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(54) Title: PROTECTING DATA OF A PARTICULAR TYPE

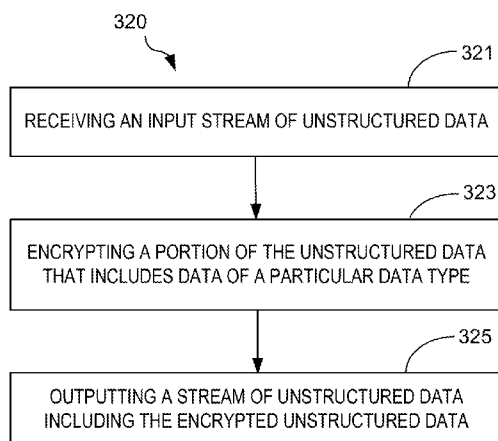


Figure 3

(57) Abstract: Example implementations relate to pro-  
tecting data of a particular data type. For example, a  
system for protecting data of a particular type may in-  
clude a configuration engine to receive a stream of data  
where a portion of the stream of data includes data of  
a particular data type. The configuration engine may  
determine the particular data type to be protected  
based, at least in part, on a format associated with the  
stream of data. Further, the system for protecting data  
of a particular type may include a cryptography engine  
to protect the data of the particular data type, and a  
generation engine to output the stream of data such  
that at least the data of the particular data type is pro-  
tected.

## PROTECTING DATA OF A PARTICULAR TYPE

### Background

[0001] At least some portions of data can be sensitive. Sensitive data may be stored in various formats that can include structured and/or unstructured data. Such data may be protected by encryption and/or tokenization.

### Brief Description of the Drawings

[0002] Figure 1 illustrates a diagram of an example of a system according to the present disclosure.

[0003] Figure 2 illustrates a diagram of an example computing device according to the present disclosure.

[0004] Figure 3 illustrates a flow diagram for an example method for particular data type encryption according to the present disclosure.

[0005] Figure 4 illustrates a diagram of an example system including a processor and non-transitory computer readable medium according to the present disclosure.

### Detailed Description

[0006] Encryption and/or tokenization may be used to protect data. Some approaches to protecting data may include the use of file transformation applications and/or

application programming interfaces (APIs). For example, one or more file transformation applications and/or APIs may be used to provide for the encryption and/or tokenization of data that a user may wish to protect (e.g., sensitive data). However, such approaches may be designed to be used within existing applications. For example, some approaches may allow for a user or users to encrypt and/or tokenize their data if it is stored in databases and/or certain applications, but may not allow for a user or users to encrypt and/or tokenize their data if it is stored in files or if the data is received as part of a stream of data that includes structured and/or unstructured data.

**[0007]** As part of encrypting and/or tokenizing data, some approaches may allow for transformation of files from one format to another format; however, such approaches may require development and/or customization to allow for files from some formats to be transformed into different formats. For example, some approaches may require development and/or customization to facilitate the batching logic utilized by some APIs to allow for transformation of files from one file format to another file format. However, some approaches are unable to support multiple field processing and/or multiple, disparate file formats, and/or data that is presented as a stream. In addition to the above described shortcomings, achieving high performance of APIs for protecting data of a particular type may include batch processing, which may increase the complexities associated with protecting data in incumbent file transformation applications. In contrast, examples of the present disclosure may support batch processing and/or multiple field processing while protecting data of a particular type that is presented in a stream of data including structured and/or unstructured data.

**[0008]** Examples of the present disclosure include methods, systems, and computer-readable and executable instructions for protecting data of a particular type. For example, methods, systems, and computer-readable and executable instructions that may support the processing of structured and/or unstructured data within a common framework are described herein. As used herein, “structured data” refers to information that is stored in a fixed field within a file, while “unstructured data” refers to information that either does not have a pre-defined data model or is not organized in a pre-defined manner. In some

examples, extensible APIs for particular data type encryption may facilitate encryption and/or tokenization of streamed data.

**[0009]** As used herein, a “particular data type” refers to data having certain predefined characteristics when compared to other data. For example, the particular data type may include certain sensitive data. For example, the particular data type may include credit card numbers, birth dates, social security numbers, etc., while other data in the stream of data includes data that is not sensitive.

**[0010]** Figure 1 illustrates a diagram of an example of a system according to the present disclosure. As shown in the example of Figure 1, the system 100 may include a database 102 accessible by and in communication with a plurality of engines 104. The engines 104 may include a configuration engine 106, a cryptography engine 108, and a generation engine 110, etc. The system 100 may include additional or fewer engines than illustrated to perform the various functions described herein and embodiments are not limited to the example shown in Figure 1.

**[0011]** The system 100 may include hardware, e.g., in the form of transistor logic and/or application specific integrated circuitry (ASICs), firmware, and software, e.g., in the form of machine readable and executable instructions (program instructions (programming) stored in a machine readable medium (MRM)) which in cooperation may form a computing device as discussed in connection with Figure 2. In some examples, program instructions stored in the hardware may be provided in a class-based, object-oriented computer programming language (e.g., Java). In some examples, the functionality of one or more of the engines 106, 108, 110 may be invoked via a Command Line Tool. Examples of Command Line Tools include Xcode Command Line Tool, HTTPie, Icdiff, Pandoc, etc.

**[0012]** The plurality of engines 104 may include a combination of hardware and software, e.g., program instructions, but at least includes hardware that is configured to perform particular functions, tasks and/or actions. For example, the engines shown in Figure 1 may be used to receive a stream of data, wherein a portion of the stream of data includes data of a particular data type, determine the particular data type to be protected based, at least in part, on a format associated with the stream of data, protect the data of the

particular data type, and output the stream of data such that at least the data of the particular data type is encrypted.

**[0013]** For example, the configuration engine 106 may include hardware and/or a combination of hardware and program instructions to receive a stream of data, wherein a portion of the stream of data includes data of a particular data type. In some examples, the configuration engine 106 may include hardware and/or a combination of hardware and program instructions to determine the particular data type in response to a command line tool command. As used herein, a “command line tool” refers to various applications that provide functionality when implemented in a command line interface. The data of the particular data type may be contained in a plurality of fields within the stream of data. In some examples, the received stream of data and the output stream of data are the same format. In at least one example, the configuration engine 106 may store a configuration instruction including a format of the received stream of data and information regarding the determined particular data type.

**[0014]** In some examples, the configuration engine 106 may determine a particular data type in response to receiving a command (e.g., a user command). For example, the command may be an explicit command that defines certain data in the data stream as data of a particular type. For example, the command may be a command that all credit card numbers contained in the data stream are to be classified as data of the particular data type. Embodiments are not so limited; however and the command may be more general. For example, the command may be a command that all unstructured data in the data stream are to be classified as data of the particular type.

**[0015]** In some examples, the configuration engine 106 may receive information regarding what type of format the data in the data stream is. As used herein, “format” and “file format” refer to the way that information is encoded for storage in a computer file. For example, “format” and “file format” specify how bits are used to encode information in a digital storage medium. Some non-limiting examples of formats and file formats include Extensible Markup Language (XML), delimited formats, positional formats, tab-separated value formats, record delimited formats, and/or record positional formats. In addition, various proprietary file formats such as the Microsoft Word Binary File Format (DOC),

Excel Binary File Format (.XLS), Office Open XML, comma-separated values (CSV), Symbolic Link (SYLK), Pages, etc. may be included.

**[0016]** The configuration engine 106 may also be configured store various processing functions. For example, the configuration engine 106 may store information regarding the particular data type, what file format the data in the data stream is in and/or what kind of encryption or tokenization is to be applied to the data. In some examples, this configuration information may be stored in an extensible markup language (XML) configuration file. This configuration file may be passed by reference when the data is processed. In some examples, the configuration engine 106 may provide support for schema-based XML configurations.

**[0017]** In some examples, the configuration engine 106 may facilitate central policy control of the system. For example, the configuration file may be re-usable across a plurality of formats and/or data types such that a user doesn't need to input configuration information to protect multiple file types. For example, if a first file is stored in an XML format, and a second file is stored in a comma separated values (CSV) format, and both files contain data of the particular type, the configuration engine 108 may receive or generate the configuration file such that each format is defined. In this example, the configuration engine 108 may execute the configuration file to locate data of the particular type based on the formats of each of the files. In some examples, the files may be presented as a data stream.

**[0018]** The cryptography engine 108 may include hardware and/or a combination of hardware and program instructions to protect the data of the particular data type. For example, the cryptography engine 108 may protect the data of the particular type by encrypting the data of the particular type, and/or the cryptography engine 108 may protect the data of the particular type by tokenizing the data of the particular type. For example, the cryptography engine 108 may apply cryptographic algorithms to protect the data of the particular type by encrypting or tokenizing the data of the particular type. As used herein, "encryption" refers to the transformation of data through the use of a set of rules or steps defined by a cryptographic algorithm or a set of variable cryptographic keys. As used here, "tokenization" refers to the process of substituting sensitive data (e.g., data of the particular

data type) with a non-sensitive token that maps back to the sensitive data through a tokenization system.

**[0019]** In some examples, the cryptography engine 108 may protect data of the particular type by format preserving encryption. As used herein, “format preserving encryption” refers to encrypting data in such a way that the output is in the same format as the input. For example, the cryptography engine 108 may encrypt the data of the particular type such that a format of an input stream of data that includes data of the particular type is the same as a format of the output stream of data that includes the encrypted data of the particular type.

**[0020]** The generation engine 110 may include hardware and/or a combination of hardware and program instructions to output the stream of data such that at least the data of the particular type is protected. In some examples, the generation engine 110 may include hardware and/or a combination of hardware and program instructions to store information regarding the particular data type and a format associated with the input data stream and/or the output data stream. For example, the generation engine 110 may include hardware and/or a combination of hardware and program instructions to store the information regarding the particular data type and the input and/or output data stream format in an extensible markup language configuration file. In some examples, at least one of the configuration engine 106, the cryptography engine 108, and the generation engine 110 may provide multi-threaded processing, as described in more detail, herein.

**[0021]** In some examples, one or more of the engines 106, 108, 110 may operate on an input and output stream of data. As used herein, a “stream of data” refers to a sequence of digitally encoded coherent signals such as packets of data. For example, the configuration engine 106 may be operable to receive data formatted as a stream. As another example, the generation engine 108 may be operable to output data as a stream of data.

**[0022]** One or more of the engines 106, 108, 110 may provide support for stream based processing of large files. For example, one or more of the engines 106, 108, 110 may provide support for multi-gigabyte (multi-GB) files. In some examples, one or more of the engines 106, 108, 110 may provide support for multi-threaded processing of individual

files. For example, one or more of the engines 106, 108, 110 may execute multiple processes or threads concurrently. In some examples, providing support for multi-threaded processing of individual files may include providing a multi-core processor either as part of one or more of the engines 106, 108, 110, or may include providing a multi-core processor coupled to one or more of the engines 106, 108, 110.

**[0023]** In some examples, one or more of the engines 106, 108, 110 may use one or more APIs on multiple fields in a file or stream of data. For example, a file or stream of data may contain multiple fields and one or more of the engines 106, 108, 110 may selectively provide functionality from one or more APIs to more than one field in the file or stream of data. In some examples, one or more of the engines 106, 108, 110 may provide batch processing of data contained in the file and/or stream of data such that particular data type encryption or tokenization may be performed with little or no human interaction.

**[0024]** Embodiments are not limited to the example engines shown in Figure 1 and one or more engines described may be combined or may be a sub-engine of another engine. Further, the engines shown may be remote from one another in a distributed computing environment, cloud computing environment, etc.

**[0025]** Figure 2 illustrates a diagram of an example computing device according to the present disclosure. The computing device 201 may utilize hardware, software (e.g., program instructions), firmware, and/or logic to perform a number of functions described herein. The computing device 201 may be any combination of hardware and program instructions configured to share information. The hardware may, for example, include a processing resource 203 and a memory resource 204 (e.g., computer or machine readable medium (CRM/MRM), database, etc.). A processing resource 203, as used herein, may include one or more processors capable of executing instructions stored by the memory resource 204. The processing resource 203 may be implemented in a single device or distributed across multiple devices. The program instructions (e.g., computer or machine readable instructions (CRI/MRI)) may include instructions stored on the memory resource 204 and executable by the processing resource 203 to perform a particular function, task and/or action (e.g. receive a stream of data, wherein a portion of the stream of data includes data of a particular data type, etc.).

**[0026]** The memory resource 204 may be a non-transitory machine readable medium, include one or more memory components capable of storing instructions that may be executed by a processing resource 203, and may be integrated in a single device or distributed across multiple devices. Further, memory resource 204 may be fully or partially integrated in the same device as processing resource 203 or it may be separate but accessible to that device and processing resource 203. Thus, it is noted that the computing device 201 may be implemented on a participant device, on a server device, on a collection of server devices, and/or a combination of a participant, (e.g., user/consumer endpoint device), and one or more server devices as part of a distributed computing environment, cloud computing environment, etc.

**[0027]** The memory resource 204 may be in communication with the processing resource 203 via a communication link (e.g., a path) 218. The communication link 218 may provide a wired and/or wireless connection between the processing resource 203 and the memory resource 204.

**[0028]** In the example of Figure 2, the memory resource 204 includes a configuration engine 206, a cryptography engine 208, and a generation engine 210. The plurality of engines may be combined or may be sub-engines of other engines. As shown in Figure 2, the configuration engine 206, the cryptography engine 208, and the generation engine 210 may be individual engines located on one memory resource 204. Embodiments are not so limited, however, and a plurality of engines may be located at separate and distinct memory resource locations, for example, in a distributed computing environment, cloud computing environment, etc.

**[0029]** Each of the plurality of engines may include instructions that when executed by the processing resource 203 may function as an engine such as the engines described in connection with Figure 1. For example, the configuration engine 206 may include instructions that when executed by the processing resource 203 may function as the configuration engine 106 shown in Figure 1. The cryptography engine 208 may include instructions that when executed by the processing resource 203 may function as the cryptography engine 108 shown in Figure 1. Additionally, the generation engine 210 may

include instructions that when executed by the processing resource 203 may function as the generation engine 110 shown in Figure 1.

**[0030]** Embodiments are not limited to the example engines shown in Figure 2 and in some cases a number of engines may operate together to function as a particular engine. Further, the engines of Figures 1 and 2 may be located in a single system and/or computing device or reside in separate distinct locations in a distributed network, cloud computing, enterprise service environment (e.g., Software as a Service (SaaS) environment), etc.

**[0031]** Figure 3 illustrates a flow diagram for an example method 320 for particular data type encryption according to the present disclosure. In various examples, the method 320 may be performed using the system 100 shown in Figure 1 and/or the computing device 201 and engines shown in Figure 2. Examples are not, however, limited to these example systems, devices, and/or engines.

**[0032]** At 321, the method 320 may include receiving an input stream of unstructured data. In various examples, receiving an input stream of data in a first file format may be executed using the receive engine 106 in Figure 1 and/or the computing device and receive engine 206 in Figure 2. The method may further include determining a location in the input stream of unstructured data that includes the portion of the unstructured data. For example, the method may include determining the location in the input stream of unstructured data that includes the portion of the unstructured data in response to determining a format associated with the input stream of unstructured data. In another example, the method may include determining the location in the input stream of unstructured data that includes the portion of the unstructured data in response to determining that the portion of the unstructured data is stored in a predetermined field of the unstructured data.

**[0033]** At 323, the method 320 may include encrypting a portion of the unstructured data that includes data of a particular data type. In some examples, encrypting a portion of the unstructured data that includes data of a particular data type may include encrypting, via a processor coupled to a memory, a portion of the unstructured data that includes data of a particular data type. As described in connection with Figures 1 and 2, herein, the portion of the unstructured data that includes data of the particular type may be tokenized. In various

examples, as described above, encrypting a portion of the unstructured data that includes data of a particular data type may be executed using the cryptography engine 108 and/or the cryptography engine 208, illustrated in Figures 1 and 2.

**[0034]** At 325, the method 320 may include outputting a stream of unstructured data including the encrypted unstructured data. The output stream of data may be in the same format as the input stream of data. In some examples, the output stream of data may include the same data as the input stream of data, except that the encrypted or tokenized portion (e.g., the protected data of the particular type) has been altered. In various examples, as described above, outputting a stream of unstructured data including the encrypted unstructured data may be executed using the generation engine 110 and/or the generation engine 210, illustrated in Figures 1 and 2.

**[0035]** Figure 4 illustrates a diagram of an example system 430 including a processing resource 403 and non-transitory computer readable medium 431 according to the present disclosure. For example, the system 430 may be an implementation of the example system of Figure 1 or the example computing device of Figure 2.

**[0036]** The processing resource 403 may execute instructions stored on the non-transitory computer readable medium 431. For example, the non-transitory computer readable medium 431 may be any type of volatile or non-volatile memory or storage, such as random access memory (RAM), flash memory, read-only memory (ROM), storage volumes, a hard disk, or a combination thereof.

**[0037]** The example medium 431 may store instructions 433 executable by the processing resource 403 to determine a particular data type to be encrypted. In addition, the instructions 433 may be executable by the processing resource 403 to determine a particular data type to be encrypted as described in connection with the configuration engine 106 of Figure 1 and/or the configuration engine 206 of Figure 2.

**[0038]** The example medium 431 may further store instructions 435. The instructions 435 may be executable to receive an input stream of data, wherein a portion of the stream of data includes data of the particular data type. In addition, the instructions 435 may be executable by the processing resource 403 to receive an input stream of data, wherein a portion of the stream of data includes data of the particular data type as described

in connection with the configuration engine 106 of Figure 1 and/or the configuration engine 206 of Figure 2.

**[0039]** The example medium 431 may further store instructions 437. The instructions 437 may be executable to tokenize the data of the particular data type. As an example, the instructions 437 may be executable by the processing resource 403 to tokenize the data of the particular data type with the encryption engine 108 of Figure 1 and/or the encryption engine 208 of Figure 2.

**[0040]** The example medium 431 may store instructions 439 executable by the processing resource 403 to output the stream of data such that the output stream of data includes at least the data of the particular data type. As an example, the instructions 439 may be executable by the processing resource 403 to output the stream of data such that the output stream of data includes at least the data of the particular data type with the generation engine 108 of Figure 1 and/or the generation engine 208 of Figure 2. The example medium 431 may store instructions executable by the processing resource 403 to determine a location in the input stream of data that includes data of the particular data type in response to determining a format associated with the input stream of data. In at least one example, the example medium 431 may store instructions executable by the processing resource 403 to determine a location in the input stream of data that includes data of the particular type in response to determining that the portion of the unstructured data is stored in a predetermined field of the unstructured data.

**[0041]** In the foregoing detailed description of the present disclosure, reference is made to the accompanying drawings that form a part hereof, and in which is shown by way of illustration how examples of the disclosure may be practiced. These examples are described in sufficient detail to enable those of ordinary skill in the art to practice the examples of this disclosure, and it is to be understood that other examples may be utilized and that process, electrical, and/or structural changes may be made without departing from the scope of the present disclosure.

**[0042]** The figures herein follow a numbering convention in which the first digit corresponds to the drawing figure number and the remaining digits identify an element or component in the drawing. For example, reference numeral 102 may refer to element “02”

in Figure 1 and an analogous element may be identified by reference numeral 203 in Figure 2. Elements shown in the various figures herein can be added, exchanged, and/or eliminated so as to provide a number of additional examples of the present disclosure. In addition, the proportion and the relative scale of the elements provided in the figures are intended to illustrate the examples of the present disclosure, and should not be taken in a limiting sense. Further, as used herein, "a number of" an element and/or feature can refer to one or more of such elements and/or features.

**[0043]** As used herein, "logic" is an alternative or additional processing resource to perform a particular action and/or function, etc., described herein, which includes hardware, for example, various forms of transistor logic, application specific integrated circuits (ASICs), etc., as opposed to computer executable instructions, for example, software firmware, etc., stored in memory and executable by a processor.

What is claimed:

1. A system, comprising:  
a configuration engine to:  
receive a stream of data, wherein a portion of the stream of data includes data of a particular data type; and  
determine the particular data type to be protected based, at least in part, on a format associated with the stream of data;  
a cryptography engine to protect the data of the particular data type; and  
a generation engine to output the stream of data such that at least the data of the particular data type is protected.
2. The system of claim 1, the configuration engine to determine the particular data type in response to a command line tool command.
3. The system of claim 2, the configuration engine to store a configuration instruction including a format of the received stream of data and information regarding the determined particular data type.
4. The system of claim 1, wherein the data of the particular data type is contained in a plurality of fields within the stream of data.
5. The system of claim 1, wherein the received stream of data and the output stream of data are the same format.
6. The system of claim 1, the cryptography engine to protect the data of the particular type by encrypting the data of the particular type.
7. The system of claim 1, the cryptography engine to protect the data of the particular type by tokenizing the data of the particular type.

8. The system of claim 1, wherein at least one of the configuration engine, the encryption engine, and the generation engine provides multi-threaded processing.
9. A method, comprising:
  - receiving an input stream of unstructured data;
  - encrypting a portion of the unstructured data that includes data of a particular data type; and
  - outputting a stream of unstructured data including the encrypted unstructured data.
10. The method of claim 9, comprising determining a location in the input stream of unstructured data that includes the portion of the unstructured data.
11. The method of claim 10, comprising determining the location in the input stream of unstructured data that includes the portion of the unstructured data in response to determining a format associated with the input stream of unstructured data.
12. The method of claim 10, comprising determining the location in the input stream of unstructured data that includes the portion of the unstructured data in response to determining that the portion of the unstructured data is stored in a predetermined field of the unstructured data.
13. A non-transitory computer readable medium storing instructions executable by a processing resource to:
  - determine a particular data type to be encrypted;
  - receive an input stream of data, wherein a portion of the stream of data includes data of the particular data type;
  - tokenize the data of the particular data type; and
  - output the stream of data such that the output stream of data includes at least the data of the particular data type.

14. The non-transitory computer readable medium of claim 13, wherein the instructions are executable by the processing resource to determine a location in the input stream of data that includes data of the particular data type in response to determining a format associated with the input stream of data.

15. The non-transitory computer readable medium of claim 13, wherein the instructions are executable by the processing resource to determine a location in the input stream of data that includes data of the particular type in response to determining that the portion of the unstructured data is stored in a predetermined field of the unstructured data.

1/2

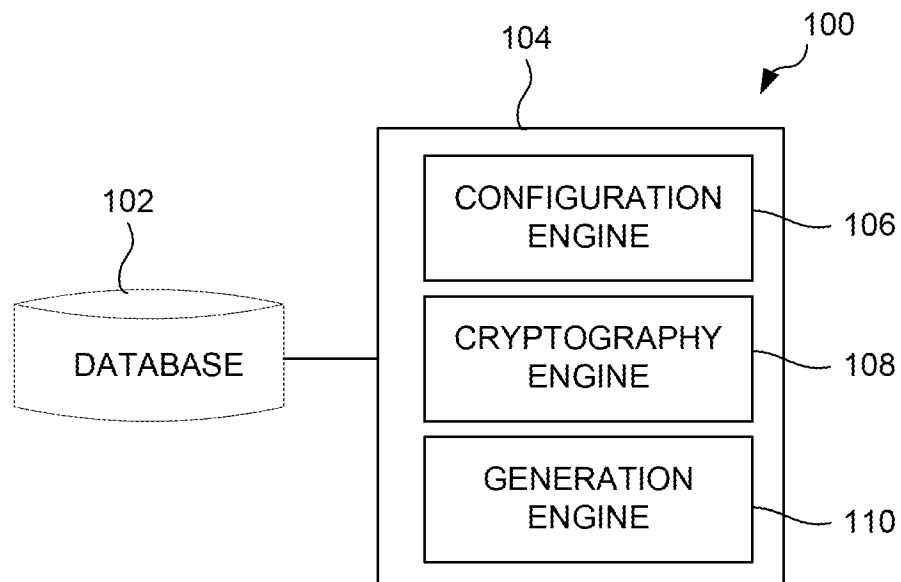


Figure 1

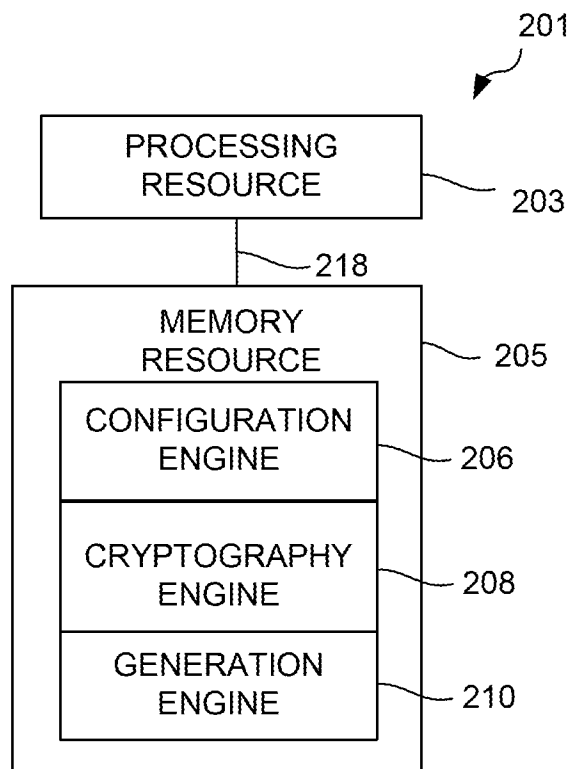


Figure 2

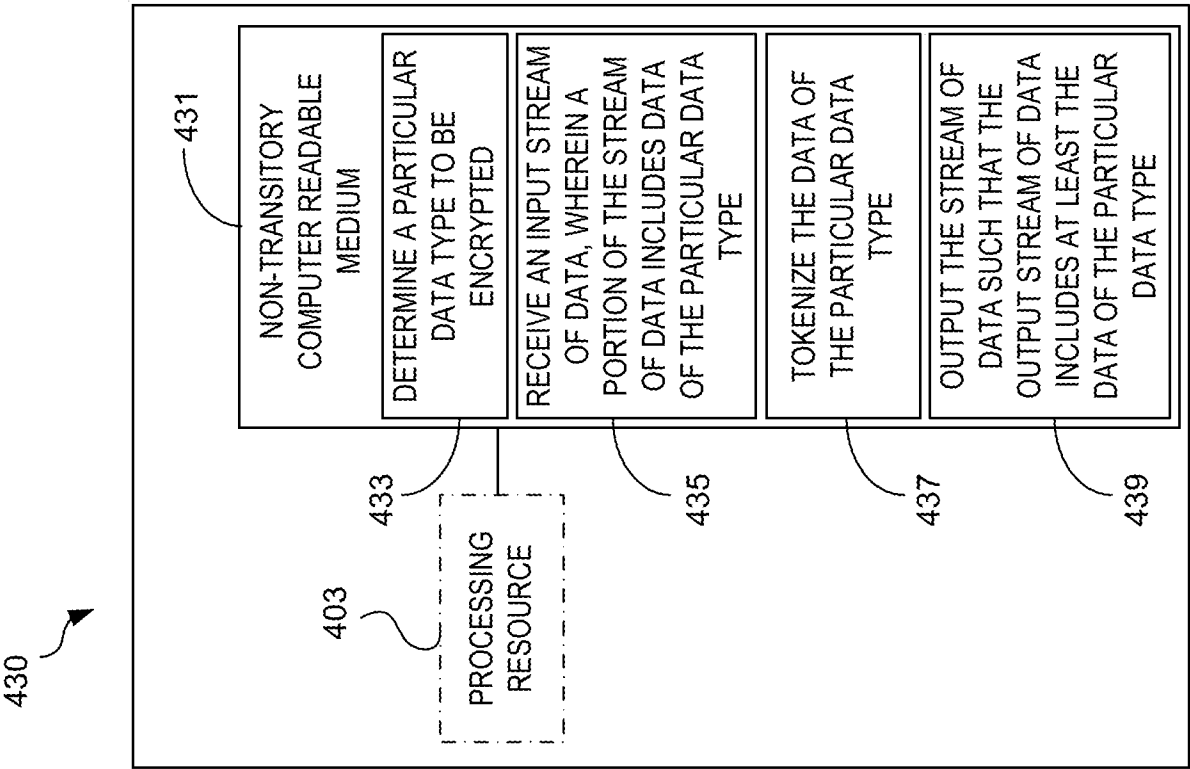


Figure 4

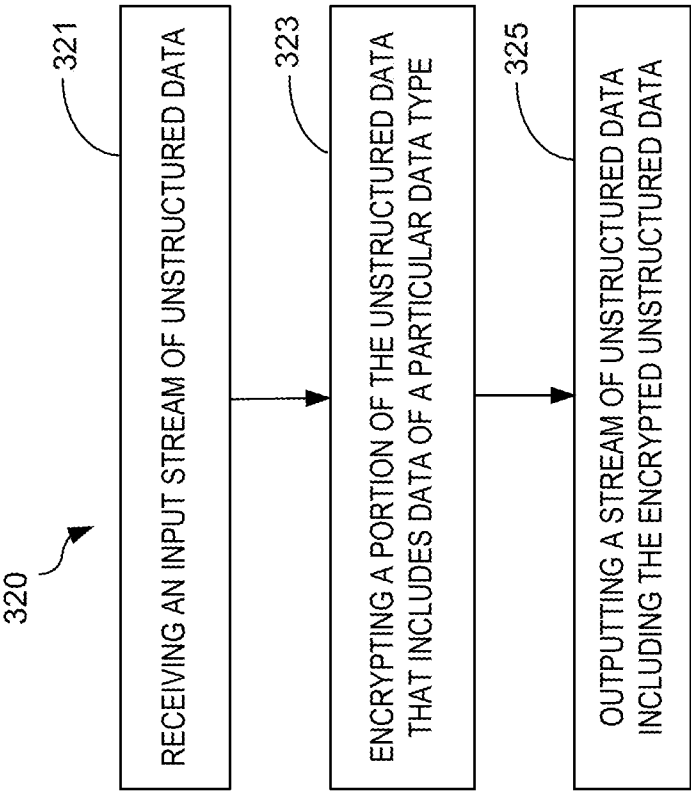


Figure 3

**A. CLASSIFICATION OF SUBJECT MATTER****G06F 21/60(2013.01)i**

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)

G06F 21/60; H04L 9/18; G06F 17/30; H04L 29/06; H04L 9/00; G06F 11/00

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) &amp; Keywords: data type, protect, cryptography, unstructured data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                          | Relevant to claim No. |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Y         | US 2007-0101123 A1 (BRAD KOLLMYER et al.) 03 May 2007<br>See paragraphs [0033]-[0038], [0041]-[0042]; and figure 1.                         | 1-15                  |
| Y         | US 2014-0150060 A1 (WAL-MART STORES, INC.) 29 May 2014<br>See paragraphs [0019], [0027]-[0028], [0031]-[0040], [0061]-[0064]; and figure 6. | 1-15                  |
| A         | US 2012-0020475 A1 (WILLIAM CONRAD ALTMANN) 26 January 2012<br>See paragraphs [0025], [0032], [0039]; claim 1; and figures 1, 9.            | 1-15                  |
| A         | US 7320069 B1 (GOBIKRISHNAN SUNDHARRAJ et al.) 15 January 2008<br>See column 2, lines 19-54; and figures 2, 4.                              | 1-15                  |
| A         | US 2013-0346412 A1 (CORTICA, LTD.) 26 December 2013<br>See paragraphs [0023]-[0027]; claim 1; and figure 4.                                 | 1-15                  |



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

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**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/US2016/014744**

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s)                                                                                                                                                                                                                                                                                              | Publication<br>date                                                                                                                                                                                                          |
|-------------------------------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| US 2007-0101123 A1                        | 03/05/2007          | AU 2001-88755 A1<br>AU 8875501 A<br>CY 1107275 T1<br>DE 60131990 T2<br>DK 1317839 T3<br>EP 1317839 A2<br>EP 1317839 B1<br>EP 1916818 A2<br>EP 1916818 A3<br>ES 2296798 T3<br>JP 2004-511931 A<br>PT 1317839 E<br>US 7165175 B1<br>US 7376831 B2<br>WO 02-021761 A2<br>WO 02-021761 A3                                   | 22/03/2002<br>22/03/2002<br>21/11/2012<br>02/01/2009<br>28/01/2008<br>11/06/2003<br>19/12/2007<br>30/04/2008<br>15/04/2009<br>01/05/2008<br>15/04/2004<br>10/01/2008<br>16/01/2007<br>20/05/2008<br>14/03/2002<br>06/03/2003 |
| US 2014-0150060 A1                        | 29/05/2014          | US 9043874 B2<br>WO 2014-085218 A1                                                                                                                                                                                                                                                                                      | 26/05/2015<br>05/06/2014                                                                                                                                                                                                     |
| US 2012-0020475 A1                        | 26/01/2012          | CN 103026722 A<br>EP 2596594 A2<br>EP 2596594 A4<br>JP 2013-538486 A<br>JP 5797267 B2<br>KR 10-2013-0129910 A<br>TW 201212637 A<br>TW I513290 B<br>WO 2012-012413 A2<br>WO 2012-012413 A3                                                                                                                               | 03/04/2013<br>29/05/2013<br>08/04/2015<br>10/10/2013<br>21/10/2015<br>29/11/2013<br>16/03/2012<br>11/12/2015<br>26/01/2012<br>29/03/2012                                                                                     |
| US 7320069 B1                             | 15/01/2008          | None                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                              |
| US 2013-0346412 A1                        | 26/12/2013          | EP 1949311 A2<br>EP 1949311 B1<br>GB 2463836 A<br>IL 171577 A<br>IL 173409 A<br>IL 185414 A<br>US 2009-0043818 A1<br>US 2009-0112864 A1<br>US 2009-0187736 A1<br>US 2009-0216761 A1<br>US 2009-0282218 A1<br>US 2009-0313305 A1<br>US 2010-0042646 A1<br>US 2010-0262609 A1<br>US 2012-0109961 A1<br>US 2012-0331011 A1 | 30/07/2008<br>15/01/2014<br>31/03/2010<br>12/03/2006<br>04/07/2007<br>06/01/2008<br>12/02/2009<br>30/04/2009<br>23/07/2009<br>27/08/2009<br>12/11/2009<br>17/12/2009<br>18/02/2010<br>14/10/2010<br>03/05/2012<br>27/12/2012 |

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/US2016/014744**

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|-------------------------------------------|---------------------|----------------------------|---------------------|
|                                           |                     | US 2013-0018736 A1         | 17/01/2013          |
|                                           |                     | US 2013-0060773 A1         | 07/03/2013          |
|                                           |                     | US 2013-0060822 A1         | 07/03/2013          |
|                                           |                     | US 2013-0080433 A1         | 28/03/2013          |
|                                           |                     | US 2013-0080868 A1         | 28/03/2013          |
|                                           |                     | US 2013-0138653 A1         | 30/05/2013          |
|                                           |                     | US 2013-0144884 A1         | 06/06/2013          |
|                                           |                     | US 2013-0159311 A1         | 20/06/2013          |
|                                           |                     | US 2013-0166276 A1         | 27/06/2013          |
|                                           |                     | US 2013-0191323 A1         | 25/07/2013          |
|                                           |                     | US 2013-0191368 A1         | 25/07/2013          |
|                                           |                     | US 2013-0227023 A1         | 29/08/2013          |
|                                           |                     | US 2013-0238393 A1         | 12/09/2013          |
|                                           |                     | US 2013-0246166 A1         | 19/09/2013          |
|                                           |                     | US 2014-0006442 A1         | 02/01/2014          |
|                                           |                     | US 2014-0033300 A1         | 30/01/2014          |
|                                           |                     | US 2014-0040232 A1         | 06/02/2014          |
|                                           |                     | US 2014-0082211 A1         | 20/03/2014          |
|                                           |                     | US 2014-0093844 A1         | 03/04/2014          |
|                                           |                     | US 2014-0095494 A1         | 03/04/2014          |
|                                           |                     | US 2014-0095536 A1         | 03/04/2014          |
|                                           |                     | US 2014-0149443 A1         | 29/05/2014          |
|                                           |                     | US 2014-0149893 A1         | 29/05/2014          |
|                                           |                     | US 2014-0156628 A1         | 05/06/2014          |
|                                           |                     | US 2014-0156901 A1         | 05/06/2014          |
|                                           |                     | US 2014-0188786 A1         | 03/07/2014          |
|                                           |                     | US 2014-0188930 A1         | 03/07/2014          |
|                                           |                     | US 2014-0195513 A1         | 10/07/2014          |
|                                           |                     | US 2014-0195524 A1         | 10/07/2014          |
|                                           |                     | US 2014-0200971 A1         | 17/07/2014          |
|                                           |                     | US 2014-0207778 A1         | 24/07/2014          |
|                                           |                     | US 2014-0258219 A1         | 11/09/2014          |
|                                           |                     | US 2014-0258328 A1         | 11/09/2014          |
|                                           |                     | US 2014-0297255 A1         | 02/10/2014          |
|                                           |                     | US 2014-0297682 A1         | 02/10/2014          |
|                                           |                     | US 2014-0310020 A1         | 16/10/2014          |
|                                           |                     | US 2014-0310825 A1         | 16/10/2014          |
|                                           |                     | US 2014-0324840 A1         | 30/10/2014          |
|                                           |                     | US 2014-0330828 A1         | 06/11/2014          |
|                                           |                     | US 2014-0330830 A1         | 06/11/2014          |
|                                           |                     | US 2015-0019586 A1         | 15/01/2015          |
|                                           |                     | US 2015-0026113 A1         | 22/01/2015          |
|                                           |                     | US 2015-0026177 A1         | 22/01/2015          |
|                                           |                     | US 2015-0032781 A1         | 29/01/2015          |
|                                           |                     | US 2015-0052086 A1         | 19/02/2015          |
|                                           |                     | US 2015-0052166 A1         | 19/02/2015          |
|                                           |                     | US 2015-0125833 A1         | 07/05/2015          |
|                                           |                     | US 2015-0128024 A1         | 07/05/2015          |
|                                           |                     | US 2015-0128025 A1         | 07/05/2015          |
|                                           |                     | US 2015-0139569 A1         | 21/05/2015          |

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/US2016/014744**

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|-------------------------------------------|---------------------|----------------------------|---------------------|
|                                           |                     | US 2015-0154189 A1         | 04/06/2015          |
|                                           |                     | US 2015-0154204 A1         | 04/06/2015          |
|                                           |                     | US 2015-0161213 A1         | 11/06/2015          |
|                                           |                     | US 2015-0161243 A1         | 11/06/2015          |
|                                           |                     | US 2015-0161653 A1         | 11/06/2015          |
|                                           |                     | US 2015-0186405 A1         | 02/07/2015          |
|                                           |                     | US 2015-0199336 A1         | 16/07/2015          |
|                                           |                     | US 2015-0199355 A1         | 16/07/2015          |
|                                           |                     | US 2015-0234851 A1         | 20/08/2015          |
|                                           |                     | US 2015-0235142 A1         | 20/08/2015          |
|                                           |                     | US 2015-0331859 A1         | 19/11/2015          |
|                                           |                     | US 2015-0331949 A1         | 19/11/2015          |
|                                           |                     | US 2015-0332154 A1         | 19/11/2015          |
|                                           |                     | US 2015-0332321 A1         | 19/11/2015          |
|                                           |                     | US 2015-0332342 A1         | 19/11/2015          |
|                                           |                     | US 2015-0371091 A1         | 24/12/2015          |
|                                           |                     | US 2015-0379751 A1         | 31/12/2015          |
|                                           |                     | US 2016-0005085 A1         | 07/01/2016          |
|                                           |                     | US 8112376 B2              | 07/02/2012          |
|                                           |                     | US 8266185 B2              | 11/09/2012          |
|                                           |                     | US 8312031 B2              | 13/11/2012          |
|                                           |                     | US 8326775 B2              | 04/12/2012          |
|                                           |                     | US 8386400 B2              | 26/02/2013          |
|                                           |                     | US 8655801 B2              | 18/02/2014          |
|                                           |                     | US 8799195 B2              | 05/08/2014          |
|                                           |                     | US 8799196 B2              | 05/08/2014          |
|                                           |                     | US 8818916 B2              | 26/08/2014          |
|                                           |                     | US 8868619 B2              | 21/10/2014          |
|                                           |                     | US 8880539 B2              | 04/11/2014          |
|                                           |                     | US 8880566 B2              | 04/11/2014          |
|                                           |                     | US 8959037 B2              | 17/02/2015          |
|                                           |                     | US 8990125 B2              | 24/03/2015          |
|                                           |                     | US 9009086 B2              | 14/04/2015          |
|                                           |                     | US 9031999 B2              | 12/05/2015          |
|                                           |                     | US 9087049 B2              | 21/07/2015          |
|                                           |                     | US 9104747 B2              | 11/08/2015          |
|                                           |                     | US 9191626 B2              | 17/11/2015          |
|                                           |                     | US 9218606 B2              | 22/12/2015          |
|                                           |                     | US 9235557 B2              | 12/01/2016          |
|                                           |                     | US 9256668 B2              | 09/02/2016          |
|                                           |                     | US 9286623 B2              | 15/03/2016          |
|                                           |                     | US 9292519 B2              | 22/03/2016          |
|                                           |                     | US 9330189 B2              | 03/05/2016          |
|                                           |                     | US 9372940 B2              | 21/06/2016          |
|                                           |                     | US 9384196 B2              | 05/07/2016          |
|                                           |                     | US 9396435 B2              | 19/07/2016          |
|                                           |                     | US 9466068 B2              | 11/10/2016          |
|                                           |                     | US 9477658 B2              | 25/10/2016          |
|                                           |                     | US 9489431 B2              | 08/11/2016          |
|                                           |                     | WO 2007-049282 A2          | 03/05/2007          |

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/US2016/014744**Patent document  
cited in search reportPublication  
datePatent family  
member(s)Publication  
date

WO 2007-049282 A3

20/03/2008

WO 2009-026433 A1

26/02/2009