



- (51) **International Patent Classification:**
G06F 21/62 (2013.01)
- (21) **International Application Number:**
PCT/US2015/028045
- (22) **International Filing Date:**
28 April 2015 (28.04.2015)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
61/985,360 28 April 2014 (28.04.2014) US
- (71) **Applicant:** TOPIA TECHNOLOGY, INC. [US/US];
1119 Pacific Ave., Suite 200, Tacoma, WA 98402 (US).
- (72) **Inventors:** HAAGER, John; 21507 102nd St. E., Bonney
Lake, WA 98391 (US). SANDWITH, Cody; 1521 Gar-
field St. S., Tacoma, WA 98444 (US). TERRANO, Jan-
ine; 5224 Saddleback Drive NW, Gig Harbor, WA 98332
(US). SARIPALLI, Prasad; 22570 NE 96th Street, Red-
mond, WA 98053 (US).
- (74) **Agents:** FALCON, Linda P. et al.; Wilson Sonsini
Goodrich & Rosati, 650 Page Mill Road, Palo Alto, CA
94304-1050 (US).
- (81) **Designated States** (*unless otherwise indicated, for every
kind of national protection available*): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG,
MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM,
PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC,
SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

- (84) **Designated States** (*unless otherwise indicated, for every
kind of regional protection available*): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ,
TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU,
TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,
DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, KM, ML, MR, NE, SN, TD, TG).

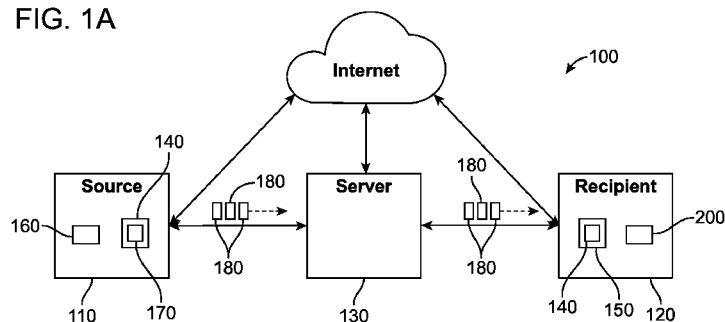
Published:

- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
amendments (Rule 48.2(h))*

- (88) **Date of publication of the international search report:**
31 March 2016

(54) **Title:** SYSTEMS AND METHODS FOR SECURITY HARDENING OF DATA IN TRANSIT AND AT REST VIA SEG-
MENTATION, SHUFFLING AND MULTI-KEY ENCRYPTION

FIG. 1A



(57) **Abstract:** Systems and methods for security hardening of a file in transit and at rest via segmentation, shuffling and multi-key encryption are presented. The method including segmenting at a first computer system a file into a plurality of file segments, and encrypting the plurality of file segments using a plurality of encryption keys in order to generate a corresponding plurality of encrypted file segments, wherein each file segment of the plurality of file segments is encrypted using a respective encryption key of the plurality of encryption keys. Additionally included is bidirectional data transformation of a file by obfuscating at a first computer system digital values of the file in order to generate corresponding obfuscated digital values of the file, wherein the obfuscated digital values of the file retain their contextual integrity and referential integrity

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2015/028045

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - G06F 21/62 (2015.01)

CPC - G06F 21/6218 (2015.10)

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)

IPC(8) - G06F 17/30; G06F 21/60; G06F 21/62 (2015.01)

CPC - G06F 17/30091; G06F 21/6209; G06F 21/6218; G06F 2221/2107 (2015.10)

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

U.S. Class/Subclass(es): 705/51; 705/57; 705/71 (Keyword delimited)

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

PatBase, Google Patents, Google Scholar, Google

Search terms used: file, segment, encryption, key

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2014/0013112 A1 (CIDON et al) 09 January 2014 (09.01.2014) entire document	1-18, 22-24
P,X	US 8,812,874 B1 (CLIFFORD) 19 August 2014 (19.08.2014) entire document	1-18, 22-24
A	US 2007/0067332 A1 (GALLAGHER et al) 22 March 2007 (22.03.2007) entire document	1-18, 22-24
A	US 2006/0064383 A1 (MARKING) 23 March 2006 (23.03.2006) entire document	1-18, 22-24
A	US 2004/0107342 A1 (PHAM et al) 03 June 2004 (03.06.2004) entire document	1-18, 22-24

☐ 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 but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"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

"I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"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

22 January 2016

Date of mailing of the international search report

05 FEB 2016

Name and mailing address of the ISA/

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
P.O. Box 1450, Alexandria, VA 22313-1450

Facsimile No. 571-273-8300

Authorized officer

Blaine R. Copenheaver

PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2015/028045

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
See supplemental page

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-18, 22-24

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

Continued from Box No. III Observations where unity of invention is lacking

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claims 1-18,22-24, drawn to hardening the security, confidentiality and privacy of a file.

Group II, claims 19-21,25, drawn to decrypting a file.

Group III, claims 26-27, drawn to a method for hardening the security, confidentiality, and privacy of a file, the method comprising: obfuscating at a first computer system.

The inventions listed as Groups I, II and III do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical feature of the Group I invention: segmenting a file into a plurality of file segments; wherein each file segment of the plurality of file segments is encrypted using a respective encryption key of the plurality of encryption keys as claimed therein is not present in the invention of Groups II and III. The special technical feature of the Group II invention: decrypting the plurality of encrypted encryption keys; decrypting the plurality of encrypted file segments; combining each file segment in the plurality of file segments so as to generate a copy of the file as claimed therein is not present in the invention of Groups I or III. The special technical feature of the Group III invention: wherein the obfuscated digital values of the file retain their contextual integrity and referential integrity; mapping the obfuscated digital values of the file to the digital values of the file; transferring the obfuscated digital values of the file to a second computer system as claimed therein is not present in the invention of Groups I or II.

Groups I, II and III lack unity of invention because even though the inventions of these groups require the technical feature of hardening the security, confidentiality, and privacy of a file; a plurality of encrypted encryption keys and a plurality of encrypted file segments; a first computer system, this technical feature is not a special technical feature as it does not make a contribution over the prior art.

Specifically, US 2004/0107342 A1 (PHAM et al) 03 June 2004 (03.06.2004) teaches hardening the security, confidentiality, and privacy of a file (Paras. 12 and 15); a plurality of encrypted encryption keys and a plurality of encrypted file segments (paras. 81-82 and 86-87); a first computer system (Para. 34).

Since none of the special technical features of the Group I, II or III inventions are found in more than one of the inventions, unity of invention is lacking.