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(54) **ESTABLISHMENT OF A SECURE COMMUNICATION LINK BASED ON A DOMAIN NAME SERVICE (DNS) REQUEST**

(75) Inventors: **Edward Colby Munger**, Crownsville, MD (US); **Robert Dunham Short, III**, Leesburg, VA (US); **Victor Larson**, Fairfax, VA (US); **Michael Williamson**, South Riding, VA (US)

(73) Assignee: **Virnetx Inc.**, Scotts Valley Drive, CA (US)

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(51) **Int. Cl.**
G06F 15/173 (2006.01)

(52) **U.S. Cl.** **709/225; 709/229**

(58) **Field of Classification Search** **709/217-225, 709/229; 713/201**

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,933,846 A 6/1990 Humphrey et al.

(Continued)

FOREIGN PATENT DOCUMENTS

DE 199 24 575 12/1999

(Continued)

OTHER PUBLICATIONS

Search Report (dated Aug. 23, 2002), International Application No. PCT/US01/13260.

(Continued)

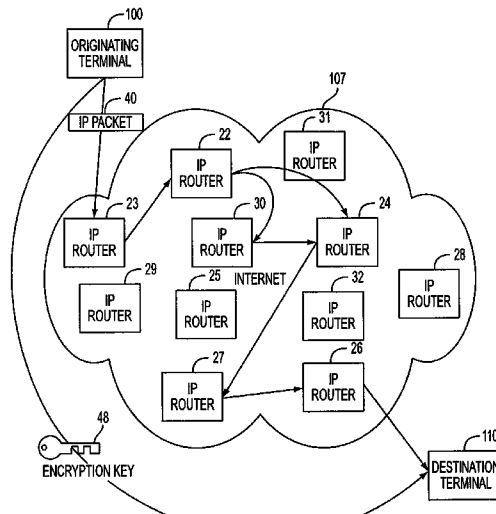
Primary Examiner—Krisna Lim

(74) *Attorney, Agent, or Firm*—McDermott Will & Emery

(57) **ABSTRACT**

A plurality of computer nodes communicate using seemingly random Internet Protocol source and destination addresses. Data packets matching criteria defined by a moving window of valid addresses are accepted for further processing, while those that do not meet the criteria are quickly rejected. Improvements to the basic design include (1) a load balancer that distributes packets across different transmission paths according to transmission path quality; (2) a DNS proxy server that transparently creates a virtual private network in response to a domain name inquiry; (3) a large-to-small link bandwidth management feature that prevents denial-of-service attacks at system chokepoints; (4) a traffic limiter that regulates incoming packets by limiting the rate at which a transmitter can be synchronized with a receiver; and (5) a signaling synchronizer that allows a large number of nodes to communicate with a central node by partitioning the communication function between two separate entities.

16 Claims, 35 Drawing Sheets



VIRNETX EXHIBIT 2023
Apple v. Virnetx

U.S. PATENT DOCUMENTS

4,988,990	A	1/1991	Warrior	
5,164,986	A *	11/1992	Bright	380/273
5,276,735	A	1/1994	Boebert et al.	
5,311,593	A	5/1994	Carmi	
5,329,521	A	7/1994	Walsh et al.	
5,341,426	A	8/1994	Barney et al.	
5,367,643	A	11/1994	Chang et al.	
5,559,883	A	9/1996	Williams	
5,561,669	A	10/1996	Lenney et al.	
5,588,060	A	12/1996	Aziz	
5,625,626	A	4/1997	Umekita	
5,654,695	A	8/1997	Olnowich et al.	
5,682,480	A	10/1997	Nakagawa	
5,689,566	A	11/1997	Nguyen	
5,740,375	A	4/1998	Dunne et al.	
5,774,660	A	6/1998	Brendel et al.	
5,787,172	A	7/1998	Arnold	
5,790,548	A *	8/1998	Sistanizadeh et al.	370/401
5,796,942	A	8/1998	Esbensen	
5,805,801	A	9/1998	Holloway et al.	
5,842,040	A	11/1998	Hughes et al.	
5,845,091	A	12/1998	Dunne et al.	
5,867,650	A	2/1999	Osterman	
5,870,610	A	2/1999	Beyda et al.	
5,878,231	A	3/1999	Baehr et al.	
5,892,903	A	4/1999	Klaus	
5,898,830	A *	4/1999	Wesinger et al.	726/15
5,905,859	A	5/1999	Holloway et al.	
5,918,019	A	6/1999	Valencia	
5,996,016	A	11/1999	Thalheimer et al.	
6,006,259	A	12/1999	Adelman et al.	
6,006,272	A	12/1999	Aravamudan et al.	
6,016,318	A	1/2000	Tomoiike	
6,016,512	A	1/2000	Huitema	
6,041,342	A	3/2000	Yamaguchi	
6,052,788	A	4/2000	Wesinger, Jr. et al.	
6,055,574	A	4/2000	Smorodinsky et al.	
6,061,736	A	5/2000	Rochberger et al.	
6,079,020	A *	6/2000	Liu	713/201
6,092,200	A	7/2000	Muniyappa et al.	
6,101,182	A *	8/2000	Sistanizadeh et al.	370/352
6,119,171	A	9/2000	Alkhatib	
6,119,234	A *	9/2000	Aziz et al.	713/201
6,147,976	A	11/2000	Shand et al.	
6,157,957	A	12/2000	Berthaud	
6,158,011	A	12/2000	Chen et al.	
6,168,409	B1	1/2001	Fare	
6,175,867	B1	1/2001	Taghadoss	
6,178,409	B1	1/2001	Weber et al.	
6,178,505	B1	1/2001	Schneider et al.	
6,179,102	B1	1/2001	Weber et al.	
6,222,842	B1	4/2001	Sasyan et al.	
6,226,751	B1	5/2001	Arrow et al.	
6,233,618	B1	5/2001	Shannon	
6,243,360	B1	6/2001	Basilico	
6,243,749	B1	6/2001	Sitaraman et al.	
6,243,754	B1	6/2001	Guerin et al.	
6,256,671	B1 *	7/2001	Strentzsch et al.	709/227
6,263,445	B1	7/2001	Blumenau	
6,286,047	B1	9/2001	Ramanathan et al.	
6,301,223	B1	10/2001	Hrastar et al.	
6,308,274	B1	10/2001	Swift	
6,311,207	B1	10/2001	Mighdoll et al.	
6,324,161	B1	11/2001	Kirch	
6,330,562	B1	12/2001	Boden et al.	
6,332,158	B1 *	12/2001	Risley et al.	709/219
6,353,614	B1	3/2002	Borella et al.	
6,425,003	B1 *	7/2002	Herzog et al.	709/223
6,430,155	B1	8/2002	Davie et al.	

6,502,135	B1 *	12/2002	Munger et al.	709/225
6,505,232	B1	1/2003	Mighdoll et al.	
6,510,154	B1	1/2003	Mayes et al.	
6,549,516	B1	4/2003	Albert et al.	
6,557,037	B1	4/2003	Provino	
6,571,296	B1	5/2003	Dillon	
6,571,338	B1	5/2003	Shaio et al.	
6,581,166	B1	6/2003	Hirst et al.	
6,606,708	B1 *	8/2003	Devine et al.	713/201
6,618,761	B2	9/2003	Munger et al.	
6,671,702	B2	12/2003	Kruglikov et al.	
6,687,551	B2	2/2004	Steindl	
6,714,970	B1	3/2004	Fiveash et al.	
6,717,949	B1	4/2004	Boden et al.	
6,751,738	B2 *	6/2004	Wesinger et al.	713/201
6,760,766	B1	7/2004	Sahlqvist	
6,826,616	B2	11/2004	Larson et al.	
6,839,759	B2	1/2005	Larson et al.	
7,010,604	B1	3/2006	Munger et al.	
7,133,930	B2	11/2006	Munger et al.	
7,188,180	B2	3/2007	Larson et al.	
7,197,563	B2	3/2007	Sheymov et al.	
2002/0004898	A1	1/2002	Droge	
2003/0196122	A1 *	10/2003	Wesinger et al.	713/201
2005/0055306	A1	3/2005	Miller et al.	
2006/0059337	A1 *	3/2006	Poyhonen et al.	713/165

FOREIGN PATENT DOCUMENTS

EP	0 814 589	12/1997
EP	0 814 589 A	12/1997
EP	0 838 930	4/1998
EP	0 838 930 A	4/1998
EP	836306 A1	4/1998
EP	0 858 189	8/1998
GB	2 317 792	4/1998
GB	2 317 792 A	4/1998
GB	2 334 181 A	8/1999
GB	2334181 A	8/1999
WO	9827783 A	6/1998
WO	WO 98/27783	6/1998
WO	WO 9827783 A	6/1998
WO	WO 98 55930	12/1998
WO	WO 98 59470	12/1998
WO	WO 99 38081	7/1999
WO	WO 99 48303	9/1999
WO	WO 00/17775	3/2000
WO	WO 00/70458	11/2000
WO	WO 01 50688	7/2001

OTHER PUBLICATIONS

Donald E. Eastlake, 3rd, "Domain Name System Security Extensions", Internet Draft, Apr. 1998, pp. 1-51.

D. B. Chapman et al., "Building Internet Firewalls", Nov. 1995, pp. 278-375.

P. Srisuresh et al., "DNA extensions to Network address Translators (DNS_ALG)", Internet Draft, Jul. 1998, pp. 1-27.

James E. Bellaire, "New Statement of Rules—Naming Internet Domains", Internet Newsgroup, Jul. 30, 1995, 1 page.

D. Clark, "US Calls for Private Domain-Name System", Computer Society, Aug. 1, 1998, pp. 22-25.

August Bequai, "Balancing Legal Concerns Over Crime and Security in Cyberspace", Computer & Security, vol. 17, No. 4, 1998, pp. 293-298.

Rich Winkel, "CAQ: Networking With Spooks: The NET & The Control Of Information", Internet Newsgroup, Jun. 21, 1997, 4 pages.

Search Report (dated Jun. 18, 2002), International Application No. PCT/US01/13260.

Search Report (dated Jun. 28, 2002), International Application No. PCT/US01/13261.

- D. B. Chapman et al., "Building Internet Firewalls", Nov. 1995, pp. 278-297 and pp. 351-375.
- P. Srisuresh et al., "DNS extensions to Network Address Translators", Jul. 1998, 27 pages.
- Laurie Wells, "Security Icon", Oct. 19, 1998, 1 page.
- W. Stallings, "Cryptography And Network Security", 2nd Edition, Chapter 13, IP Security, Jun. 8, 1998, pp. 399-440.
- W. Stallings, "New Cryptography and Network Security Book", Jun. 8, 1998, 3 pages.
- Search Report (dated Aug. 20, 2002), International Application No. PCT/US01/04340.
- Shree Murthy et al., "Congestion-Oriented Shortest Multipath Routing", Proceedings of IEEE Infocom, 1996, pp. 1028-1036.
- Jim Jones et al., "Distributed Denial of Service Attacks: Defenses", Global Integrity Corporation, 2000, pp. 1-14.
- Fasbender, Kesdogan, and Kubitz: "Variable and Scalable Security: Protection of Location Information in Mobile IP", IEEE publication, 1996, pp. 963-967.
- Laurie Wells (Lancasterbiblemail MSN COM); "Subject: Security Icon" Usenet Newsgroup, Oct. 19, 1998, XP002200606.
- Davila J et al, "Implementation of Virtual Private Networks at the Transport Layer", Information Security, Second International Workshop, ISW '99. Proceedings (Lecture Springer-Verlag Berlin, Germany, [Online] 1999, pp. 85-102, XP002399276, ISBN 3-540-66695-B, retrieved from the Internet: URL: <http://www.springerlink.com/content/4uac0tb0hecma89/fulltext.pdf>) (Abstract).
- Alan O. Frier et al., "The SSL Protocol Version 3.0", Nov. 18, 1996, printed from <http://www.netscape.com/eng/ssl13/draft302.txt> on Feb. 4, 2002, 56 pages.
- Davila J et al, "Implementation of Virtual Private Networks at the Transport Layer", Information Security, Second International Workshop, ISW'99. Proceedings (Lecture Springer-Verlag Berlin, Germany, [Online] 1999, pp. 85-102, XP002399276, ISBN 3-540-66695-B, retrieved from the Internet: URL: <http://www.springerlink.com/content/4uac0tb0hecma89/fulltext.pdf>).
- Dolev, Shlomi and Ostrovsky, Rafil, Efficient Anonymous Multicast and Reception (Extended Abstract), 16 pages.
- F. Halsall, "Data Communications, Computer Networks and Open Systems", Chapter 4, Protocol Basics, 1996, pp. 198-203.
- Glossary for the Linux FreeS/WAN project, printed from http://liberty.freeswan.org/freeswan_trees/freeswan-1.3/doc/glossary.html on Feb. 21, 2002, 25 pages.
- J. Gilmore, "Swan: Securing the Internet against Wiretapping", printed from http://liberty.freeswan.org/freeswan_trees/freeswan-1.3.doc/rationale.html on Feb. 21, 2002, 4 pages.
- Linux FreeS/WAN Index File, printed from http://liberty.freeswan.org/freeswan_trees/freeswan-1.3/doc/ on Feb. 21, 2002, 3 pages.
- Reiter, Michael K. and Rubin, Aviel D. (AT&T Labs—Research), Crowds: Anonymity for Web Transactions, pp. 1-23.
- RFC 2401-Security Architecture for the Internet Protocol (RTP).
- RFC 2543-SIP: Session Initiation Protocol (SIP or SIPS).
- Rubin, Aviel D., Geer, Daniel, and Ranum, Marcus J. (Wiley Computer Publishing), "Web Security Sourcebook", pp. 82-94.
- Search Report, IPER (dated Nov. 13, 2002), International Application No. PCT/US01/04340.
- Search Report, IPER (dated Feb. 6, 2002), International Application No. PCT/US01/13261.
- Search Report, IPER (dated Jan. 14, 2003), International Application No. PCT/US01/13260.
- Shankar, A.U. "A verified sliding window protocol with variable flow control". Proceedings of ACM SIGCOMM conference on Communications architectures & protocols. pp. 84-91, ACM Press, NY, NY 1986.

* cited by examiner

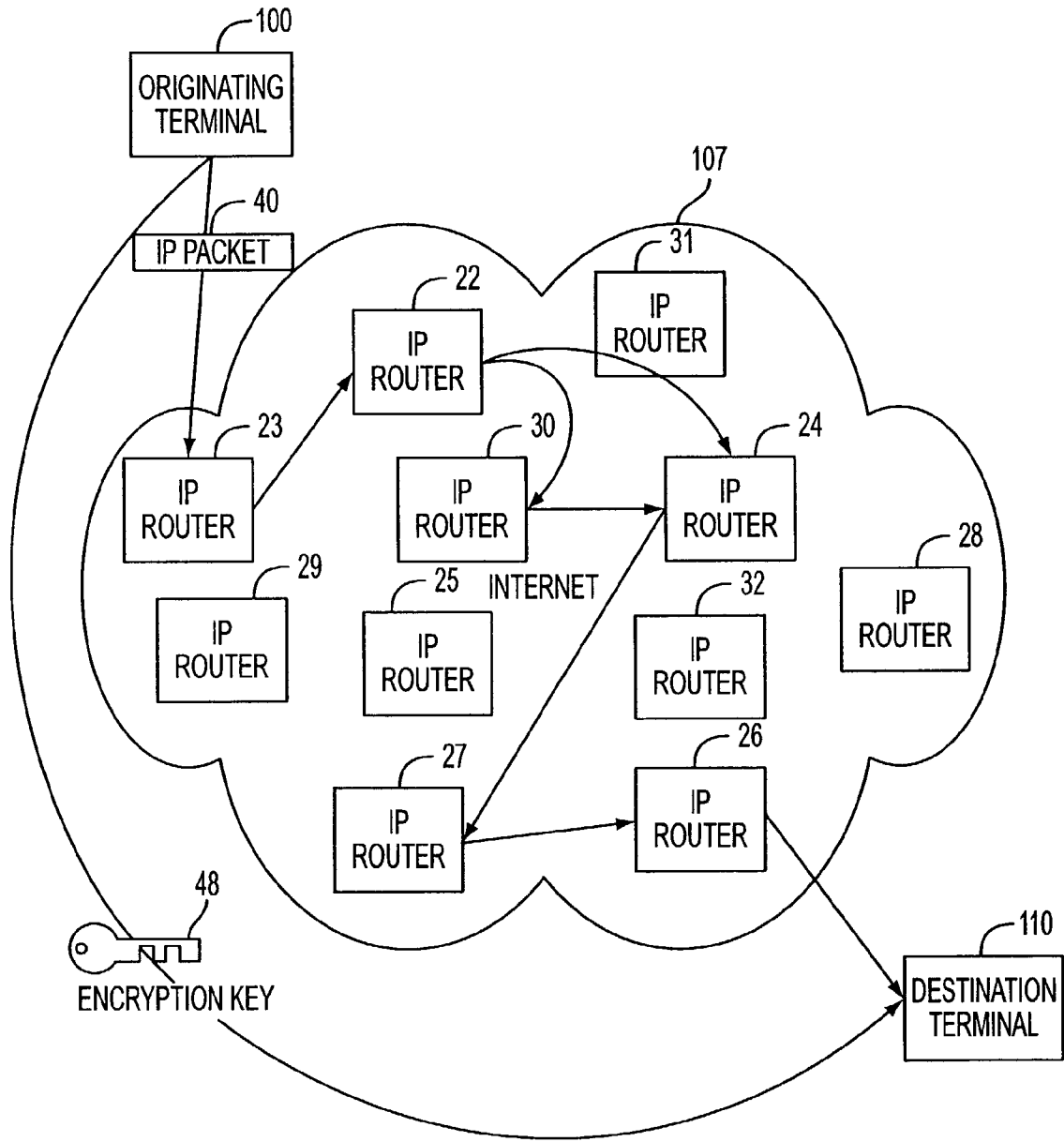


FIG. 1

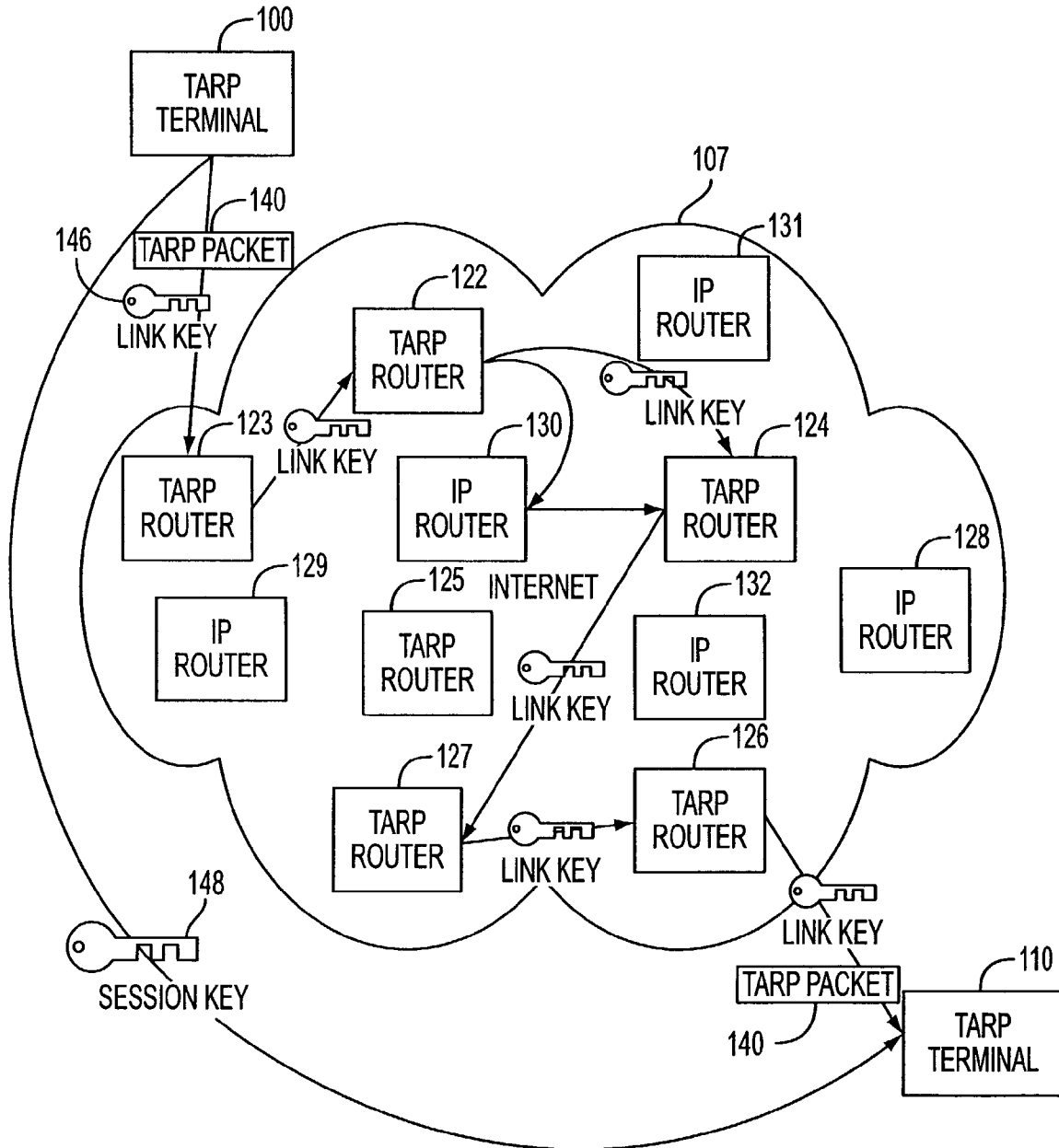


FIG. 2

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