EXHIBIT 4

US007613926B2

(12) United States Patent

Edery et al.

(10) Patent No.:

US 7,613,926 B2

(45) **Date of Patent:**

*Nov. 3, 2009

(54) METHOD AND SYSTEM FOR PROTECTING A COMPUTER AND A NETWORK FROM HOSTILE DOWNLOADABLES

(75) Inventors: **Yigal Mordechai Edery**, Pardesia (IL); **Nimrod Itzhak Vered**, Goosh Tel-Mond

(IL); David R. Kroll, San Jose, CA (US); Shlomo Touboul, Kefar-Haim (IL)

(73) Assignee: Finjan Software, Ltd, Netanya (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35

U.S.C. 154(b) by 659 days.

This patent is subject to a terminal dis-

claimer.

(21) Appl. No.: 11/370,114(22) Filed: Mar. 7, 2006

(65) Prior Publication Data

US 2006/0149968 A1 Jul. 6, 2006

Related U.S. Application Data

- (63) Continuation of application No. 09/861,229, filed on May 17, 2001, now Pat. No. 7,058,822, and a continuation-in-part of application No. 09/539,667, filed on Mar. 30, 2000, now Pat. No. 6,804,780, which is a continuation of application No. 08/964,388, filed on Nov. 6, 1997, now Pat. No. 6,092,194, said application No. 09/861,229 is a continuation-in-part of application No. 09/551,302, filed on Apr. 18, 2000, now Pat. No. 6,480,962
- 6,480,962. Provisional application No. 60/205,591, filed on May 17, 2000.
- (51) Int. Cl. G06F 21/24 (2006.01) G06F 11/30 (2006.01) H04L 9/00 (2006.01) G06F 15/16 (2006.01)

- (56) References Cited

U.S. PATENT DOCUMENTS

5,077,677 A 12/1991 Murphy et al. 706/62

5,359,659 A 10/1994 Rosenthal 726/24

(Continued)

FOREIGN PATENT DOCUMENTS

EP 1091276 4/2001 EP 1132796 9/2001

OTHER PUBLICATIONS

Zhong, et al., "Security in the Large: is Java's Sandbox Scalable?," Seventh IEEE Symposium on Reliable Distributed Systems, pp. 1-6, Oct. 1998.

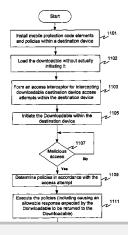
(Continued)

Primary Examiner—Christopher A Revak (74) Attorney, Agent, or Firm—King & Spalding LLP

(57) ABSTRACT

Protection systems and methods provide for protecting one or more personal computers ("PCs") and/or other intermittently or persistently network accessible devices or processes from undesirable or otherwise malicious operations of JavaTM applets, ActiveXTM controls, JavaScriptTM scripts, Visual Basic scripts, add-ins, downloaded/uploaded programs or other "Downloadables" or "mobile code" in whole or part. A protection engine embodiment provides, within a server, firewall or other suitable "re-communicator," for monitoring information received by the communicator, determining whether received information does or is likely to include executable code, and if so, causes mobile protection code (MPC) to be transferred to and rendered operable within a destination device of the received information, more suitably by forming a protection agent including the MPC, protection policies and a detected-Downloadable. An MPC embodiment further provides, within a Downloadable-destination, for initiating the Downloadable, enabling malicious Downloadable operation attempts to be received by the MPC, and causing (predetermined) corresponding operations to be executed in response to the attempts, more suitably in conjunction with protection policies.

30 Claims, 10 Drawing Sheets





US 7,613,926 B2

Page 2

U.S. PATENT DOCUMENTS 5,361,359 A 11/1994 Tajalli et al. 726/23 5,414,833 A 5/1995 Hershey et al. 726/22 5,485,409 A 5,485,575 A 1/1996 Chess et al. 714/38 5,572,643 A 11/1996 Judson 709/218 5,579,509 A 11/1996 Furtney et al. 703/27 5,606,668 A * 2/1997 Shwed 726/13 5,623,600 A * 4/1997 Ji et al. 726/24 5,638,446 A 6/1997 Rubin 705/51 10/1997 Kephart et al. 706/12 5,675,711 A 5,692,047 A 11/1997 McManis 713/167 11/1997 Holden et al. 726/2 5,692,124 A 5,720,033 A 2/1998 Deo 726/2 5,724,425 A 3/1998 Chang et al. 705/52 4/1998 Fieres et al. 713/156 5,740,248 A 5,740,441 A 4/1998 Yellin et al. 717/134 5,761,421 A 6/1998 van Hoff et al. 709/223 5,765,205 A 6/1998 Breslau et al. 711/203 5,784,459 A 7/1998 Devarakonda et al. 713/165 5,796,952 A 8/1998 Davis et al. 709/224 5,805,829 A 9/1998 Cohen et al. 709/202 5,832,208 A 11/1998 Chen et al. 726/24 5,832,274 A 11/1998 Cutler et al. 717/171 5,850,559 A 12/1998 Angelo et al. 713/320 5,859,966 A 1/1999 Hayman et al. 726/23 5,864,683 A 1/1999 Boebert et al. 709/249 3/1999 Yamamoto 726/24 5,881,151 A 5,884,033 A 3/1999 Duvall et al. 709/206 5,892,904 A 4/1999 Atkinson et al. 726/22 5,951,698 A 9/1999 Chen et al. 714/38 5,956,481 A 9/1999 Walsh et al. 726/23 10/1999 Williams 717/143 5,963,742 A 5,974,549 A 10/1999 5,978,484 A 11/1999 Apperson et al. 705/54 5,983,348 A 11/1999 Ji 5,987,611 A 11/1999 Freund 726/4 6.088.801 A 6,088,803 A 7/2000 Tso et al. 726/22 6.092.194 A * 7/2000 Touboul 726/24 6,154,844 A * 11/2000 Touboul et al. 726/24 6,167,520 A 12/2000 Toubou1 $1/2002 \ \ Beadle \ et \ al. \ \ \ \ 726/15$ 6,339,829 B1 6,425,058 B1 7/2002 Arimilli et al. 711/134 8/2002 Arimilli et al. 711/128 6,434,668 B1 6,434,669 B1 8/2002 Arimilli et al. 711/128 6,480,962 B1* 11/2002 Touboul 726/22 6,487,666 B1 11/2002 Shanklin et al. 726/23 6,519,679 B2 2/2003 Devireddy et al. 711/114 6,598,033 B2 7/2003 Ross et al. 706/46 5/2004 Brown et al. 709/229 6,732,179 B1* 6,804,780 B1* 10/2004 Touboul 713/181 6,901,519 B1* 5/2005 Stewart et al. 726/24 6,917,953 B2 7/2005 Simon et al. 707/204 7,058,822 B2* 6/2006 Edery et al. 726/22 7,093,135 B1* 8/2006 Radatti et al. 713/188 7,210,041 B1 4/2007 Gryaznov et al. 713/188 7,343,604 B2 3/2008 Grabarnik et al. 719/313 8/2008 Touboul 726/22 7,418,731 B2 2004/0073811 A1 4/2004 Sanin 726/13 2004/0088425 A1 5/2004 Rubinstein et al. 709/230 8/2005 Sandu et al. 726/22 2005/0172338 A1 2/2006 Bjarnestam et al. 707/3 2006/0031207 A1

OTHER PUBLICATIONS

Rubin, et al., "Mobile Code Security," *IEEE Internet*, pp. 30-34, Dec. 1998. Schmid, et al. "Protecting Data From Malicious Software," *Proceedings of the 18th Annual Computer Security Applications Conference*, pp. 1-10, 2002.

International Search Report for Application No. PCT/IB97/01626, 3 pp., May 14, 1998 (mailing date).

International Search Report for Application No. PCT/IL05/00915, 4 pp., dated Mar. 3, 2006.

Written Opinion for Application no. PCT/IL05/00915, 5 pp., dated Mar. 3, 2006 (mailing date).

International Search Report for Application No. PCT/IB01/01138, 4 pp., Sep. 20, 2002 (mailing date).

International Preliminary Examination Report for Application No. PCT/IB01/01138, 2 pp., dated Dec. 19, 2002.

Gerzic, Amer, "Write Your Own Regular Expression Parser," Nov. 17, 2003, 18 pp.

Power, James, "Lexical Analysis," 4 pp., May 14, 2006.

Sitaker, Kragen, "Rapid Genetic Evolution of Regular Expressions" [online], *The Mial Archive*, Apr. 24, 2004 (retrieved on Dec. 7, 2004), 5 pp.

"Lexical Analysis: DFA Minimization & Wrap Up" [online], Fall, 2004 [retrieved on Mar. 2, 2005], 8 pp.

"Minimization of DFA" [online], [retrieved on Dec. 7, 2004], 7 pp. "Algorithm: NFS -> DFA" [online], Copyright 1999-2001 [retrieved on Dec. 7, 2004], 4 pp.

"CS 3813: Introduction to Formal Languages and Automata—State Minimization and Other Algorithms for Finite Automata," 3 pp., May 11, 2003

Watson, Bruce W., "Constructing Minimal Acyclic Deterministic Finite Automata," [retrieved on Mar. 20, 2005], 38 pp.

Chang, Chia-Hsiang, "From Regular Expressions to DFA's Using Compressed NFA's," Oct. 1992, 243 pp.

"Products," Articles published on the Internet, "Revolutionary Security for a New Computing Paradigm" regarding SurfinGate™, 7 pp. "Release Notes for the Microsoft ActiveX Development Kit," Aug. 13, 1996, pp. 1-10.

Doyle, et al., "Microsoft Press Computer Dictionary," Microsoft Press, 2d Edition, pp. 137-138, 1993.

Finjan Software Ltd., "Powerful PC Security for the New World of JavaTM and Downloadables, Surfin ShieldTM," Article published on the Internet by Finjan Software Ltd., 2 pp. 1996.

Finjan Sofrtware Ltd., "Finjan Announces a Personal Java™ Firewall for Web Browsers—the SurfinShield™ 1.6 (formerly known as SurfinBoard)," Press Release of Finjan Releases SurfinShield 1.6, 2 pp., Oct. 21, 1996.

Finjan Software Ltd., "Finjan Announces Major Power Boost and New Features for SurfinShield™ 2.0," Las Vegas Convention Center/Pavillion 5 P5551, 3 pp., Nov. 18, 1996.

Finjan Software Ltd., "Finjan Software Releases SurfinBoard, Industry's First JAVA Security Product for the World Wide Web," Article published on the Internet by Finjan Software Ltd., 1 p., Jul. 29, 1996. Finjan Software Ltd., "Java Security: Issues & Solutions," Article published on the Internet by Finjan Software Ltd., 8 pp. 1996.

Finjan Software Ltd., Company Profile, "Finjan—Safe Surfing, The Java Security Solutions Provider," Article published on the Internet by Finjan Software Ltd., 3 pp., Oct. 31, 1996.

"IBM AntiVirus User's Guide, Version 2.4,", International Business Machines Corporation, pp. 6-7, Nov. 15, 1995.

Khare, R., "Microsoft Authenticode Analyzed" [online], Jul. 22, 1996 [retrieved on Jun. 25, 2003], 2 pp.

LaDue, M., Online Business Consultant: Java Security: Whose Business is It?, Article published on the Internet, Home Page Press, Inc., 4 pp., 1996.

Leach, Norvin, et al., "IE 3.0 Applets Will Earn Certification," *PC Week*, vol. 13, No. 29, 2 pp., Jul. 22, 1996.

Moritz, R., "Why We Shouldn't Fear Java," *Java Report*, pp. 51-56, Feb. 1997.

Microsoft, "Microsoft ActiveX Software Development Kit" [Online], Aug. 12, 1996 [retrieved on Jun. 25, 2003], pp. 1-6.

Microsoft® Authenticode Technology, "Ensuring Accountability and Authenticity for Software Components on the Internet," Microsoft Corporation, Oct. 1996, including Abstract, Contents, Introduction, and pp. 1-10.

Microsoft Corporation, Web Page Article "Frequently Asked Ques-



Case 3:17-cv-05659-WHA Document 88-4 Filed 05/18/18 Page 4 of 27

US 7,613,926 B2

Page 3

Okamoto, E., et al., "ID-Based Authentication System for Computer Virus Detection," *IEEE/IEE Electronic Library online, Electronics Letters*, vol. 26, Issue 15, ISSN 0013-5194, Jul. 19, 1990, Abstract and pp. 1169-1170.

Omura, J. K., "Novel Applications of Cryptography in Digital Communications," *IEEE Communications Magazine*, pp. 21-29, May 1990.

Schmitt, D.A., ".EXE files, OS-2 style," *PC Tech Journal*, vol. 6, No. 11, p. 76(13), Nov. 1988.

Zhang, X. N., "Secure Code Distribution," *IEEE/IEE Electronic Library online, Computer*, vol. 30, Issue 6, pp. 76-79, Jun. 1997. D. Grune, et al., "Parsing Techniques: A Practical Guide," John Wiley & Sons, Inc., New York, New York, USA, pp. 1-326, 2000.

* cited by examiner



U.S. Patent

Nov. 3, 2009

Sheet 1 of 10

US 7,613,926 B2

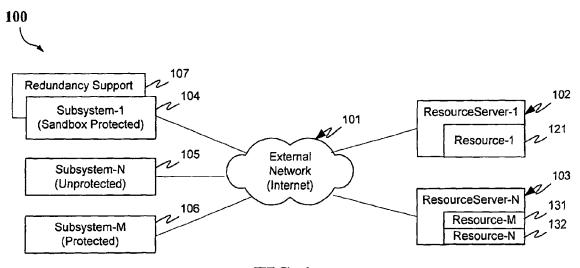


FIG. 1a

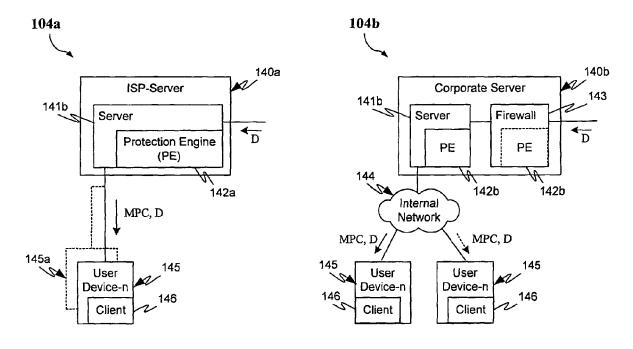


FIG. 1b FIG. 1c

DOCKET

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.

