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Jacobson et al.

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

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

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(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

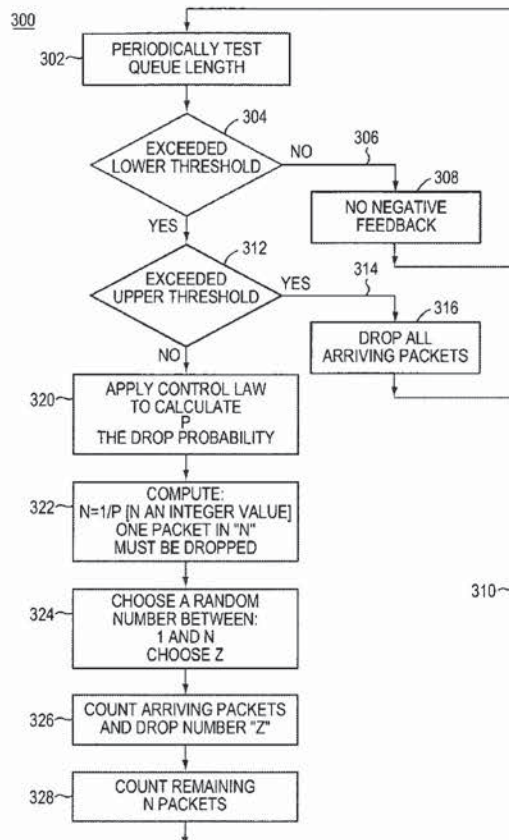
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(57) **ABSTRACT**

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



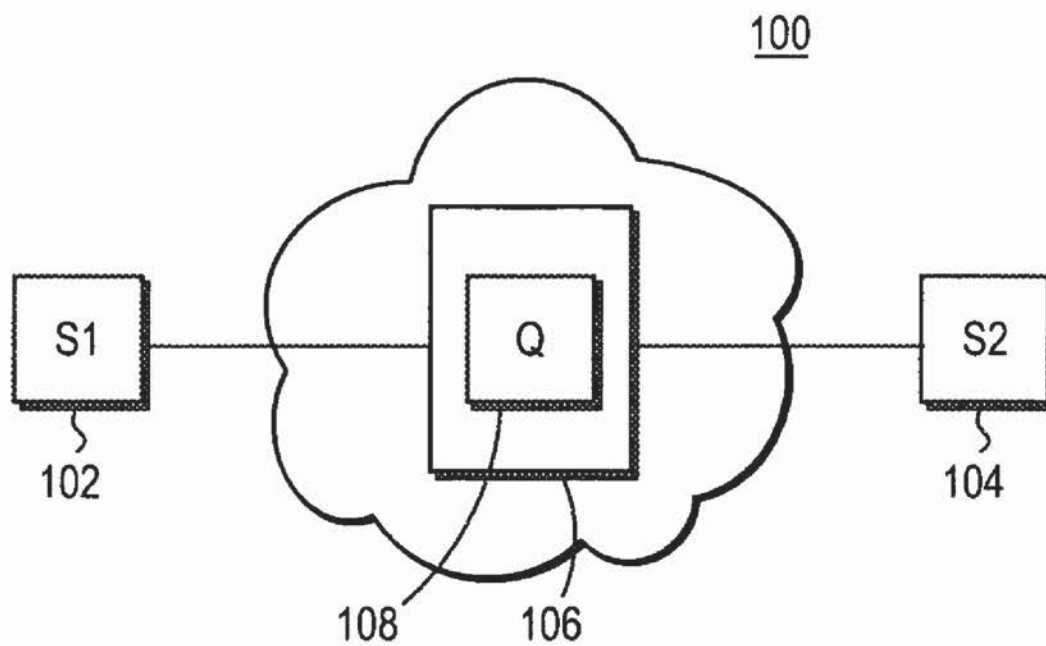


FIG. 1

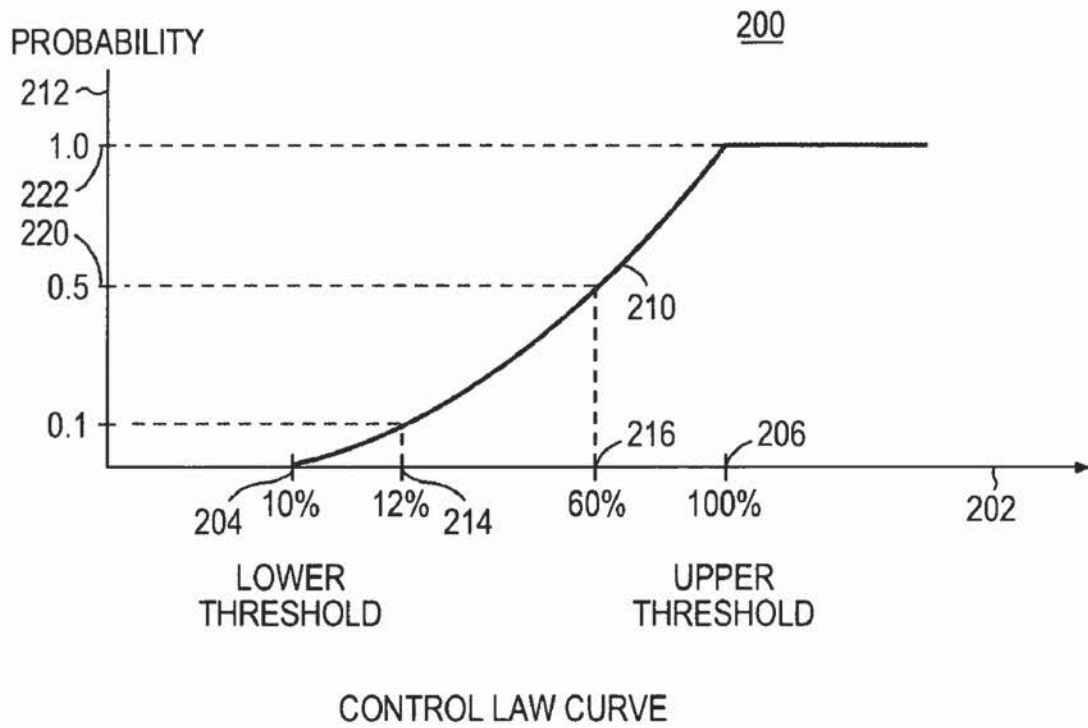


FIG. 2

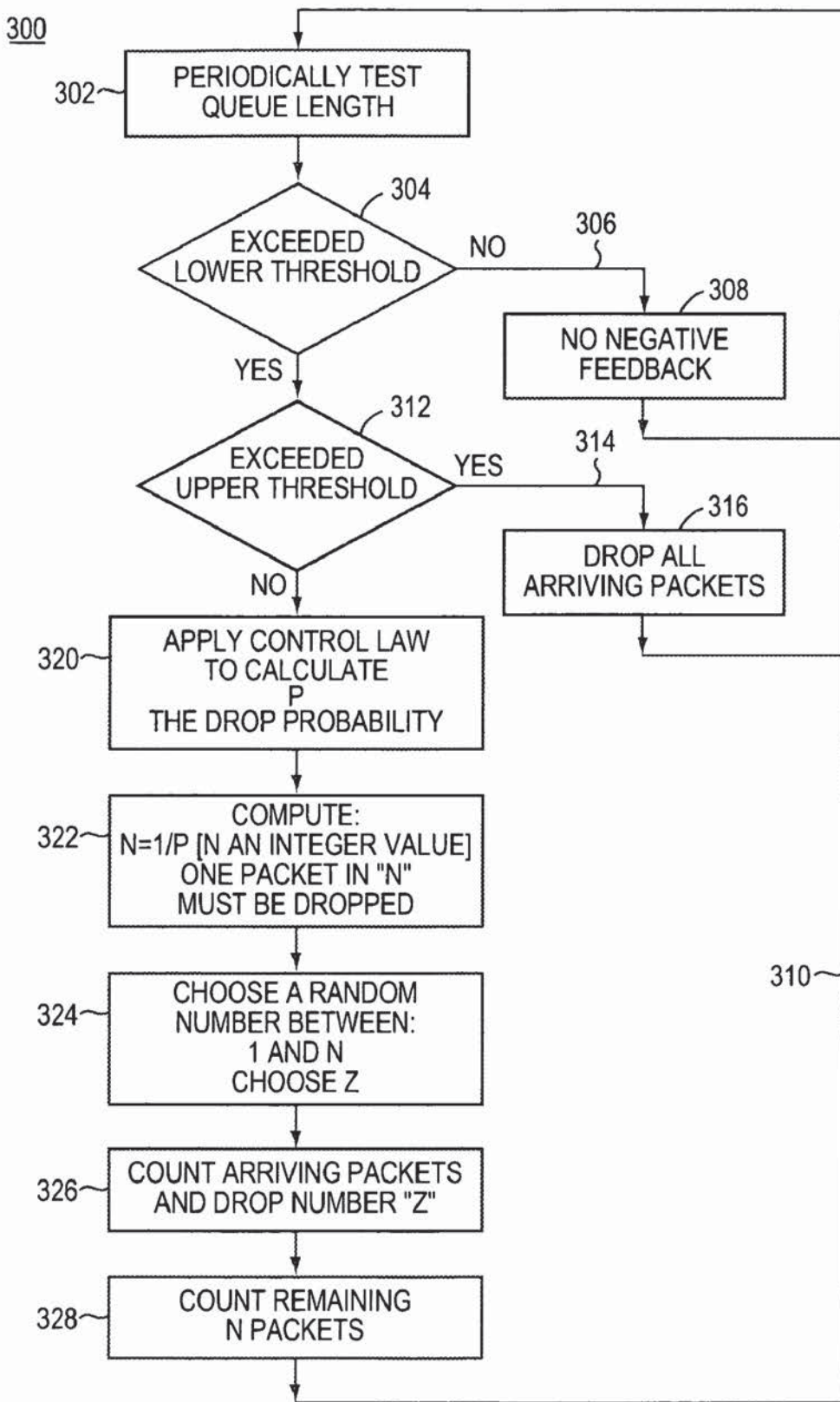


FIG. 3

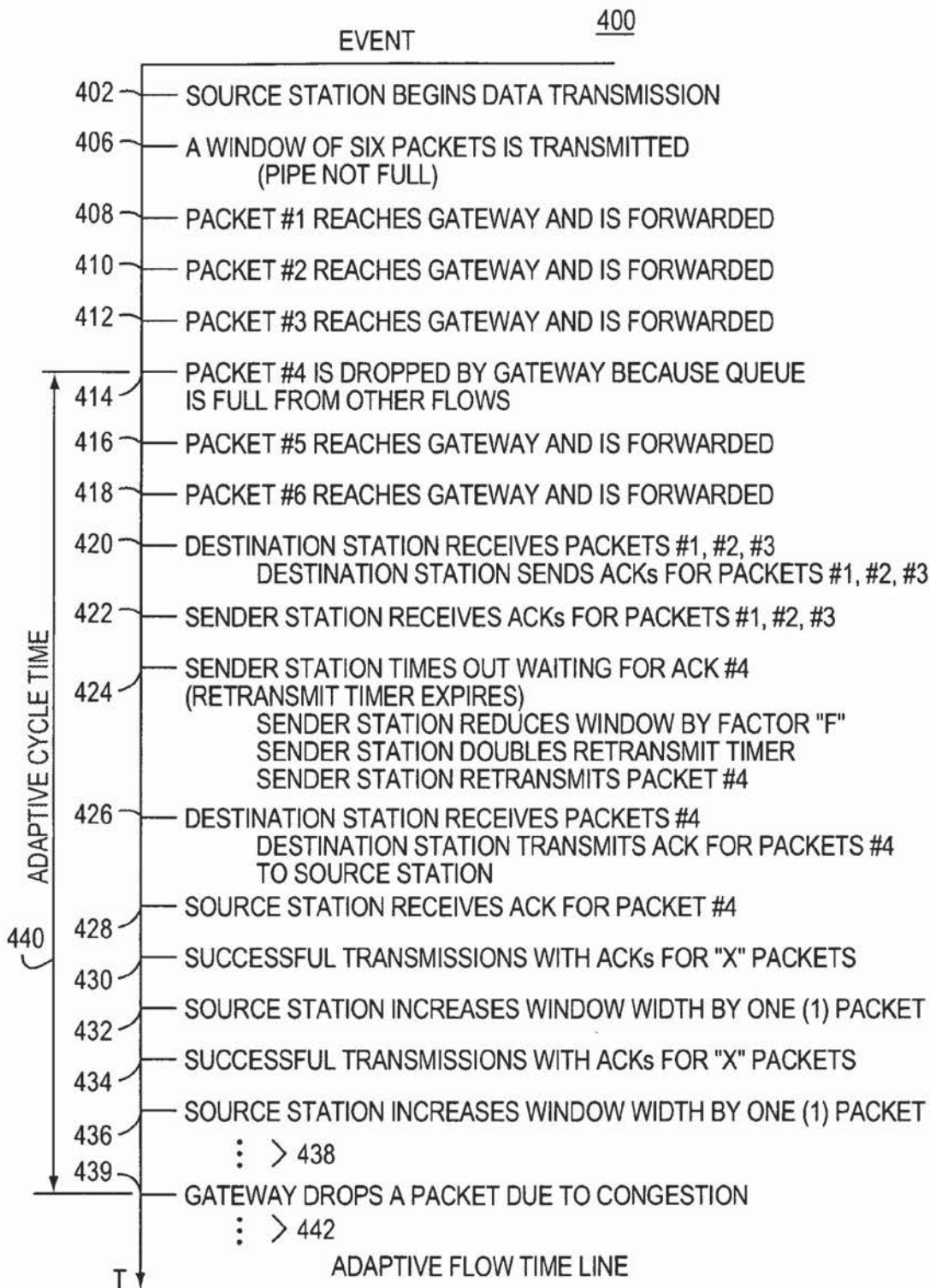


FIG. 4

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