

(12) **United States Patent**
Munger et al.

(10) **Patent No.:** **US 6,502,135 B1**
(45) **Date of Patent:** **Dec. 31, 2002**

- (54) **AGILE NETWORK PROTOCOL FOR SECURE COMMUNICATIONS WITH ASSURED SYSTEM AVAILABILITY**
- (75) Inventors: **Edmund Colby Munger**, Crownsville, MD (US); **Douglas Charles Schmidt**, Severna Park, MD (US); **Robert Dunham Short, III**, Leesburg, VA (US); **Victor Larson**, Fairfax, VA (US); **Michael Williamson**, South Riding, VA (US)

DE	199 24 575	12/1999
EP	2 317 792	4/1998
EP	0 858 189	8/1998
GB	0 814 589	12/1997
WO	WO 98/27783	6/1998
WO	WO 98 59470	12/1998
WO	WO 99 38081	7/1999
WO	WO 99 48303	9/1999
WO	WO 00/70458	11/2000
WO	WO 01 50688	7/2001

OTHER PUBLICATIONS

- (73) Assignee: **Science Applications International Corporation**, San Diego, CA (US)
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

Fasbender, Kesdogan, and Kubitz: "Variable and Scalable Security: Protection of Location Information in Mobile IP", IEEE publication, 1996, pp. 963-967.

(List continued on next page.)

(21) Appl. No.: **09/504,783**

Primary Examiner—Krisna Lim

(22) Filed: **Feb. 15, 2000**

(74) *Attorney, Agent, or Firm*—Banner & Witcoff, Ltd.

(57) **ABSTRACT**

Related U.S. Application Data

- (63) Continuation-in-part of application No. 09/429,643, filed on Oct. 29, 1999
- (60) Provisional application No. 60/106,261, filed on Oct. 30, 1998, and provisional application No. 60/137,704, filed on Jun. 7, 1999.
- (51) **Int. Cl.⁷** **G06F 15/173**
- (52) **U.S. Cl.** **709/225; 709/229; 709/245**
- (58) **Field of Search** **709/249, 223, 709/225, 229, 245; 713/201**

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.

(56) **References Cited**

U.S. PATENT DOCUMENTS

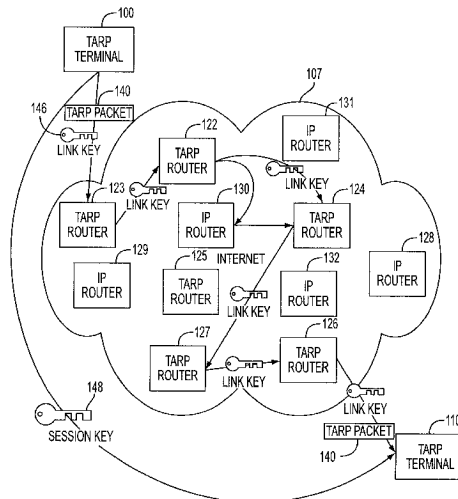
4,933,846 A 6/1990 Humphrey et al.

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

DE 0 838 930 12/1999

17 Claims, 35 Drawing Sheets



U.S. PATENT DOCUMENTS

5,588,060	A	12/1996	Aziz	
5,689,566	A	11/1997	Nguyen	
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.	
5,878,231	A *	3/1999	Baehr et al.	709/243
5,892,903	A	4/1999	Klaus	
5,898,830	A *	4/1999	Wesinger et al.	709/225
5,905,859	A	5/1999	Holloway et al.	
6,006,259	A	12/1999	Adelman et al.	
6,016,318	A *	1/2000	Tomoike	370/338
6,052,788	A	4/2000	Wesinger, Jr. et al.	
6,079,020	A *	6/2000	Liu	713/201
6,119,171	A	9/2000	Alkhatib	
6,178,505	B1 *	1/2001	Schneider et al.	713/168
6,226,751	B1 *	5/2001	Arrow et al.	370/351
6,243,749	B1	6/2001	Sitaraman et al.	
6,286,047	B1 *	9/2001	Ramanathan et al.	345/733
6,330,562	B1 *	12/2001	Boden et al.	707/10
6,332,158	B1 *	12/2001	Risley et al.	709/219
6,353,614	B1 *	3/2002	Borella et al.	370/389

OTHER PUBLICATIONS

Linux FreeS/WAN Index File, printed from http://liberty.freeswan.org/freeswan_trees/freeswan-1.3/doc/ on Feb. 21, 2002, 3 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.

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.

Alan O. Frier et al., "The SSL Protocol Version 3.0", Nov. 18, 1996, printed from <http://www.netscape.com/eng/ss13/draft302.txt> on Feb. 4, 2002, 56 pages.

Reiter, Michael K. and Rubin, Aviel D. (AT&T Labs—Research), "Crowds: Anonymity for Web Transactions", pp. 1–23.

Dolev, Shlomi and Ostrovsky, Rafail, "Efficient Anonymous Multicast and Reception" (Extended Abstract), 16 pages.

Rubin, Aviel D., Geer, Daniel, and Ranum, Marcus J. (Wiley Computer Publishing), "Web Security Sourcebook", pp. 82–94.

Shree Murthy et al., "Congestion-Oriented Shortest Multi-path 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.

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

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

Donald E. Eastlake, "Domain Name System Security Extensions", DNS Security Working Group, Apr. 1998, 51 pages.

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. 399–400.

W. Stallings, "New Cryptography and Network Security Book", Jun. 8, 1998, 3 pages.

* cited by examiner

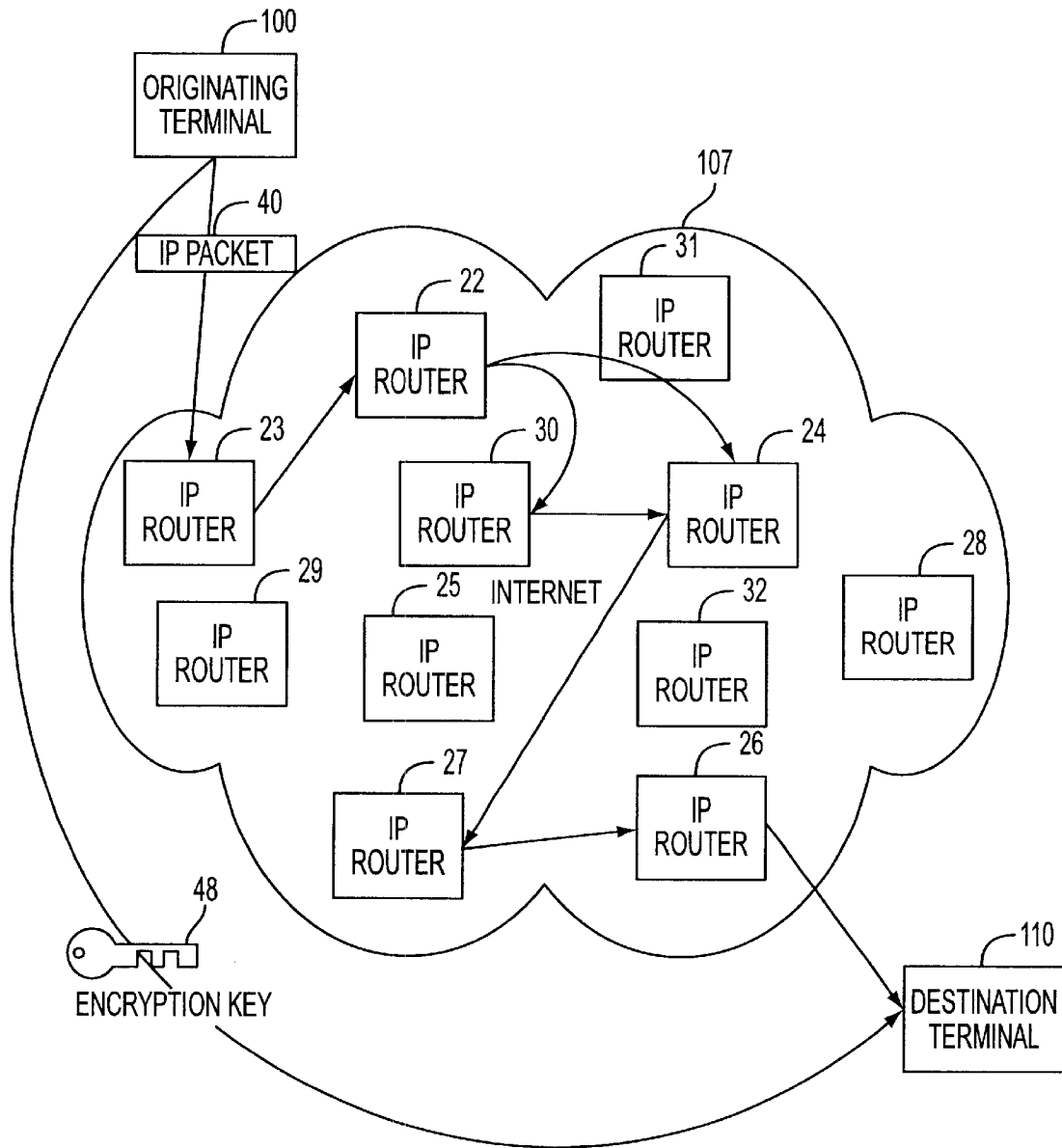


FIG. 1

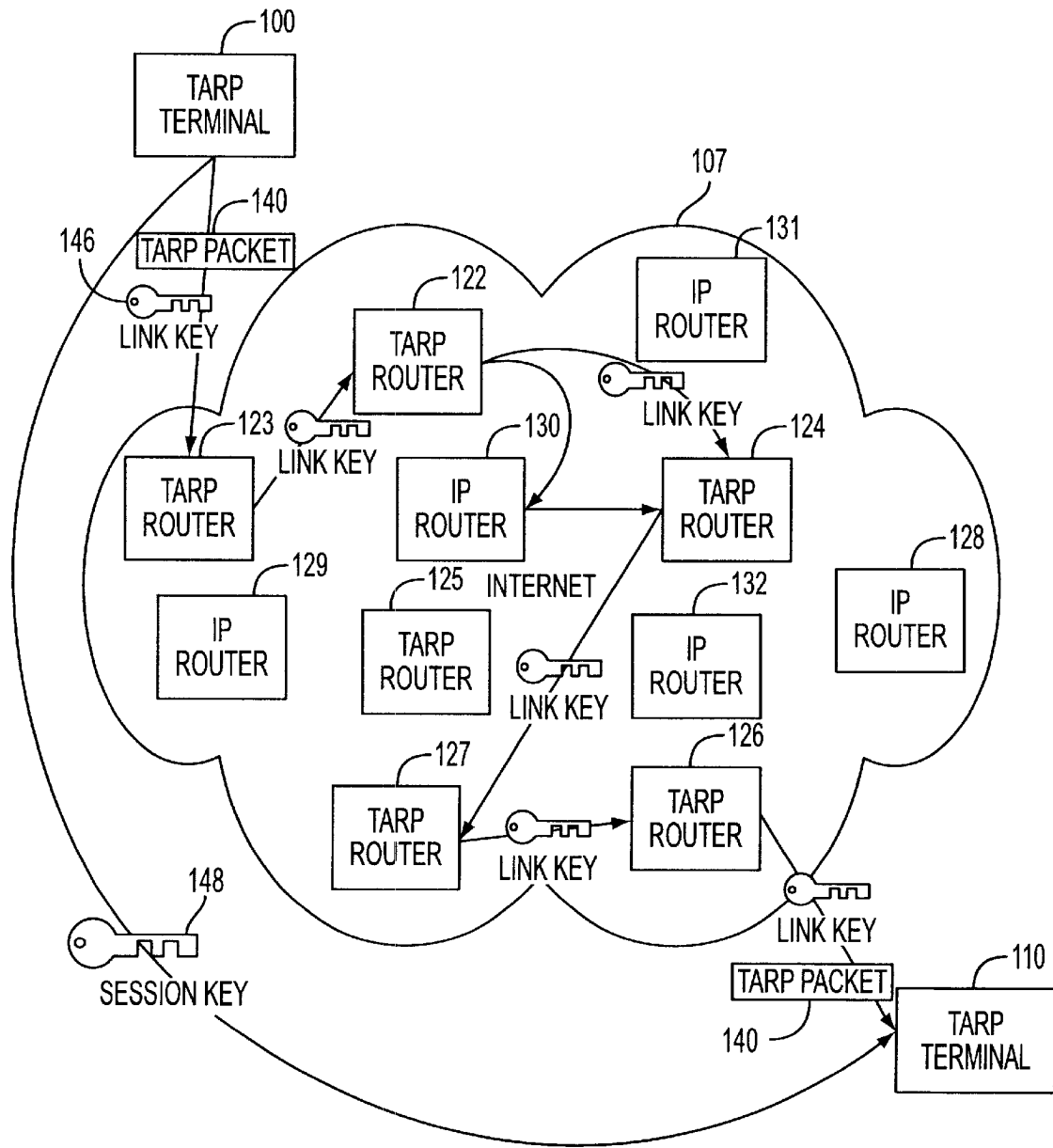


FIG. 2

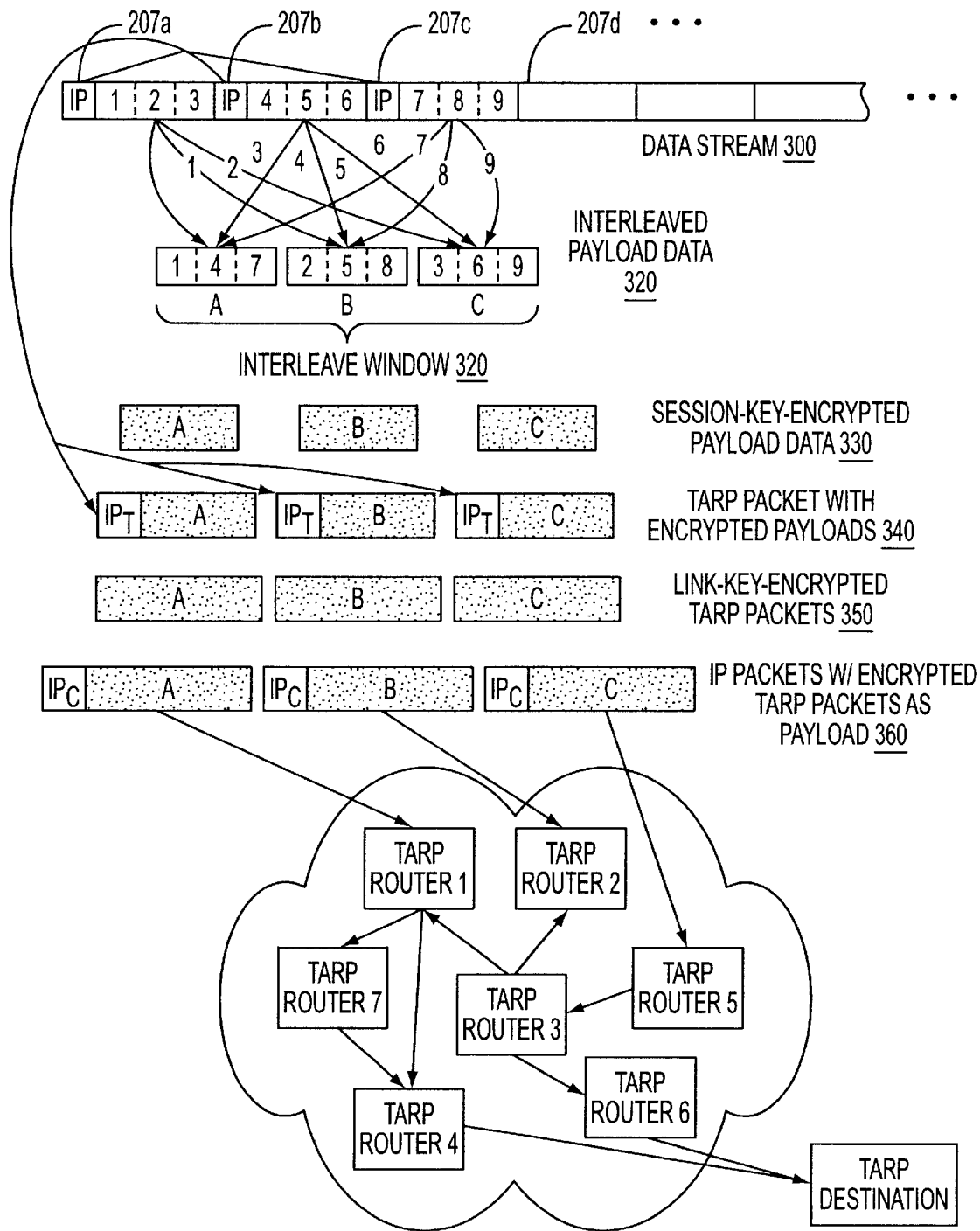


FIG. 3A

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.