



US008316421B2

(12) **United States Patent**
Etchegoyen

(10) **Patent No.:** **US 8,316,421 B2**
(45) **Date of Patent:** **Nov. 20, 2012**

(54) **SYSTEM AND METHOD FOR DEVICE AUTHENTICATION WITH BUILT-IN TOLERANCE**

5,113,518 A * 5/1992 Durst et al. 726/29
5,210,795 A 5/1993 Lipner et al.
5,291,598 A 3/1994 Grundy

(Continued)

(75) Inventor: **Craig S. Etchegoyen**, Irvine, CA (US)

FOREIGN PATENT DOCUMENTS

(73) Assignee: **Uniloc Luxembourg S.A.**, Luxembourg (LU)

AU 678985 6/1997

(Continued)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 133 days.

OTHER PUBLICATIONS

Efficient Fingerprint-based User Authentication for Embedded Systems by Gupta et al; Date: Jun. 2005; Publisher: ACM.*

(Continued)

(21) Appl. No.: **12/903,948**

(22) Filed: **Oct. 13, 2010**

Primary Examiner — Taghi Arani

Assistant Examiner — Madhuri Herzog

(65) **Prior Publication Data**

US 2011/0093920 A1 Apr. 21, 2011

(74) *Attorney, Agent, or Firm* — Sean D. Burdick

Related U.S. Application Data

(57) **ABSTRACT**

(60) Provisional application No. 61/252,960, filed on Oct. 19, 2009.

(51) **Int. Cl.**
H04L 29/06 (2006.01)

(52) **U.S. Cl.** **726/4**; 726/1; 726/2; 726/3; 726/16; 726/17; 726/21; 726/26; 726/27; 726/30; 713/168; 713/176; 713/177; 713/180; 713/187; 709/217; 709/219; 709/224; 709/225; 709/229

(58) **Field of Classification Search** 726/1-4, 726/16-21, 22-30; 713/168-170, 180-187; 709/217-219, 223-229

See application file for complete search history.

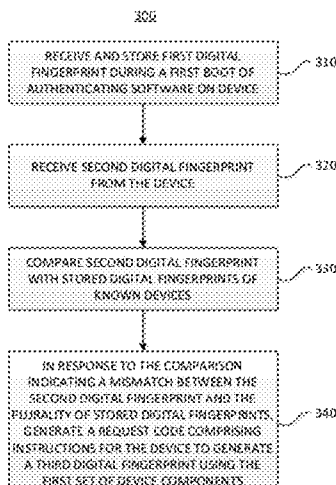
A system for building tolerance into authentication of a computing device includes a means for executing, from a computer-readable medium, computer-implementable steps of: (a) receiving and storing a first digital fingerprint of the device during a first boot of an authenticating software on the device, the first digital fingerprint based on a first set of device components, (b) receiving a second digital fingerprint from the device at a subsequent time, (c) comparing the second digital fingerprint with a plurality of stored digital fingerprints of known devices, (d) in response to the comparison indicating a mismatch between the second digital fingerprint and the plurality of stored digital fingerprints, generating a request code comprising instructions for the device to generate a third digital fingerprint using the first set of device components, (e) sending the request code to the remote device, (f) receiving the third digital fingerprint from the remote device in response to the request code, and (g) authenticating the device based on a comparison of the first and third digital fingerprints.

6 Claims, 7 Drawing Sheets

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,351,982 A 9/1982 Miller et al.
4,658,093 A 4/1987 Hellman
4,704,610 A 11/1987 Smith et al.
4,796,220 A 1/1989 Wolfe



U.S. PATENT DOCUMENTS

5,414,269	A	5/1995	Takahashi	
5,418,854	A	5/1995	Kaufman et al.	
5,440,635	A	8/1995	Bellovin et al.	
5,490,216	A	2/1996	Richardson, III	
5,666,415	A	9/1997	Kaufman	
5,745,879	A	4/1998	Wyman	
5,754,763	A	5/1998	Bereiter	
5,790,664	A	8/1998	Coley et al.	
5,925,127	A	7/1999	Ahmad	
5,974,150	A	10/1999	Kaish et al.	
6,009,401	A	12/1999	Horstmann	
6,044,471	A	3/2000	Colvin	
6,158,005	A	12/2000	Bharathan et al.	
6,167,517	A	12/2000	Gilchrist et al.	713/186
6,230,199	B1	5/2001	Revashetti et al.	
6,233,567	B1	5/2001	Cohen	
6,243,468	B1	6/2001	Pearce et al.	
6,294,793	B1	9/2001	Brunfeld et al.	
6,330,670	B1	12/2001	England et al.	
6,449,645	B1	9/2002	Nash	
6,536,005	B1	3/2003	Augarten	
6,785,825	B2	8/2004	Colvin	
6,859,793	B1	2/2005	Lambiase	
6,920,567	B1	7/2005	Doherty et al.	
6,976,009	B2	12/2005	Tadayon et al.	
7,032,110	B1	4/2006	Su et al.	
7,069,440	B2	6/2006	Aull	
7,069,595	B2	6/2006	Cogmigni et al.	
7,085,741	B2	8/2006	Lao et al.	
7,111,167	B1	9/2006	Yeung	
7,188,241	B2	3/2007	Cronce et al.	
7,203,966	B2	4/2007	Abhuri et al.	
7,206,765	B2	4/2007	Gilliam et al.	
7,272,728	B2	9/2007	Pierson et al.	
7,302,590	B2	11/2007	Dublish et al.	
7,319,987	B1	1/2008	Hoffman et al.	
7,327,280	B2	2/2008	Bachelder et al.	
7,337,147	B2	2/2008	Chen et al.	
7,343,297	B2	3/2008	Bergler et al.	
7,420,474	B1	9/2008	Elks et al.	
7,463,945	B2	12/2008	Kiesel et al.	
7,653,899	B1	1/2010	Lindahl et al.	
7,779,274	B2	8/2010	Dublish et al.	
7,934,250	B2	4/2011	Richardson, III	
2001/0034712	A1	10/2001	Colvin	
2001/0044782	A1	11/2001	Hughes et al.	
2002/0019814	A1	2/2002	Ganesan	
2002/0082997	A1	6/2002	Kobata et al.	
2002/0161718	A1	10/2002	Coley et al.	
2003/0033541	A1	2/2003	Edmark et al.	
2003/0065918	A1	4/2003	Wiley	
2003/0084306	A1	5/2003	Abhuri et al.	
2004/0024860	A1	2/2004	Sato et al.	
2004/0030912	A1	2/2004	Merkle et al.	
2004/0059929	A1	3/2004	Rodgers et al.	
2004/0143746	A1	7/2004	Ligeti et al.	
2004/0177354	A1*	9/2004	Gunyakti et al.	717/174
2004/0187018	A1	9/2004	Owen et al.	
2005/0004954	A1*	1/2005	Soule, III	707/203
2005/0050531	A1	3/2005	Lee	
2005/0108173	A1	5/2005	Stefik et al.	
2005/0138155	A1	6/2005	Lewis	
2005/0172280	A1	8/2005	Ziegler et al.	
2006/0072444	A1	4/2006	Engle et al.	
2006/0095454	A1	5/2006	Shankar et al.	
2006/0161914	A1	7/2006	Morrison et al.	
2006/0169777	A1*	8/2006	Colson et al.	235/386
2006/0230317	A1	10/2006	Anderson	
2006/0265337	A1	11/2006	Wesinger, Jr.	
2006/0265446	A1*	11/2006	Elgressy et al.	709/200
2006/0282660	A1	12/2006	Varghese et al.	
2007/0100690	A1	5/2007	Hopkins	
2007/0113090	A1*	5/2007	Villela	713/170
2007/0136726	A1	6/2007	Freeland et al.	
2007/0168288	A1	7/2007	Bozeman	
2007/0198422	A1	8/2007	Prahlad et al.	

2007/0234409	A1	10/2007	Eisen	
2007/0234427	A1	10/2007	Gardner et al.	
2007/0239606	A1	10/2007	Eisen	
2007/0282615	A1	12/2007	Hamilton et al.	
2008/0005655	A1	1/2008	Sankaran et al.	
2008/0065552	A1	3/2008	Elezar et al.	
2008/0086423	A1	4/2008	Waites	
2008/0147556	A1	6/2008	Smith et al.	
2008/0212846	A1*	9/2008	Yamamoto et al.	382/115
2008/0228578	A1	9/2008	Mashinsky	
2008/0320607	A1	12/2008	Richardson	
2009/0083730	A1	3/2009	Richardson	
2009/0089869	A1	4/2009	Varghese	
2009/0138975	A1	5/2009	Richardson	
2009/0150330	A1	6/2009	Gobeyn	
2009/0292816	A1	11/2009	Etchegoyen et al.	
2010/0235241	A1	9/2010	Wang et al.	

FOREIGN PATENT DOCUMENTS

EP	1 637 958	3/2006
EP	1 637 961	3/2006
EP	1 670 188	6/2006
EP	2 267 629	12/2010
EP	2 270 737	1/2011
EP	2 273 438	1/2011
EP	1978454	4/2011
GB	2434724	8/2007
WO	WO 92/20022	11/1992
WO	WO 93/01550	1/1993
WO	WO 95/35533	12/1995
WO	WO 98/42098	9/1998
WO	WO 2005/104686	11/2005
WO	WO 2007/060516	5/2007
WO	WO 2008/013504	1/2008
WO	WO 2008/127431	10/2008
WO	WO 2008/157639	12/2008
WO	WO 2009/039504	3/2009
WO	WO 2009/065135	5/2009
WO	WO 2009/076232	6/2009
WO	WO 2009/105702	8/2009
WO	WO 2009/143115	11/2009
WO	WO 2009/158525	12/2009
WO	WO 2010/093683	8/2010
WO	WO 2010/104928	9/2010

OTHER PUBLICATIONS

Primetime BioScreen Web Enabled Kiosk by Timeware; Year: 2005; Publisher: Timeware Inc.*

A survey of forensic characterization methods for physical devices by Khanna et al; Publisher: Elsevier Ltd.; Year: 2006.*

Wikipedia: "Software Extension," May 28, 2009, Internet Article retrieved on Oct. 11, 2010. XP002604710.

"Technical Details on Microsoft Product Activation for Windows XP;" Internet Citation, XP002398930, Aug. 13, 2001.

Angha et al.; "Securing Transportation Network Infrastructure with Patented Technology of Device Locking—Developed by Uniloc USA", http://www.dkassociates.com/admin/paperfile/ITS%20World%20Paper%20Submission_Uniloc%20_2_.pdf; Oct. 24, 2006.

Econolite; Econolite and Uniloc Partner to Bring Unmatched Infrastructure Security to Advanced Traffic Control Networks with Launch to StrongPoint; http://www.econolite.com/docs/press/20080304_Econolite_StronPoint.pdf; Mar. 4, 2008.

Williams, R., "A Painless Guide to CRC Error Detection Algorithms," Aug. 13, 1993, 33 pages, www.ross.net/crc/download/crc_v3.txt.

Johnson et al. "Dimensions of Online Behavior: Toward a User Typology," *Cyberpsychology and Behavior*, vol. 10, No. 6, pp. 773-779, 2007. XP002317349.

Lallous, "Changing Volume's Serial Number," Code Project Feb. 17, 2008, retrieved from the internet on Dec. 14, 2010. XP002614149.

Lee P, "Oracle Adaptive Access Manager Reference Guide, Release 10g (10.1.4.5)," May 2009, Internet Article retrieved on Sep. 27, 2010. XP002603489.

Williams et al., "Web Database Applications with PHP & MySQL,"

Wikipedia: "Device Fingerprint," May 5, 2009, Internet Article retrieved on Sep. 28, 2010. XP002603492.

Beverly, Robert, "A Robust Classifier for Passive TCP/IP Fingerprinting," *Proceedings of the 5th Passive and Active Measurement Workshop*, Apr. 2004, Juan-les-Pins, France, pp. 158-167.

Eckersley, Peter, "How Unique is Your Web Browser?" *Lecture Notes in Computer Science*, 2010, DOI: 10.1007/978-3-542-14527-8_1, pp. 1-18.

G. Wiesen, "What is a Device Fingerprint?", *WiseGeek*, 2003.

Kohno et al., "Remote Physical Device Fingerprinting," *IEEE Transactions on Dependable and Secure Computing*, vol. 2, No. 2, Apr.-Jun. 2005, pp. 93-108.

Martone et al., "Characterization of RF Devices Using Two-tone Probe Signals," School of Electrical and Computer Engineering, Purdue University, West Lafayette, Indiana, 2007.

Muncaster et al., "Continuous Multimodal Authentication Using Dynamic Bayesian Networks," Second Workshop on Multimodal User Authentication, Toulouse, France, May 11-12, 2006. XP55003041.

Salo, Timothy J., "Multi-Factor Fingerprints for Personal Computer Hardware," Military Communications Conference, Piscataway, New Jersey, Oct. 29, 2007, 7 pages. XP031232751.

Williath, "Future Grid Portal," *VampirTrace*, Dec. 23, 2010.

* cited by examiner

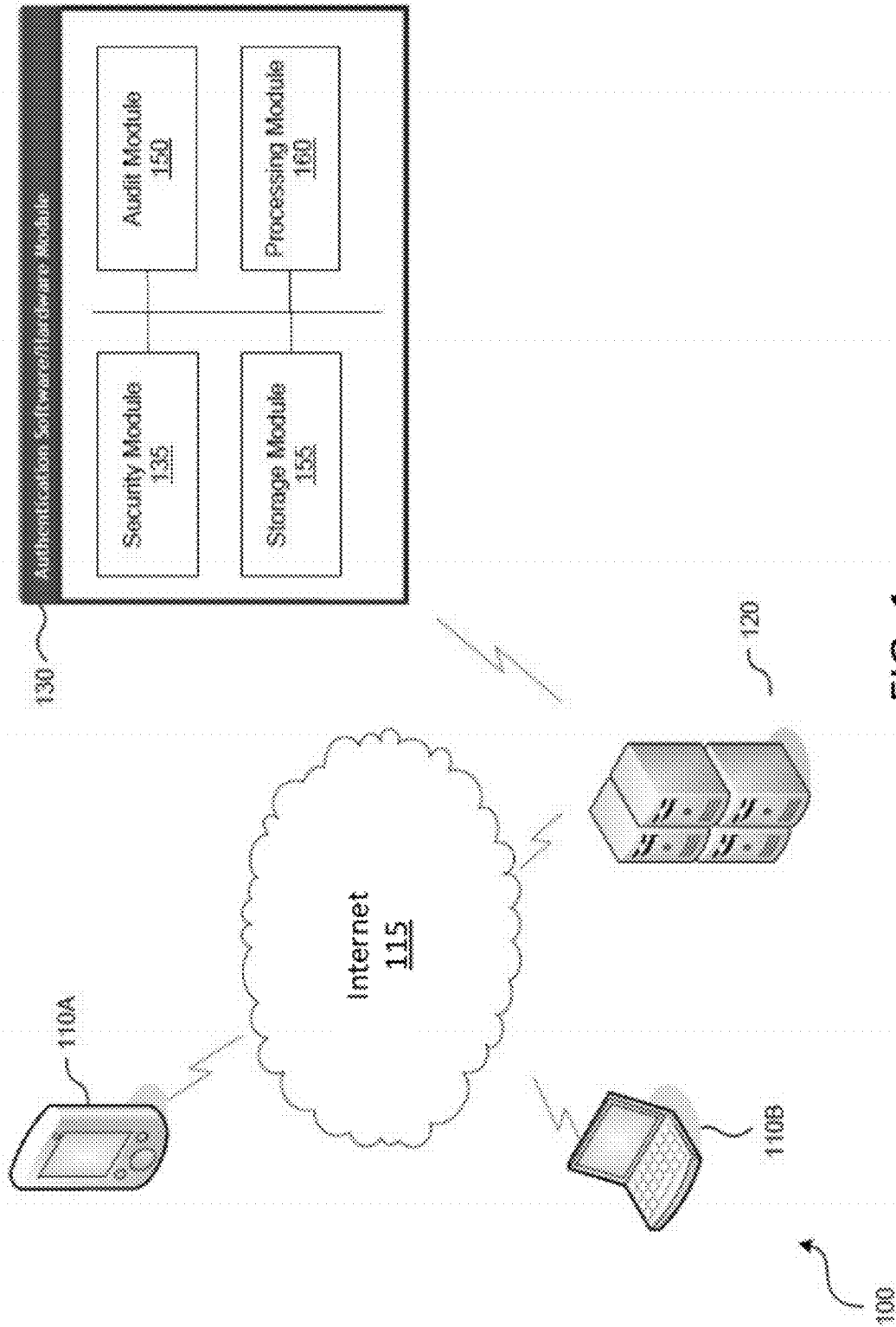


FIG. 1

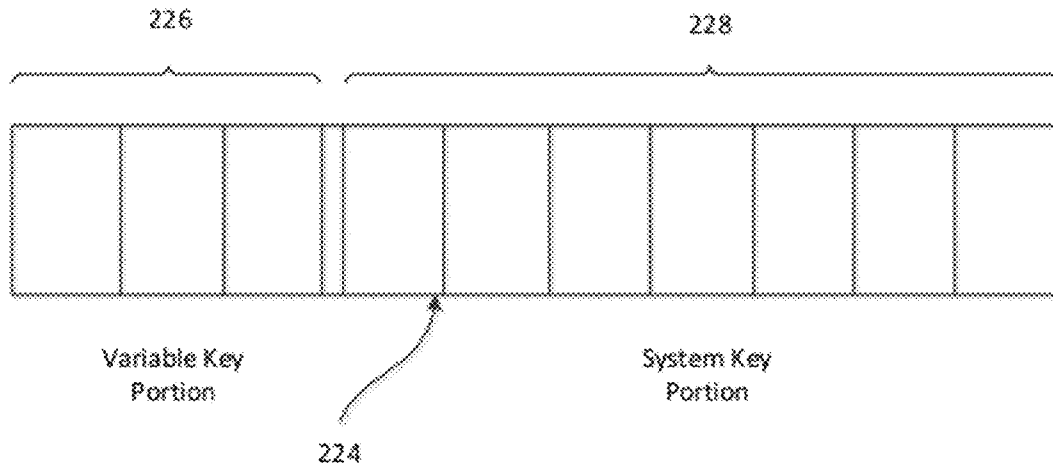


FIG. 2

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.