minimum number of individuals, and wherein the request message includes a batch number and at least one report option;

producing, by a processor of an encryption server, a unique request token from identifying data for each individual included in the group, wherein the request tokens are encrypted before being transmitted over a network;

comparing the request tokens to tokens associated with healthcare data that includes de-identified information to find matching tokens;

producing the healthcare information with the identity of the individuals being unattainable from the produced healthcare information based on a minimum number of matched tokens; and

providing the produced healthcare information to report the characteristics of the group absent authorization from the individuals in the group.

2. The computer-implemented method of claim 1, wherein the provided healthcare information is in conformity with the Health Insurance Portability and Accountability Act (HIPAA).

3. The computer-implemented method of claim 1, wherein receiving the request for healthcare information that characterizes the group of individuals includes receiving personally identifiable information associated with the individuals of the group.

4. The computer-implemented method of claim 1, in which producing the requested healthcare information includes encrypting respective data that identifies each individual.

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5. The computer-implemented method of claim 1, in which the tokens associated with healthcare data and the request tokens are similarly encrypted.

6. The computer-implemented method of claim 1, in which the healthcare data represents medical related information associated with the individuals of the group.

7. A system comprising:

a data server device for producing healthcare information that characterizes a group of a number of individuals identified in a request for the healthcare information that characterizes the group, wherein the request for healthcare information is sent to an encryption server that is configured to determine if the number of individuals in the request is at least a defined minimum number of individuals, wherein a unique request token is produced for each individual included in the group, the data server is configured to compare the request tokens to tokens associated with healthcare data that includes de-identified information to find matching tokens, the produced healthcare information is absent personally identifiable information and is based on a minimum number of matched tokens, the data server is also configured to provide the produced healthcare information to report the characteristics of the group absent authorization from the individuals in the group.

8. The system of claim 7, wherein the provided healthcare information is in conformity with the Health Insurance Portability and Accountability Act (HIPAA).

9. The system of claim 7, wherein the request for healthcare information that characterizes a group of individuals includes personally identifiable information associated with the individuals of the group.

10. The system of claim 7, in which the data that identifies each individual is encrypted.

11. The system of claim 7, in which the tokens associated with the healthcare data and the request tokens are similarly encrypted.

12. The system of claim 7, in which the data server provides the requested healthcare information if the group includes at least the minimum number of individuals.

13. The system of claim 7, in which the healthcare data represents medical related information associated with the individuals of the group.

14. One or more computer readable storage devices storing instructions that are executable by a processing device, and upon such execution cause the processing device to perform operations comprising:

receiving a request message for healthcare information that characterizes a group composed of a number of individuals, wherein the request message for healthcare

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information is sent to an encryption server that is configured to determine if the number of individuals in the request is at least a defined minimum number of individuals, and wherein the request message includes a batch number and at least one report option;

producing, by a processor of an encryption server, a unique request token from identifying data for each individual included in the group, wherein the request tokens are encrypted before being transmitted over a network;

comparing the request tokens to tokens associated with healthcare data that includes de-identified information to find matching tokens;

producing the healthcare information with the identity of the individuals being unattainable from the produced healthcare information based on a minimum number of matched tokens; and

providing the produced healthcare information to report the characteristics of the group absent authorization from the individuals in the group.

15. The computer readable storage devices of claim 14, wherein the provided healthcare information is in conformity with the Health Insurance Portability and Accountability Act (HIPAA).

16. The computer readable storage devices of claim 14, wherein receiving the request for healthcare information that characterizes the group of individuals includes receiving personally identifiable information associated with the individuals of the group.

17. The computer readable storage devices of claim 14, in which producing the requested healthcare information includes encrypting respective data that identifies each individual.

18. The computer readable storage devices of claim 14, in which the tokens associated with the healthcare data and the request tokens are similarly encrypted.

19. The computer readable storage devices of claim 14, in which the healthcare data represents medical related information associated with the individuals of the group.

20. The computer readable storage devices of claim 14, in which producing the requested healthcare information includes determining if the group includes at least the minimum number of individuals.

21. The computer-implemented method of claim 1, wherein the identity of the individuals is unattainable from the unique request tokens.

22. The computer-implemented method of claim 1, wherein the unique request tokens and the tokens associated with the healthcare data are similarly encrypted.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

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DATED : October 23, 2018
INVENTOR(S) : Andrew L. Paris, III

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims

Column 12, Line 2: In Claim 14, delete "it" and insert -- if --, therefor.

Signed and Sealed this
Eleventh Day of December, 2018

A handwritten signature in black ink, appearing to read "Andrei Iancu".

Andrei Iancu
Director of the United States Patent and Trademark Office