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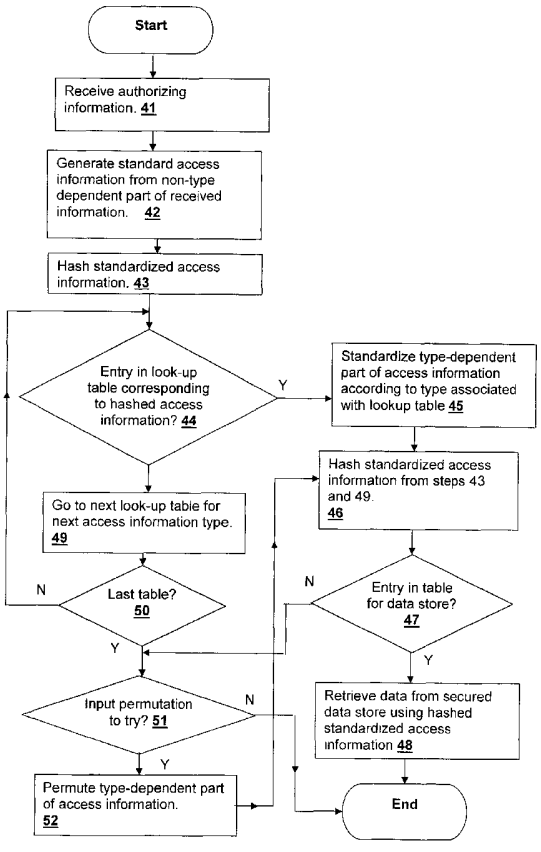
(54) Title: METHOD AND SYSTEM FOR EFFICIENTLY RETRIEVING SECURED DATA BY SECURELY PRE-PROCESSING PROVIDED ACCESS INFORMATION



(57) Abstract: A method and system for efficiently retrieving secured data by securely pre-processing provided access information, provides data store security based on only a single piece of access information, which is generally public, such as the proper name of a business or individual that is used to retrieve mailing address information. The access information is hashed (43) for access to a secured data store and efficient access and low data storage for permutations of input access information are provided by verifying the presence of an entry for the hashed access information in a look-up table (44). if an entry is found, the data store is accessed using the hashed access information (48), but if an entry is not found, another look-up table corresponding to another information type may be tried (49) or the input access information permuted (52) and retried.

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METHOD AND SYSTEM FOR EFFICIENTLY RETRIEVING SECURED DATA BY SECURELY PRE-PROCESSING PROVIDED ACCESS INFORMATION

RELATED APPLICATIONS

This application claims priority under 35 U.S.C. 119(e) to provisional application Ser. No. 60/409,262, filed September 6, 2002 and is also a continuation-in-part of co-pending U.S. Patent Application "METHOD AND SYSTEM FOR STORING AND RETRIEVING DATA USING HASH-ACCESSED MULTIPLE DATA STORES", Ser. No. 10/377,989 filed February 28, 2003, the specification of which is incorporated herein by reference. This application is further related to pending U.S. Patent Applications: "SYSTEM AND METHOD FOR STANDARDIZING A MAILING ADDRESS", Ser. No. 10/297,986 filed December 12,2002; "A METHOD FOR CORRECTING A MAILING ADDRESS", Ser. No. 10/384,915, filed March 6, 2003; and "DELIVERY POINT VALIDATION SYSTEM", Ser. No. 10/344,990, filed March 20, 2003, the specifications of all of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to secure database data retrieval, and more specifically, to a method and system for efficiently retrieving data from a secured

database by pre-processing provided access information. The present invention relates specifically to a method and system for retrieving new mailing address information from a privatized mailing address database in response to permutations of name and old address inputs that are non-standardized.

2. Background of the Invention

Mailing address information privacy is protected by statutes such as 39 U.S.C. §412, that prevents the United States Postal Service (USPS) and others from providing a list of addresses and 5 U.S.C. §552(a) that prevents the revelation of private information for other than intended purposes. Consequently, the USPS must oversee authorized agents who are selected to possess sensitive data such as mailing address database information. Specifically, lists of mailing addresses must not be provided by the USPS or any agent, and when retrieving change-of-address information for a single party, name and address information for any other party must not be revealed.

The above-incorporated parent application "METHOD AND SYSTEM FOR STORING AND RETRIEVING DATA USING HASH-ACCESSED MULTIPLE DATA STORES" provides a secured data store that may contain address information and be distributed to vendors that are not agents supervised by the USPS. However, in order to

use the method and system described in the above-referenced patent application, access information must be standardized and filtered (pre-processed) so that the information placed in the data store may be retrieved. While the above-referenced patent application describes a level of pre-processing that obtains an 11-digit delivery point code (DPC) that is used to access the data stores and retrieve associated address information, the DPC must be obtainable from user input or other data entry, such as records in other data stores, before the address information can be accessed.

However, stored data, user input and access information provide by other sources that correspond to the name of a business or an individual may not be uniform and may contain errors. For example, a user verifying the address for ABC, Inc. known as ABC Computers, where valid identifiers may be Albuquerque Computers, Inc., ABC Computers, ABQ Computers, ABC, Inc. and a number of other permutations that should provide access to the requested new mailing address information, when a valid old address is supplied in conjunction. Further, when verifying the address of an individual, valid variations in proper names may also yield many permutations that should provide access to the requested mailing address information.

In order to process permutations of access information, however, a typical software application would need to contain

the required access information in order to match the permutations and to determine to which type of entity (business or individual) a particular input corresponds. Such embedding of the information in the above-described data store system would compromise the security provided by the system.

Therefore, it would be desirable to provide a method and system for retrieving information from a secured data store that securely pre-processes provided access information and provides efficient retrieval of address information in response to permutations of access information input.

SUMMARY OF THE INVENTION

The above objective of efficiently retrieving information from a secured data store by securely pre-processing access information is accomplished in a method and system for retrieving data. The method may also be embodied in a computer program product and system containing computer-readable program instructions for carrying out the steps of the method on a general-purpose or workstation computer system.

The method for retrieving data receives input of access information such as an entity name and old mailing address. The access information is pre-processed by extracting a non-type-dependent portion of the access information and hashing the non-type-dependent portion to provide an access key to one or more look-up tables. Presence in the look-up tables verifies whether or not an entry exists that corresponds to the access information and permits categorization of the access information by type (e.g., business or individual). Once an entry is found, type-dependent portions of the access information are pre-processed to standardize the non-type dependent portions (e.g., standardizing a business name or individual's name) and the pre-processing may be performed according to the access information type. Again, look-up tables may be consulted to determine whether or not data is present in the data store corresponding to the access information. If data is present, requested secured data is

retrieved from the secured data store using the security retrieval algorithm associated with the data store. If an entry is not found, the type-dependent portion of the access information can be permuted and access attempts can be reiteratively made until possible permutations are exhausted.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a block diagram depicting a computer system in which the present invention may be practiced.

Figure 2 is a pictorial diagram depicting the flow of access information in accordance with an embodiment of the present invention.

Figure 3 is a flowchart depicting operation of the system executing a retrieval method in accordance with a generalized embodiment of the present invention.

Figure 4 is a flowchart depicting operation of the system executing a retrieval method in accordance with another specific embodiment of the present invention for retrieving change-of-address information.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Referring now to the figures and in particular to **Figure 1**, there is depicted a computer system **10** within which a method may be performed via the execution of program instructions forming a computer program product and computer system in accordance with an embodiment of the present invention. The method may employ program instructions located within a memory **19** of a workstation computer **14** and executed by a central processing unit **18** (CPU) and the data store and look-up tables of the present invention may be located entirely within a storage media **13A** and memory **19**. Alternatively, workstation computer **14** may be coupled via a network **11** connection for coupling workstation computer **14** to a network such as a local-area network (LAN), wide-area network (WAN) or the Internet. In a network implementation, the data store and/or program instructions for implementing the methods of the present invention may be located within a database server **12** coupled to a storage media **13B**.

The method of the present invention provides inherent database security, permitting distribution of a program, data store and look-up tables to an end-user for execution on workstation computer **14** or access to the data store/look-up tables and execution of the program via the Internet or other

network. Other combinations such as local-hosted program with remote data store, local data store with remote-hosted program are possible and should be understood to be variations in accordance with embodiments of the present invention.

A specific embodiment or set of embodiments is described herein for application to securing change-of-address information for business names and addresses and individual names and addresses. The use of the term "individual" should be understood to refer to family names as well, as a change-of-address can be entered for a family or an individual. The system and method provide a new address, given an old address and entity (individual/family or business) name as input. In the case of either business or individual/family names, the data store may also contain footnote indicators that verify that a move has taken place, but no change-of-address data is available. Such output may also be provided if conflicting information is found in the data store. The system may indicate that a known move has occurred, but that a new address is unavailable as a valid output.

Referring now to **Figure 2**, a flow of information between computer program modules accordance with an embodiment of the present invention is shown. Access information **30**, (for example, an old mailing address and entity name) is provided

to a type-independent access information standardization module **20**, which may be an enhanced modified delivery point (EDMP) generator in accordance with the techniques described in the above-incorporated U.S. Patent Application "SYSTEM AND METHOD FOR STANDARDIZING A MAILING ADDRESS", which produces a single numeric representation of a mailing address (an EDMP) given one of many permutations or expressions of a mailing address. The details of the techniques can be determined from the above-referenced Patent Application, but, in general, a postal code such as a ZIP Code or ZIP+4 Code extracted from the mailing address is concatenated with numeric fields (e.g., street number and unit number) extracted from the mailing address to provide a standardized address that is not dependent on spelling, street type (e.g., road, place, boulevard, street, etc.) or other variant (e.g., suite, apartment, apt., etc.).

Once a standardized version of the type-independent portion of the access information has been produced by standardization module **20**, the standardized information (e.g., an EDMP) is hashed using a Secure Hash Algorithm (SHA) by SHA generator **21A**.

The algorithm used by SHA generator **21A** may be a SHA-1 algorithm, or may be another hashing algorithm that provides sufficient security.

Details of SHA-1 algorithms are described in the "SECURE HASH STANDARD", Federal Information Processing Standards Publication 180-1 issued by the National Institute of Standards and Technology (NIST), an agency of the U.S. government. The SHA-1 algorithm is typically used for producing a condensed version of a message for verification through a Digital Signature Algorithm (DSA). The condensed version of the message (the message digest) encoded in a digital signature can be compared to a message digest generated from a received for verification that the received message content is the same as the transmitted message content. The message digest is a 20-byte number that is typically used for signature/message verification, but will be used herein in a new manner to provide access to the look-up tables and data stores of the present invention.

The present invention uses the SHA-1 algorithm to produce a representation of the access information or portions thereof for access to look-up tables and access to data stores and not for the above-described original purpose of the SHA-1 algorithm. It should be understood that other algorithms may be used to produce the hashed representation of the access information as used in the present invention and that use of

the SHA-1 algorithm is a convenience and not a limitation of the present invention.

Once the hashed version of the type-independent portion of the access information is obtained, one or more look-up tables **22A** are consulted to determine whether or not an entry exists for the access information according to the entry type associated with the look-up tables **22A**. In the illustrated embodiment, look-up tables **22A** comprises a single table that indicates whether or not there is an entry for a business at the EDMP produced by standardization generator **20**. Since the change-of-address system described as an embodiment of the invention herein manages two information types (i.e., business entries and individual entries), only one look-up table **22A** is required, as absence of an entry in look-up table **22A** is used as a presumption that the EDMP is associated with an individual. However, other embodiments of the invention may manage more than two information types, and therefore multiple look-up tables may be used to consecutively filter the information in order to determine a valid entry type.

Look-up table **22A** may be implemented as a bit array as described in the above-incorporated U.S. Patent Application entitled "DELIVERY POINT VALIDATION SYSTEM", which describes the use of a bit array for verification of the presence of an

address entry in the look-up table that has very low computational overhead on retrieval of the information. Address indicia that changes, e.g., street renaming, unit re-numbering, etc. are updated in the look-up table as described in the above-incorporated patent application "METHOD FOR CORRECTING A MAILING ADDRESS". The delivery point validation technique provides the hashed EMDP to an extraction algorithm that selects samples from the hashed EMDP (or other access information in applications other than a change-of-address system) that are used as offsets into the bit array. If a bit is set within the bit array, the presence of the individual sample is verified. If all samples are indicated as present, then the existence of an entry in look-up tables is verified. The above-referenced patent application provides further details of bit array implementation for verifying the validity of an EMDP or other data type.

If the EMDP is verified as a valid business address, a business name standardizer **24A** standardizes the name provided as input (the type-dependent portion of access information). The business name standarizer **24A** uses the ZIP Code to access a business name table that contains a list of correct business names as entered on the actual change-of-address card, Internet change-of-address system or other mechanism used to enter changes of address.

Once the business name has been standardized, the business name is provided to SHA generator **21B** and combined with the EMDP and a SHA-1 result is generated. SHA generator **21B** may use the same set of program instructions that provide SHA generator **21A** or may be another algorithm that provides security to access a move table **27**. Secure data store retrieval algorithm **28** provides access to move table **27**, which is stored in data storage device **29** as a file. Exemplary move table **27** comprises multiple data stores as described in the above-incorporated parent application "METHOD AND SYSTEM FOR STORING AND RETRIEVING DATA USING HASH-ACCESSED MULTIPLE DATA STORES", which yields a new mailing address (or other information for other applications of the system) in response to access information that has been processed into a hashed result. The data store comprising all of the multiple data stores described in the above-referenced patent is very secure against data mining and prevents revelation of private data, unless all of the required access information (e.g., name and old mailing address) are known.

The above-referenced patent application describes the storing and retrieving of standardized address information and may be extended to other types of information, depending on the type of information retrieval required for the particular

embodiment of the present invention. In particular, a mathematical representation of a new (moved-to) address is used with a change-of-address system in accordance with an embodiment of the present invention. The data that is placed in the data stores is 7-byte information that comprises a number computed from: a five digit ZIP Code Z[64000], a four-digit add-on with a two-digit delivery point selector ZP[1000000], a gender flag G[3], the first M1[27] and second M2[27] characters of the middle initial, the move effective date D[120], an address drop flag A[2] and a flag to indicate the use of a middle name MU[2]. The numbers in brackets following each of the above elements depicts the number of values or states that each of the above-listed elements can assume.

The mathematical expression of the stored address information is computed as a representation that essentially assigns a "digit" of a base equal to the number of states (or a greater arbitrary number) assumable by each of the above elements, and therefore is a sum of each of the elements multiplied by the next lower digit's base and the base of the digit itself. The expression for the stored data (which, once retrieved, is used to compute the elements of the address by modulo arithmetic to extract each "digit" knowing the base).

The formula for the data stored in each element of data stores in the secured database is:

Data = ZP + 1,000,000 * (Z + (64,000 *(G + M2*3 + M1*81 + D*2187 + A*262440 + MU*524880))

which can be equivalently expressed as described above, but for clarity of the relationship of the ZIP and ZIP+4 values to the stored/retrieved data, is expressed with the additional information grouped separately. The factors can be multiplied through to determine the base values of the individual digits. Upon extraction of a data element from the data store, the element is divided by the base values to yield modulo results giving the components of the new address. The above number will not exceed 254^7, which is the maximum data size for the seven data store implementation of the storage and retrieval method disclosed in the above-referenced patent application. The data portions are retrieved, de-striped and combined after modulo-254 processing, then the new address is generated by performing the above variable-modulo computation to yield the individual new address elements.

As an alternative to the use of the multiple data store security techniques described in the above-referenced patent application, the look-up table techniques for improving the

operating efficiency of the method of the present invention may be applied to other data security methods and algorithms in addition to the secure data store method of the above-referenced patent application. For example, an encrypted data store (as opposed to a hash-coded data store access) requires a large amount of computational overhead for retrieving data due to the decryption process. Look-up tables may be employed in front of such data stores to avoid searching an encrypted data store for invalid entries.

If the name provided in the description above does not correspond to a business name, then an Individual Name Parser **24B** parses out the individual components of the name (e.g., first, middle and last) and also attempts to find a gender commonly associated with the name. The parsed name is supplied to SHA generator **21B**, and is combined with the EMDP as in the case for the business name and move table **27** is checked for the presence of a change-of-address entry. If no entry is found, permutations of the name can be generated by Individual Name Parser **24B** using common misspellings of the last name. Subsequent attempts can permute the name using known nicknames (from a nickname table) and common misspelling of the first name. Other tables may be used to provide sound-alike (via phonetic soundex representation) permutations with fuzzy logic exceptions to the sound-alike variations. For example, Baker

and Becker may have the same soundex but are not considered equivalent. After the above-described variants have been attempted, a query is made using just the last name and address. An entry in move table **27** for a last name/address combination indicates a "family" move, where no one is left in a household having the same last name after a move.

Referring now to **Figure 3**, a secure data retrieval method in accordance with a generic embodiment of the present invention is depicted. First, authorizing information is received (**step 41**) and standard access information is generated from a non-type dependent portion of the received access information (**step 42**). The standardized access information is hashed (**step 43**) and one or more look-up tables are consulted to determine if an entry exists for the hashed access information (**decision 44**). If an entry is found, the type-dependent portion of the access information is standardized according to the type corresponding to the look-up table in which the entry was found (**step 45**). The combined standardized access information from **steps 43** and **49** is then hashed (**step 46**) and the presence of an entry is verified in the secure data store (**decision 47**). If there is an entry in the secure data store corresponding to the combined standardized access information (**decision 47**), the requested data is retrieved from the secure data store using the hashed

combined standardized access information (**step 48**). If no entry was found in **decision 47**, if input permutations are to be tried and all permutations are not exhausted (**decision 51**), then the type-dependent portion of the access information is permuted (**step 52**) and another combined access information hashed result is computed according to **step 46** and the steps of verifying (**step 47**) and retrieving (**step 48**) are repeated for the permutation(s).

If in **decision 44**, an entry is not found in the first look-up table, additional look-up tables may be consulted for other access information types (**step 49**) until the last table is reached (**decision 50**). The input from **step 41** can be permuted according to **step 51** if no entry is found in any table in **step 44**.

The method of **Figure 3** may be applied to any system that requires output of "revealed data" in response to the receipt of "authorizing data". For example, the following table depicts authorizing/revealed data pairs to which the method may be applied according to **Table I** below.

Authorizing Data	**Revealed Data**
Vehicle Identification Number	Key Number
Full Name and Address	Unpublished Telephone Number
Full Name and Address	Credit Card Number
Computer Serial Number	Password
Full Name and Address	Weapon Registration Number
Patient ID Number	Medical Information
Last Name and Telephone Number	Limited Guest Invitation number
Biometric data (eye scan, palm print, DNA, thumbprint, etc.)	Name
Name and registration number	Email Address

Table I

Table I is illustrative of private data that must be secured, and is not limiting, but exemplary of various applications for both government entities, businesses and private organizations.

Referring now to **Figure 4**, a method in accordance with a specific embodiment of the invention as applied to a change-of-mailing address system is depicted. The name and old address of a business or individual is received (**step 61**) and an EMDP is generated for the old address (**step 62**). The EMDP is hashed (**step 63**) and the business change-of-address look-up

table is consulted. If an entry is found in the business change-of-address look-up table (**step 64**), then the business name is standardized (**step 65**) using the business name table and hashed along with the EMDP (**step 66**). The move table is consulted to determine if an entry exists (**decision 67**) and if the entry exists, the new address is retrieved from the secured data store using the hashed standardized access information (**step 68**). If an entry is not found in the move table, further permutation of the input if available (**decision 70**), may be attempted (**step 71**) and the name and EMDP hashed (**step 66**) and the move table re-checked (**decision 67**) for an entry.

If a business entry was not found in **decision 64**, then the name and old address received in **step 61** are presumed to be that of an individual and the name is parsed and standardized **69**. The standardized name and EMDP are hashed (**step 66**) and the move table consulted (**decision 67**) to determine if an entry is present. If an entry is present, the individual's new address is extracted from the secured data store using the combined hashed result of **step 68**.

While the invention has been particularly shown and described with reference to the preferred embodiments thereof, it will be understood by those skilled in the art that the

foregoing and other changes in form, and details may be made therein without departing from the spirit and scope of the invention.

WHAT IS CLAIMED IS:

1. A method for retrieving secured data from a secure data store, comprising:

receiving access information;

hashing a type-independent portion of said received access information to produce a hashed result;

determining whether or not said hashed result is present in a look-up table; and

in response to determining that said hashed result is present in said look-up table, retrieving said secured data from said secured data store using a secure retrieval algorithm associated with said secured data store.

2. The method of Claim 1, wherein said retrieving comprises:

standardizing a type dependent portion of said received access information;

combining said standardized type dependent portion of said received access information with said type-independent portion of said received access information;

hashing a result of said combining to obtain a combined hashed result; and

accessing said secure data store with said combined hashed result.

3. The method of Claim 2, wherein said accessing comprises:

splitting said combined hashed result into a plurality of offset fields, a quantity of said plurality of fields corresponding to a number of separate data stores in which portions of said secured data are stored;

accessing locations in said separate data stores using said offset fields as indices into said data stores, whereby portions of said secured data are retrieved from said locations; and

combining said portions of said secure data to produce said secured data.

4. The method of Claim 3, wherein said combining combines said data value portions by multiplying said data value portions by powers of a predetermined numeric base corresponding to a position of each data value portion in said data value.

5. The method of Claim 3, wherein said combining comprises:

dividing a field of said hashed result by a predetermined striping combination number to produce a striping modulus;

selecting a striping order from a striping order table in conformity with said modulus; and

reordering said portions of said secured data according to said retrieved striping order, whereby said combining is performed in conformity with said striping order.

6. The method of Claim 1, wherein said hashing is performed according to a SHA-1 algorithm.

7. The method of Claim 1, wherein said look-up table is associated with a first type of said access information, and wherein said method further comprises in response to determining that said hashed result is not present in said look-up table, determining whether or not said hashed result is present in a second look-up table corresponding to a second type of said access information.

8. The method of Claim 1, further comprising in response to determining that said hashed result is not present in said look-up table, permuting said access information to obtain permuted access information, and wherein said steps of hashing, determining and retrieving are performed in conformity with said permuted access information.

9. The method of Claim 1, wherein said type-independent portion of said access information is an old mailing address of an entity, wherein said type-dependent portion of said access information is a name of an entity and wherein said secured data is a new mailing address of said entity.

10. The method of Claim 9, wherein said look-up table contains entries corresponding to business entities, and wherein said method further comprises in response to determining that said hashed result is not present in said look-up table, treating the access information as a name and old address of one or more individual persons.

11. A computer system comprising a processor for executing program instructions and a memory coupled to said processor for storing program instructions and data, wherein said program instructions comprise program instructions for:

receiving access information,

hashing a type-independent portion of said received access information to produce a hashed result,

determining whether or not said hashed result is present in a look-up table, and

in response to determining that said hashed result is present in said look-up table, retrieving said secured data from said secured data store using a secure retrieval algorithm associated with said secured data store.

12. The computer system of Claim 11, wherein said program instructions for retrieving comprise program instructions for:

standardizing a type dependent portion of said received access information,

combining said standardized type dependent portion of said received access information with said type-independent portion of said received access information,

hashing a result of said combining to obtain a combined hashed result, and

accessing said secure data store with said combined hashed result.

13. The computer system of Claim 12, wherein said program instructions for accessing comprise program instructions for:

splitting said combined hashed result into a plurality of offset fields, a quantity of said plurality of fields corresponding to a number of separate data stores in which portions of said secured data are stored,

accessing locations in said separate data stores using said offset fields as indices into said data stores, whereby portions of said secured data are retrieved from said locations, and

combining said portions of said secure data to produce said secured data.

14. The computer system of Claim 13, wherein said program instructions for combining combine said data value portions by multiplying said data value portions by powers of a predetermined numeric base corresponding to a position of each data value portion in said data value.

15. The computer system of Claim 13, wherein said program instructions for combining comprise program instructions for:

dividing a field of said hashed result by a predetermined striping combination number to produce a striping modulus,

selecting a striping order from a striping order table in conformity with said modulus, and

reordering said portions of said secured data according to said retrieved striping order, whereby said combining is performed in conformity with said striping order.

16. The computer system of Claim 11, wherein said program instructions for hashing implement a SHA-1 algorithm.

17. The computer system of Claim 11, wherein said look-up table is associated with a first type of said access information, and wherein said program instructions further comprise program instructions for in response to determining that said hashed result is not present in said look-up table, determining whether or not said hashed result is present in a second look-up table corresponding to a second type of said access information.

18. The computer system of Claim 11, further comprising program instructions for in response to determining that said hashed result is not present in said look-up table, permuting said access information to obtain permuted access information, and wherein said program instructions for hashing, determining and retrieving are executed again using said permuted access information as input.

19. The computer system of Claim 11, wherein said type-independent portion of said access information is an old mailing address of an entity, wherein said type-dependent portion of said access information is a name of an entity and wherein said secured data is a new mailing address of said entity.

20. The computer system of Claim 19, wherein said look-up table contains entries corresponding to business entities, and wherein said program instructions further comprise program instructions for in response to determining that said hashed result is not present in said look-up table, processing the access information as a name and old address of one or more individual persons.

21. A computer program product comprising a signal-bearing media encoding program instructions for execution within a general-purpose computer system, wherein said program instructions comprise program instructions for:

receiving access information,

hashing a type-independent portion of said received access information to produce a hashed result,

determining whether or not said hashed result is present in a look-up table, and

in response to determining that said hashed result is present in said look-up table, retrieving said secured data from said secured data store using a secure retrieval algorithm associated with said secured data store.

22. The computer program product of Claim 21, wherein said program instructions for retrieving comprise program instructions for:

standardizing a type dependent portion of said received access information,

combining said standardized type dependent portion of said received access information with said type-independent portion of said received access information,

hashing a result of said combining to obtain a combined hashed result, and

accessing said secure data store with said combined hashed result.

23. The computer program product of Claim 22, wherein said program instructions for accessing comprise program instructions for:

splitting said combined hashed result into a plurality of offset fields, a quantity of said plurality of fields corresponding to a number of separate data stores in which portions of said secured data are stored,

accessing locations in said separate data stores using said offset fields as indices into said data stores, whereby portions of said secured data are retrieved from said locations, and

combining said portions of said secure data to produce said secured data.

24. The computer program product of Claim 23, wherein said program instructions for combining combine said data value portions by multiplying said data value portions by powers of a predetermined numeric base corresponding to a position of each data value portion in said data value.

25. The computer program product of Claim 23, wherein said program instructions for combining comprise program instructions for:

dividing a field of said hashed result by a predetermined striping combination number to produce a striping modulus,

selecting a striping order from a striping order table in conformity with said modulus, and

reordering said portions of said secured data according to said retrieved striping order, whereby said combining is performed in conformity with said striping order.

26. The computer program product of Claim 21, wherein said program instructions for hashing implement a SHA-1 algorithm.

27. The computer program product of Claim 21, wherein said look-up table is associated with a first type of said access information, and wherein said program instructions further comprise program instructions for in response to determining that said hashed result is not present in said look-up table, determining whether or not said hashed result is present in a second look-up table corresponding to a second type of said access information.

28. The computer program product of Claim 21, further comprising program instructions for in response to determining that said hashed result is not present in said look-up table, permuting said access information to obtain permuted access information, and wherein said program instructions for hashing, determining and retrieving are executed again using said permuted access information as input.

29. The computer program product of Claim 21, wherein said type-independent portion of said access information is an old mailing address of an entity, wherein said type-dependent portion of said access information is a name of an entity and wherein said secured data is a new mailing address of said entity.

30. The computer program product of Claim 29, wherein said look-up table contains entries corresponding to business entities, and wherein said program instructions further comprise program instructions for in response to determining that said hashed result is not present in said look-up table, processing the access information as a name and old address of one or more individual persons.

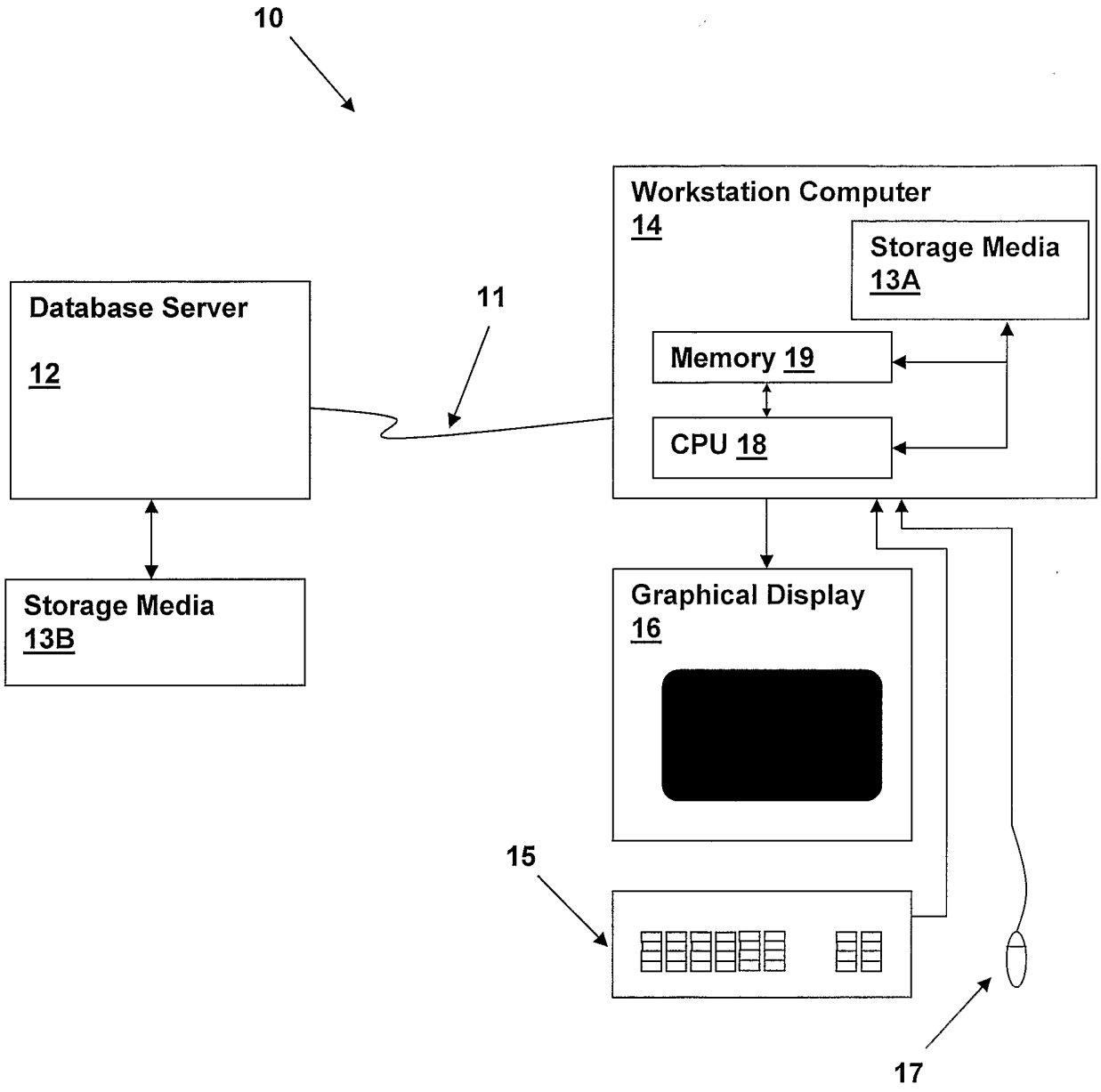
10
Workstation Computer
14
Storage Media
13A
Database Server
12
11
Memory 19
CPU 18
Storage Media
13B
Graphical Display
16
15
17

Fig. 1

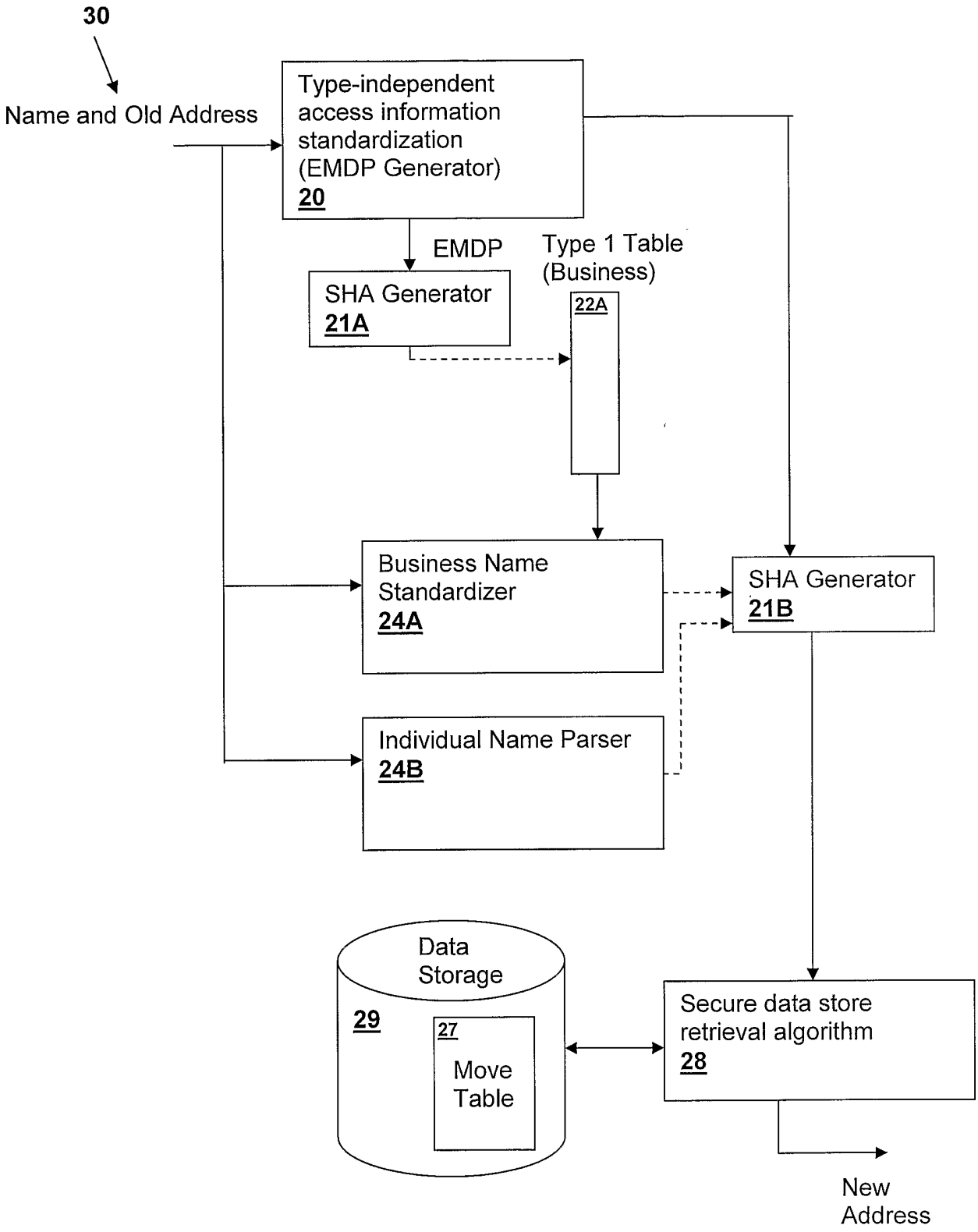
30
Name and Old Address
Type-independent access information standardization (EMDP Generator) 20
EMDP
Type 1 Table (Business)
SHA Generator 21A
22A
Business Name Standardizer 24A
SHA Generator 21B
Individual Name Parser 24B
Data Storage
29
27
Move Table
Secure data store retrieval algorithm 28
New Address

Fig. 2

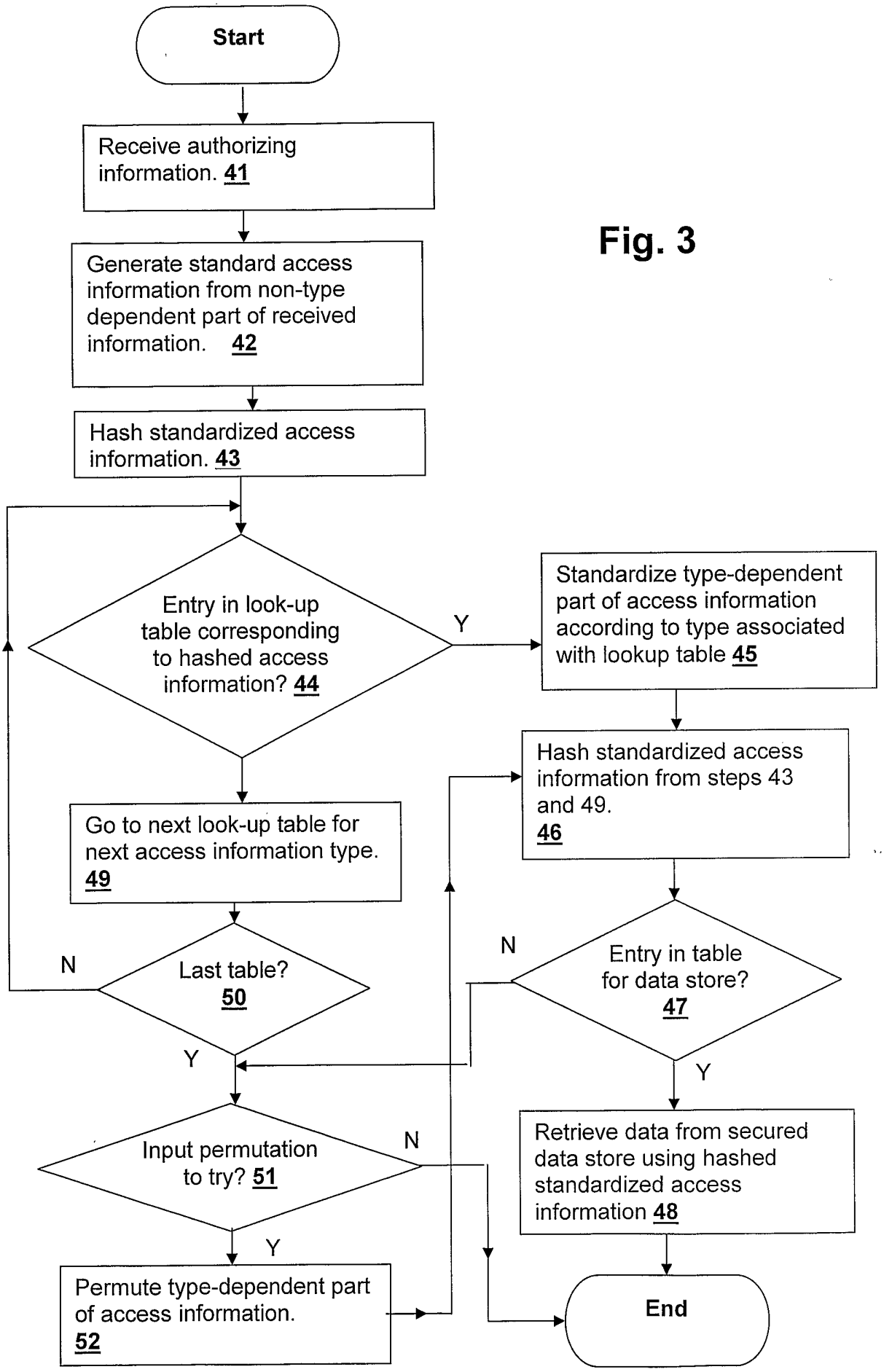
Start
Receive authorizing information. 41
Generate standard access information from non-type dependent part of received information. 42
Hash standardized access information. 43
Entry in look-up table corresponding to hashed access information? 44
Y
Standardize type-dependent part of access information according to type associated with lookup table 45
Hash standardized access information from steps 43 and 49. 46
Entry in table for data store? 47
N
Y
Retrieve data from secured data store using hashed standardized access information 48
End
Go to next look-up table for next access information type. 49
Last table? 50
N
Y
Input permutation to try? 51
N
Y
Permute type-dependent part of access information. 52

Fig. 3

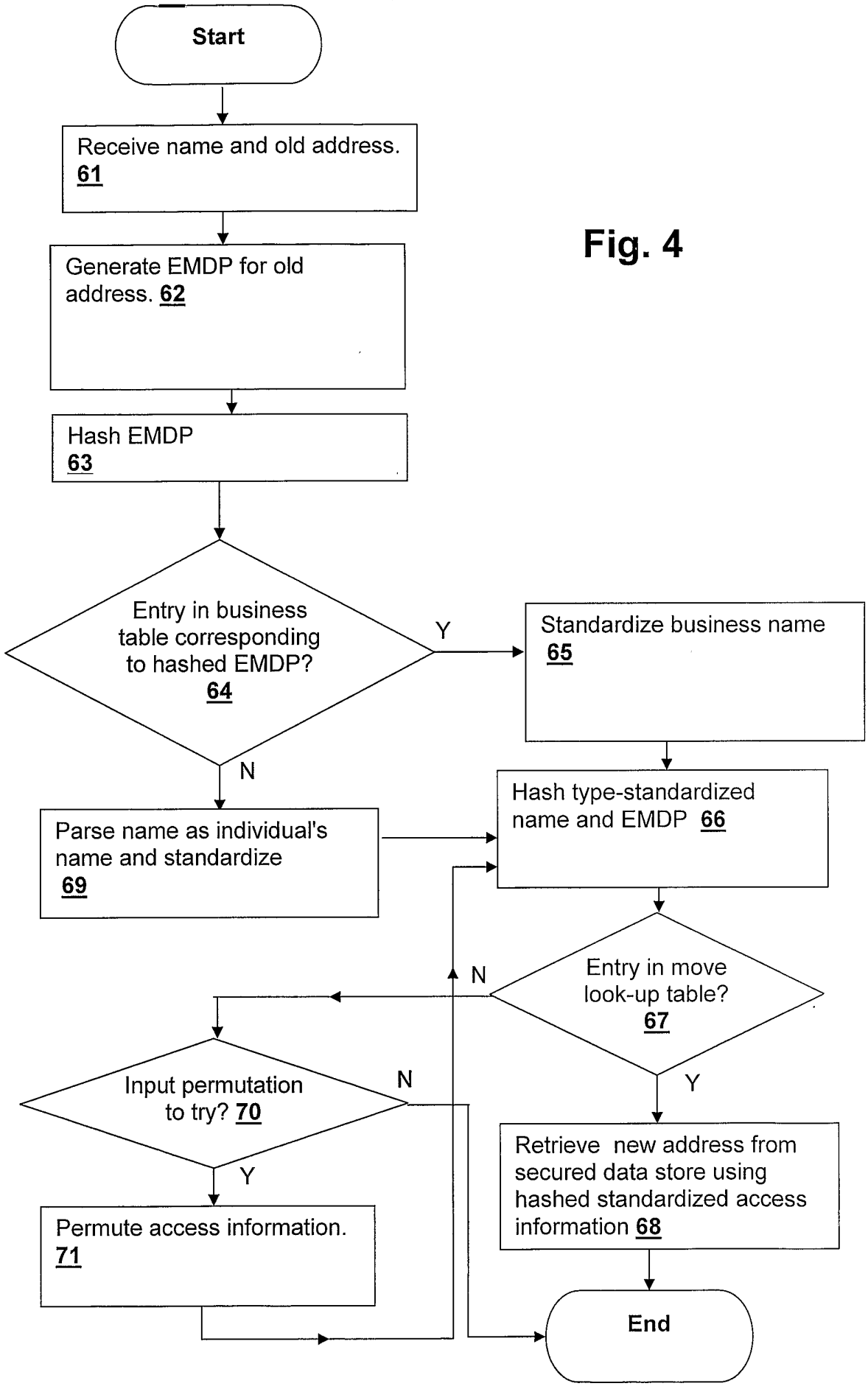
Start
Receive name and old address. 61
Generate EMDP for old address. 62
Hash EMDP 63
Entry in business table corresponding to hashed EMDP? 64
Y
N
Standardize business name 65
Parse name as individual's name and standardize 69
Hash type-standardized name and EMDP 66
Entry in move look-up table? 67
N
Y
Input permutation to try? 70
N
Y
Permute access information. 71
Retrieve new address from secured data store using hashed standardized access information 68
End

Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US03/18412

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : H04L 9/00; 9/32
US CL : 713/181

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)
U.S. : 713/181

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2002/0049670 A1 (MORITSU et al) 25 April 2002, paragraph 46, pages 5-6	1,6-11,16-21,26-30
A	US 5,933,604 A (INAKOSHI) 08 August 1999, see entire document	1-30
A	US 5,966,542 A (TOCK) 12 October 1999, see entire document	1-30

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent published on or after the international filing date

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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

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"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

"&" document member of the same patent family

Date of the actual completion of the international search
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Form PCT/ISA/210 (second sheet) (July 1998)

Continuation of B. FIELDS SEARCHED Item 3:
BRS (files: USPAT, USPGPUB)

search terms: entry, entries, hash, hashing, hashed, determine, determination, determining, determined, mail, mailing, address