



US006934256B1

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

(10) **Patent No.:** **US 6,934,256 B1**
(45) **Date of Patent:** **Aug. 23, 2005**

(54) **METHOD OF DETECTING
NON-RESPONSIVE NETWORK FLOWS**

(75) Inventors: **Van Jacobson**, Woodside, CA (US); **Li Fan**, San Jose, CA (US); **Kathleen Nichols**, Woodside, CA (US)

(73) Assignee: **Cisco Technology, Inc.**, San Jose, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 916 days.

(21) Appl. No.: **09/769,544**

(22) Filed: **Jan. 25, 2001**

(51) **Int. Cl.**⁷ **H04L 12/26**

(52) **U.S. Cl.** **370/235; 370/235.1**

(58) **Field of Search** **370/235, 235.1, 370/236, 401, 412**

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,646,988 B1 * 11/2003 Nandy et al. 370/235
6,690,645 B1 * 2/2004 Aweya et al. 370/230
2002/0089930 A1 * 7/2002 Aceves et al. 370/230

OTHER PUBLICATIONS

Sally Floyd and Van Jacobson Random Early Detection Gateways for Congestion Avoidance Aug., 1993 pp. 1-22.
V. Jacobson, K. Nichols, K. Poduri Cisco Systems RED in a Different Light Sep. 30, 1999 pp. 1-38.
Van Jacobson Notes on using RED for Queue Management and Congestion Avoidance Jun. 8, 1998.

* cited by examiner

Primary Examiner—Kenneth Vanderpuye

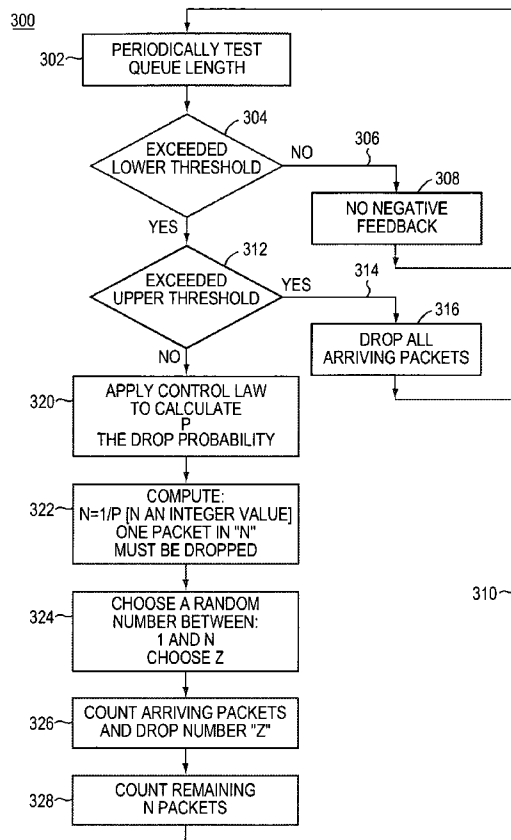
Assistant Examiner—Rhonda Murphy

(74) *Attorney, Agent, or Firm*—Cesari and McKenna, LLP

(57) **ABSTRACT**

A network device identifies a non-adaptive flow as follows. The network device drops packets on a random basis using a Random Early Detection (RED) algorithm. A classifier reads indicia of a selected flow from at least one field of a header of a packet received by the network device. The network device calculates a drop interval for packets of the selected flow dropped by the RED algorithm, in response to a time at which the packets were dropped. The network device then applies a statistical test to drop intervals of a plurality of flows in order to identify the non-adaptive flow.

20 Claims, 15 Drawing Sheets



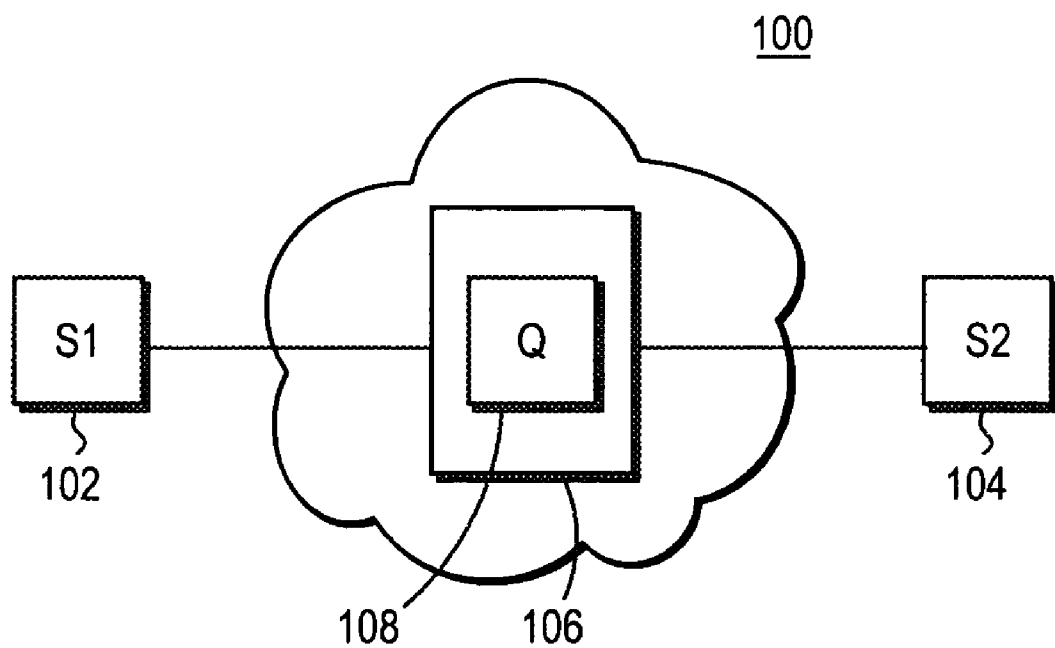


FIG. 1

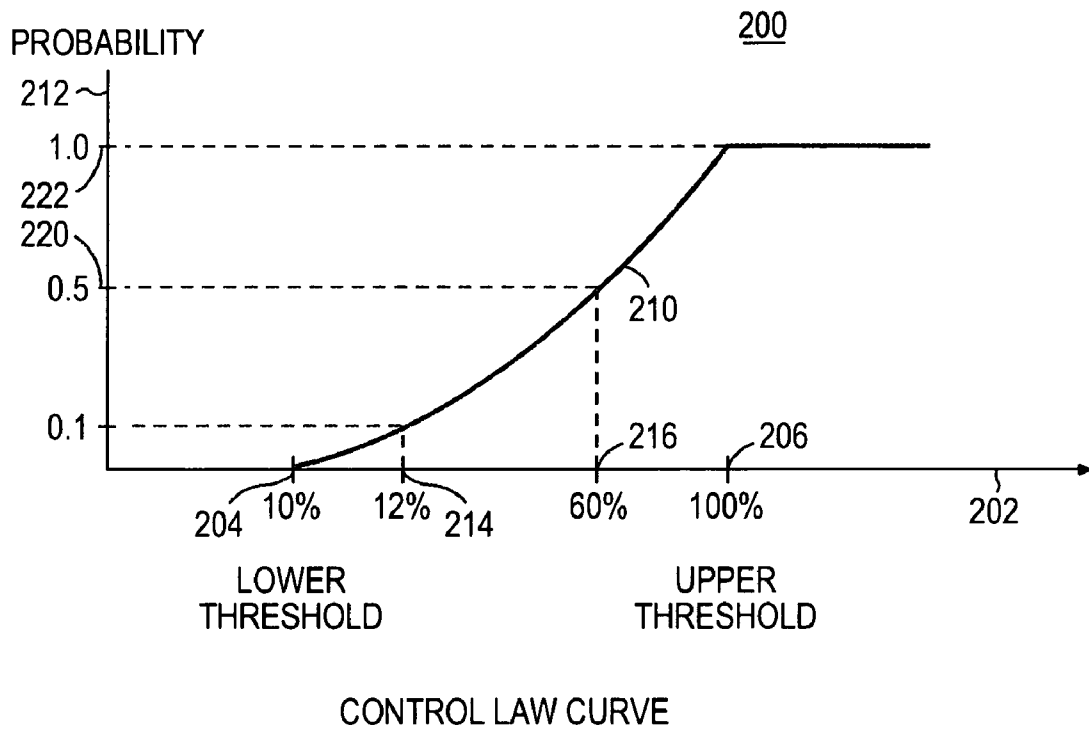


FIG. 2

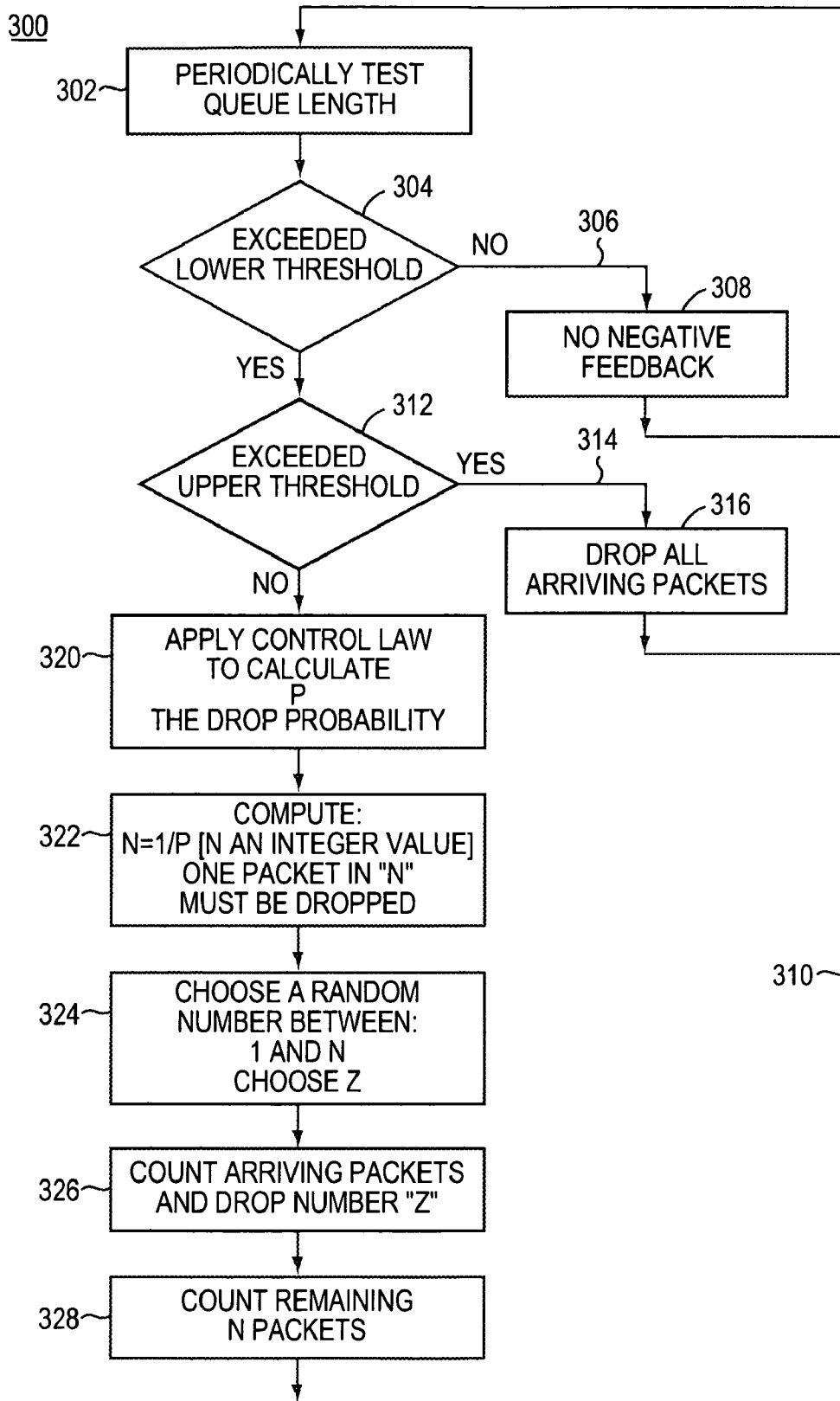


FIG. 3

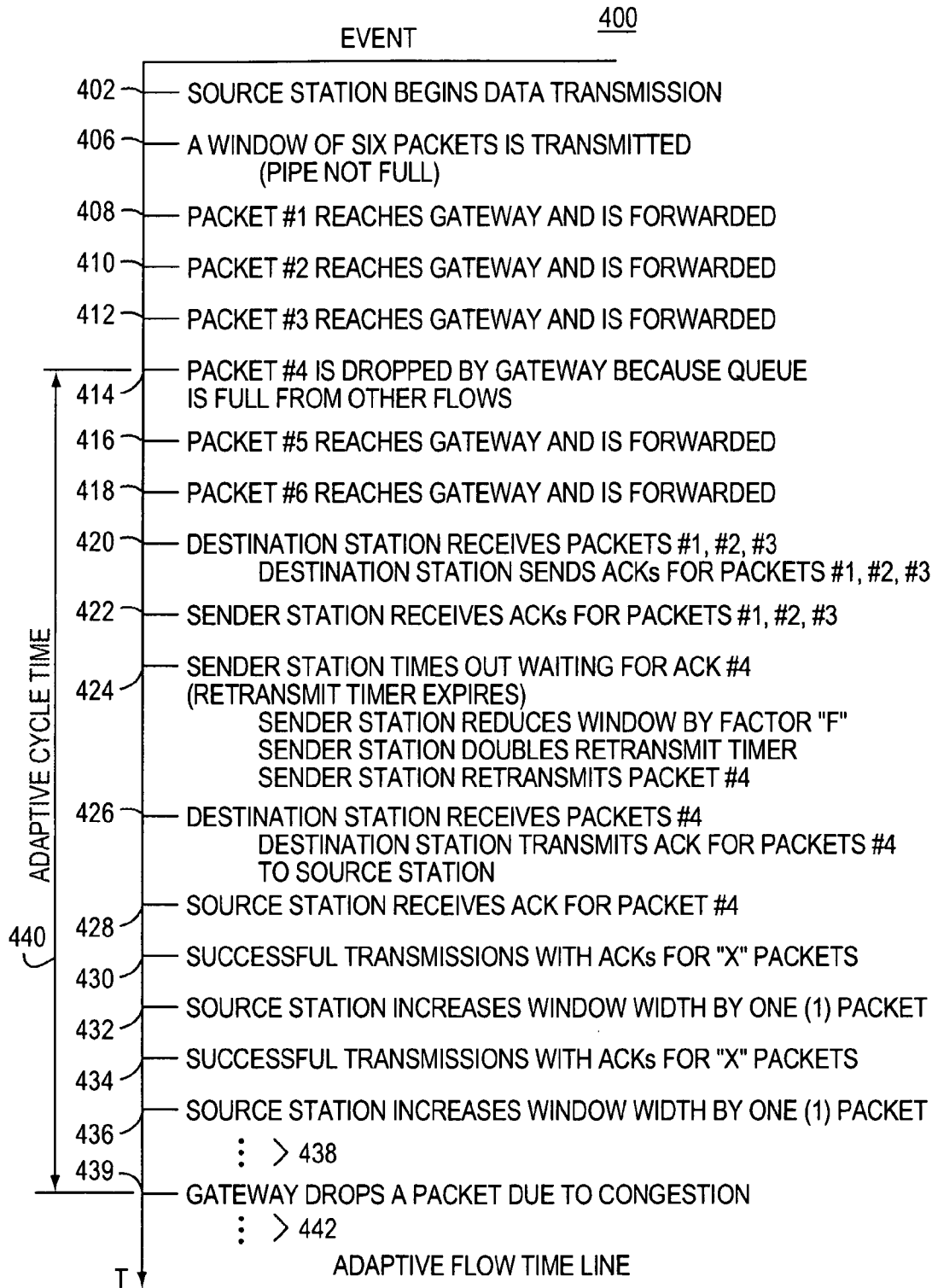


FIG. 4

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.