

SYSTEMS AND METHODS FOR DISTRIBUTED DATA MAPPING

CROSS REFERENCE TO RELATED APPLICATIONS

[01] This application claims priority to U.S. Provisional Patent Application No. 62/490,818, filed on April 27, 2017, U.S. Provisional Patent Application No. 62/506,090, filed on May 15, 2017, and U.S. Patent Application No. 15/922,505, filed on March 15, 2018, which are each hereby incorporated by reference herein in their entireties.

BACKGROUND INFORMATION

[02] Increasingly, people store and rely upon sensitive data to conduct transactions. This data can include identify information, such as names, addresses, telephone numbers, state identification numbers, etc.; financial information, such as bank account numbers, account balances, transaction identifiers, etc.; and various other items of data that may be regarded as sensitive in various contexts. Transactions that may rely on such data are myriad, and can include purchase transactions, credit applications, account creation transactions, identify verifications, security interrogations, employment applications, etc.

[03] The effectiveness of transactions relying on sensitive data to function according to their intended purposes depends upon the secure storage and access of this data. The consequences of sensitive data falling into the wrong hands can be severe. For example, when an individual's identity data is stolen, a criminal entity may use the data to impersonate the individual to conduct transactions, open accounts, etc.. The process of recovering from identity theft, such as by restoring funds, establishing new identity credentials, and clearing a credit record, etc., may be arduous, and take months or even years.

[04] Secure access and storage of data has traditionally been achieved using technologies such as encryption. However, technologically adept entities are increasingly able to bypass even the most secure encryption techniques.

[05] Thus, a need exists for systems and methods to provide improved security for storage and access to data for conducting transactions and other purposes.

SUMMARY OF THE INVENTION

[05a] According to a first aspect of the present invention, there is provided a method for conducting a transaction, the method comprising: receiving, at a user device from a transaction system, a request for a data element for conducting the transaction; in response to receiving the request, accessing by one of the user device or a data service

~~system, determining~~ a data map corresponding to the requested data element, the data map including (i) a plurality of pointers for a plurality of data fragments of the data element, each of the data fragments containing a different portion of the data element, each of the pointers ~~including an address of pointing to~~ a respective one of a plurality of different storage locations storing a respective one of the plurality of data fragments, ~~and (ii) time-to-live (TTL) attributes for the plurality of data fragments, each TTL attribute indicating a time period for which a respective data fragment is valid; for each of the plurality of data fragments, determining from the data map a time to live (TTL) attribute, the TTL attribute indicating a time period for which the respective data fragment is valid;~~ determining whether the TTL attributes for the plurality of data fragments indicate that the plurality of data fragments are currently valid; retrieving, using the pointers of the data map, the plurality of data fragments from the plurality of different storage locations; assembling the requested data element using the retrieved plurality of data fragments; and providing, by the user device to the transaction system, the requested data element to conduct the transaction; wherein the retrieving the plurality of data fragments, the assembling the requested data element, and the providing the requested data element are performed in response to determining that the TTL attributes for the plurality of data fragment indicate that the plurality of data fragments are still valid; and in response to the TTL attributes for at least one of the plurality of data fragments indicating that the at least one data fragment is not valid, preventing retrieving of that data fragment.

[05b] According to a second aspect of the present invention, there is provided a method for processing a data map, the method comprising: fragmenting a data element into a plurality of data fragments, each data fragment representing a different portion of the data element; storing each of the plurality of data fragments at a respective different one of a plurality of different data storage locations; generating a data map including a plurality of pointers, each of the pointers ~~including an address of pointing for~~ a respective one of the plurality of different data storage locations storing a respective one of the plurality of data fragments ~~located at the respective one of the plurality of different data storage locations;~~ for each of the plurality of data fragments, assigning a time-to-live (TTL) attribute indicating a predetermined time period for which the data fragment is valid; adding the time-to-live attributes for the plurality of data fragments to the data map; and storing the data map on a device separate from the plurality of data storage locations.

[05c] According to a third aspect of the present invention, there is provided a system for conducting a transaction, the system comprising: at least one non-transitory machine readable storage medium having ~~a data map and~~ program instructions, ~~the data map including a plurality of pointers, each of the plurality of pointers pointing to a respective one of a plurality of different data storage locations storing a respective one of a plurality of different data fragments of a data element;~~ and at least one processor configured to execute the program instructions to perform a method of conducting a transaction, the method including: receiving, by a user device from a transaction system a request for the data element for conducting the transaction; in response to receiving the request, accessing by one of the user device or a data service system, a data map corresponding to the requested data element, the data map including (i) a plurality of pointers for a plurality of data fragments of the data element, each of the data fragments containing a different portion of the data element, each of the pointers including an address of a respective one of a plurality of different storage locations storing a respective one of the plurality of data fragments, and (ii) time-to-live (TTL) attributes for the plurality of data fragments, each TTL attribute indicating a time period for which a respective data fragment is valid; for each of the plurality of data fragments, determining from the data map a time to live (TTL) attribute, the TTL attribute indicating a time period for which the respective data fragment is valid; determining whether the TTL attributes for the plurality of data fragments indicate that the plurality of data fragments are currently valid; in response to receiving the request, using the pointers of the data map to retrieve the plurality of data fragments of the data element from the plurality of different data storage locations; assembling the data element from the retrieved plurality of data fragments; and providing the data element to the transaction system to conduct the transaction; wherein the retrieving the plurality of data fragments, the assembling the requested data element, and the providing the requested data element are performed in response to determining that the TTL attributes for the plurality of data fragment indicate that the plurality of data fragments are still valid; and in response to the TTL attributes for at least one of the plurality of data fragments indicating that the at least one data fragment is not valid, preventing retrieving of that data fragment.

[05d] According to a fourth aspect of the present invention, there is provided a system for conducting a transaction, the system comprising: at least one non-transitory machine readable storage medium having program instructions; and at least one processor configured to execute the program instructions to perform a method of processing a data map, the method including: fragmenting a data element into a plurality of separate data

fragments, each data fragment representing a different portion of the data element; storing each of the plurality of data fragments on a respective different one of a plurality of different data storage locations; generating a data map including a plurality of pointers, each of the pointers ~~including an address of pointing to~~ a respective one of the ~~plurality of different data storage locations storing a respective one of the~~ plurality of data fragments ~~on the respective one of the plurality of different data storage locations~~; for each of the plurality of data fragments, assigning a time-to-live (TTL) attribute indicating a predetermined time period for which the data fragment is valid; adding the time-to-live attributes for the plurality of data fragments to the data map; and storing the data map on a device separate from the plurality of data storage locations.

BRIEF DESCRIPTION OF THE DRAWINGS

[06] So that the features of the present invention can be understood, a number of drawings are described below. However, the appended drawings illustrate only particular embodiments of the invention and are therefore not to be considered limiting of its scope, for the invention may encompass other equally effective embodiments.

CLAIMS:

1. A method for conducting a transaction, the method comprising:
 - receiving, at a user device from a transaction system, a request for a data element for conducting the transaction;
 - in response to receiving the request, ~~accessing by one of the user device or a data service system, determining~~ a data map corresponding to the requested data element, the data map including (i) a plurality of pointers for a plurality of data fragments of the data element, each of the data fragments containing a different portion of the data element, each of the pointers ~~including an address of pointing to~~ a respective one of a plurality of different storage locations storing a respective one of the plurality of data fragments, ~~and (ii) time-to-live (TTL) attributes for the plurality of data fragments, each TTL attribute indicating a time period for which a respective data fragment is valid;~~
 - ~~for each of the plurality of data fragments, determining from the data map a time-to-live (TTL) attribute, the TTL attribute indicating a time period for which the respective data fragment is valid;~~
 - determining whether the TTL attributes for the plurality of data fragments indicate that the plurality of data fragments are currently valid;
 - retrieving, using the pointers of the data map, the plurality of data fragments from the plurality of different storage locations;
 - assembling the requested data element using the retrieved plurality of data fragments; and
 - providing, by the user device to the transaction system, the requested data element to conduct the transaction;
 - wherein the retrieving the plurality of data fragments, the assembling the requested data element, and the providing the requested data element are performed in response to determining that the TTL attributes for the plurality of data fragment indicate that the plurality of data fragments are still valid; and
 - in response to the TTL attributes for at least one of the plurality of data fragments indicating that the at least one data fragment is not valid, preventing retrieving of that data fragment.
2. The method of claim 1, wherein the plurality of different storage locations include a plurality of different data storage systems.
3. The method of claim 1, wherein the determining the data map and the retrieving the plurality of fragments are performed by the user device.

4. The method of claim 1, wherein the determining the data map includes:
sending, by the user device to a data service system separate from the user device, a request for the data map; and
receiving, by the user device from the identity service system, the data map.
5. The method of claim 1, wherein the determining the data map and the retrieving the plurality of fragments are performed by a data service system separate from the user device, the method further comprising:
receiving, by the user device from the identity service system, at least one of: the retrieved plurality of data fragments, or the assembled data element.
6. The method of claim 1, wherein the transaction includes at least one of: an identification of the user, or a security interrogation of the user.
7. The method of claim 1, further comprising:
fragmenting the data element into the plurality of data fragments, each data fragment representing a different portion of the data element;
storing the plurality of data fragments at the plurality of different data storage locations so that each of the plurality of data fragments is stored on respective different one of the plurality of different data storage systems;
generating the data map including the plurality of pointers for the plurality of data fragments; and
storing the data map on a system separate from the plurality of data storage locations.
8. A method for processing a data map, the method comprising:
fragmenting a data element into a plurality of data fragments, each data fragment representing a different portion of the data element;
storing each of the plurality of data fragments at a respective different one of a plurality of different data storage locations;
generating a data map including a plurality of pointers, each of the pointers including an address of pointing for a respective one of the plurality of different data storage locations storing a respective one of the plurality of data fragments ~~located at the respective one of the plurality of different data storage locations~~;
for each of the plurality of data fragments, assigning a time-to-live (TTL) attribute indicating a predetermined time period for which the data fragment is valid;

adding the time-to-live attributes for the plurality of data fragments to the data map;
and
storing the data map on a device separate from the plurality of data storage locations.

9. The method of claim 8, wherein the plurality of different storage locations include a plurality of different data storage systems.

10. The method of claim 8, further comprising determining a distribution of the plurality of data fragments among the plurality of different data storage systems.

11. The method of claim 8, further comprising:
encrypting the data map before storing the data map on the device; and
at least one of: encrypting the data element before the fragmenting, or encrypting the plurality of data fragments.

12. The method of claim 8, further comprising:
receiving, at a user device from a transaction system, a request for the data element for conducting a transaction;
in response to receiving the request, determining the data map corresponding to the requested data element;
retrieving, using the data map, the plurality of data fragments of the data element from the plurality of different data storage locations;
assembling the data element from the retrieved plurality of data fragments; and
providing, by the user device, the data element to the transaction system to conduct the transaction.

13. A system for conducting a transaction, the system comprising:
at least one non-transitory machine readable storage medium having ~~a data map and program instructions, the data map including a plurality of pointers, each of the plurality of pointers pointing to a respective one of a plurality of different data storage locations storing a respective one of a plurality of different data fragments of a data element;~~ and
at least one processor configured to execute the program instructions to perform a method of conducting a transaction, the method including:

receiving, by a user device from a transaction system a request for the data element for conducting the transaction;

in response to receiving the request, accessing by one of the user device or a data service system, a data map corresponding to the requested data element, the data

map including (i) a plurality of pointers for a plurality of data fragments of the data element, each of the data fragments containing a different portion of the data element, each of the pointers including an address of a respective one of a plurality of different storage locations storing a respective one of the plurality of data fragments, and (ii) time-to-live (TTL) attributes for the plurality of data fragments, each TTL attribute indicating a time period for which a respective data fragment is valid;

~~for each of the plurality of data fragments, determining from the data map a time-to-live (TTL) attribute, the TTL attribute indicating a time period for which the respective data fragment is valid;~~

determining whether the TTL attributes for the plurality of data fragments indicate that the plurality of data fragments are currently valid;

in response to receiving the request, using the pointers of the data map to retrieve the plurality of data fragments of the data element from the plurality of different data storage locations;

assembling the data element from the retrieved plurality of data fragments;
and

providing the data element to the transaction system to conduct the transaction;

wherein the retrieving the plurality of data fragments, the assembling the requested data element, and the providing the requested data element are performed in response to determining that the TTL attributes for the plurality of data fragment indicate that the plurality of data fragments are still valid; and

in response to the TTL attributes for at least one of the plurality of data fragments indicating that the at least one data fragment is not valid, preventing retrieving of that data fragment.

14. The system of claim 13, wherein the plurality of different storage locations include a plurality of different data storage systems.

15. The system of claim 13, wherein the method further includes:

fragmenting the data element into the plurality of data fragments, each of the data fragments representing a different portion of the data element;

storing each of the plurality of data fragments on the respective different one of the plurality of different data storage locations;

generating the data map including the plurality of pointers for the plurality of data fragments; and

storing the data map on a device separate from the plurality of data storage locations.

16. A system for conducting a transaction, the system comprising:

at least one non-transitory machine readable storage medium having program instructions; and

at least one processor configured to execute the program instructions to perform a method of processing a data map, the method including:

fragmenting a data element into a plurality of separate data fragments, each data fragment representing a different portion of the data element;

storing each of the plurality of data fragments on a respective different one of a plurality of different data storage locations;

generating a data map including a plurality of pointers, each of the pointers ~~including an address of pointing to a respective one of the plurality of different data storage locations storing a respective one of the plurality of data fragments on the respective one of the plurality of different data storage locations;~~

for each of the plurality of data fragments, assigning a time-to-live (TTL) attribute indicating a predetermined time period for which the data fragment is valid;

adding the time-to-live attributes for the plurality of data fragments to the data map; and

storing the data map on a device separate from the plurality of data storage locations.

17. The system of claim 16, wherein the plurality of different storage locations include a plurality of different data storage systems.

18. The system of claim 16, wherein the method further includes:

receiving from a transaction system a request for the data element for conducting a transaction;

in response to receiving the request, using the data map to retrieve the plurality of data fragments of the data element from the plurality of different data storage locations;

assembling the data element from the retrieved plurality of data fragments; and

providing the data element to the transaction system to conduct the transaction.