IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF GEORGIA
ATLANTA DIVISION

PACSEC3, LLC, **Plaintiff,**	**Civil Action No. _____**
v.	
BEYONDTRUST CORP., **Defendant**	**JURY TRIAL DEMANDED**

PLAINTIFF'S ORIGINAL COMPLAINT

Plaintiff, PacSec3, LLC, ("PacSec3") files this Original Complaint and demand for jury trial seeking relief from patent infringement of the claims of US Patent No. 7,523,497 ("the '497 Patent" or the "Patent-in-Suit") by BeyondTrust Corp. ("BeyondTrust" or "Defendant").

I. THE PARTIES

1. Plaintiff PacSec3, LLC is a Texas Limited Liability Company with its principal place of business located at 5900 Balcones Dr. Ste. 100, Austin, Texas 78731-4298.

2. On information and belief, Defendant is a corporation organized and existing under the laws Delaware. Defendant has a place of business at 11695 Johns Creek Pkwy, Ste. 200, Johns Creek, Georgia 30097. On information and belief, Defendant sells and offers to sell products and services throughout the United States, including in this judicial district, and introduces products and services that perform infringing methods or processes into the stream of commerce knowing that they would be sold in this judicial district. Defendant can be served through its registered agent, CT Corporation System, 289 Culver Street, Lawrenceville, Georgia 30046-4805, at its place of business, or anywhere else it may be found.

II. JURISDICTION AND VENUE

3. This civil action arises under the Patent Laws of the United States, 35 U.S.C. § 1 *et seq*., including without limitation 35 U.S.C. §§ 271, 281, 283, 284, and 285 based on Defendant's unauthorized commercial manufacture, use, importation, offer for sale, and sale of the Accused Products in the United States. This is a patent infringement lawsuit over which this Court has subject matter jurisdiction under, *inter alia*, 28 U.S.C. §§ 1331, 1332, and 1338(a).

4. This United States District Court for the District Northern District of Georgia Atlanta Division has general and specific personal jurisdiction over Defendant because, directly or through intermediaries, Defendant has committed acts within the District giving rise to this action and are present in and transact and conduct business in and with residents of this District and other Districts through out the United States.

5. Plaintiff's causes of action arise, at least in part, from Defendant's contacts with, and activities in this District.

6. Defendant has committed acts of infringing the patents-in-suit within this District by making, using, selling, offering for sale, and/or importing in or into this District and elsewhere, products claimed by the patents-in-suit, including without limitation products made by practicing the claimed methods of the patents-in-suit. Defendant, directly and through intermediaries, makes, uses, sells, offers for sale, imports, ships, distributes, advertises, promotes, and/or otherwise commercializes such infringing products into this District others. Defendant regularly conducts and solicits business in, engages in other persistent courses of conduct in, and/or derives substantial revenue from goods and services provided to residents of this District and others.

7. This Court has personal jurisdiction over Defendant, in part, because Defendant does continuous and systematic business in this District, as well as having a place of business in this District, by providing infringing products and services to the residents of this District that Defendant knew would be used within this District, and by soliciting business from the residents of this District. For example, Defendant is subject to personal jurisdiction in this Court because, *inter alia*, Defendant maintains an office at 11695 Johns Creek Pkwy, Ste. 200, Johns Creek, Georgia 30097, and directly and through agents regularly does, solicits, and transacts business in this District. Also, Defendant has hired and is hiring within this District for positions that, on information and belief, relate to infringement of the patents-in-suit. Accordingly, this Court's jurisdiction over the Defendant comports with the constitutional standards of fair play and substantial justice and arises directly from the Defendant's purposeful minimum contacts with the State of Georgia.

8. Furthermore, this Court has personal jurisdiction over Defendant, because in addition to Defendant's online website and advertising within this District, Defendant has also made its products available within this judicial district and advertised to residents within the District to hire employees to be located in this District.

9. The amount in controversy exceeds $75,000 exclusive of interests and costs.

10. Venue is proper in this Court under 28 U.S.C. § 1400(b) based on information set forth herein, which is hereby repeated and incorporated by reference. Further, upon information and belief, Defendant has committed or induced acts of infringement, and/or advertise, market, sell, and/or offer to sell products, including infringing products, in this District. In addition, and

without limitation, Defendant has regular and established places of business throughout this District, including at least at 11695 Johns Creek Pkwy, Ste. 200, Johns Creek, Georgia 30097.

III. INFRINGEMENT

A. Infringement of the '497 Patent

11. Plaintiff incorporates by reference paragraphs 1-10 as if fully presented herein.

12. On 2009, U.S. Patent No. 7,523,497 ("the '497 patent", included as **EXHIBIT A**) entitled "PACKET FLOODING DEFENSE SYSTEM," was duly and legally issued by the U.S. Patent and Trademark Office. PacSec3, LLC owns the '497 Patent by assignment.

13. The '497 patent relates to a novel and improved manner and system of defense to a data packet flood attack.

14. Defendant offers for sale, sells and manufactures one or more firewall systems that infringes one or more claims of the '497 Patent, including one or more of claims 7 and 10, literally or under the doctrine of equivalents. Defendant put the inventions claimed by the '497 Patent into service, i.e., used them, and; but for Defendant's actions, the claimed-inventions embodiments involving Defendant's products and services would never have been put into service. Defendant's acts complained of herein caused those claimed-invention embodiments as a whole to perform, and Defendant's procurement of monetary and commercial benefit from it.

15. Support for the allegations of infringement may be found in **Exhibit B**, a claim chart for claim 10, provided herewith.

16. Defendant has and continues to induce infringement. Defendant has actively encouraged or instructed others, e.g., its customers and/or the customers of its related companies, and continues to do so, on how to use its products and services e.g., BeyondTrust, and related

services that provide services across the Internet such as to cause infringement of one or more of claims 7 and 10 of the '497 patent, literally or under the doctrine of equivalents. Moreover, Defendant has known of the '497 patent and the technology underlying it from at least the filing date of the lawsuit.[1] For clarity, direct infringement is previously alleged in this complaint.

17. Defendant has and continues to contributorily infringe. Defendant has actively encouraged or instructed others (e.g., its customers and/or the customers of its related companies), and continues to do so, on how to use its products and services and related services that provide question and answer services across the Internet such as to cause infringement of one or more of claims 7 and 10 of the '497 patent, literally or under the doctrine of equivalents. Further, there are no substantial noninfringing uses for Defendant's products and services. Moreover, Defendant has known of the '497 patent and the technology underlying it from at least the filing date of the lawsuit. [2] For clarity, direct infringement is previously alleged in this complaint.

18. On information and belief, Defendant's infringement of the '497 Patent has been willful and merits increased damages.

19. On information and belief, Defendant has made no attempt to design around the claims of the '497 Patent.

20. On information and belief, Defendant did not have a reasonable basis for believing that the claims of the '497 Patent were invalid.

21. On information and belief, Defendant's Accused Products are available to businesses and individuals throughout the United States and including in this District.

22. Plaintiff has been damaged as the result of Defendant's infringement.

[1] Plaintiff reserves the right to amend if discovery reveals an earlier date of knowledge.
[2] Plaintiff reserves the right to amend if discovery reveals an earlier date of knowledge.

23. The claim chart attached hereto as **Exhibit B** describes how the elements of an exemplary claim from the '497 Patent are infringed by the Accused Products. This provides details regarding only one example of Defendant's infringement, and only as to a single patent claim. These allegations of infringement are preliminary and are therefore subject to change.

24. Defendant has caused and will continue to cause PacSec3 damage by direct and indirect infringement (including inducement and contributory) of the claims of the '497 Patent

IV. CONDITIONS PRECEDENT

Plaintiff is a non-practicing entity, with no products to mark. Plaintiff has pled all statutory requirements to obtain pre-suit damages. Further, all conditions precedent to recovery are met.

V. JURY DEMAND

25. Plaintiff hereby requests a trial by jury on issues so triable by right.

VI. PRAYER FOR RELIEF

WHEREFORE, PacSec3 prays for relief as follows:

a. enter judgment that Defendant has infringed the claims of the '497 patent through selling, offering for sale, manufacturing, and inducing others to infringe by using and instructing to use Defendant's products;

b. award PacSec3 damages in an amount sufficient to compensate it for Defendant's infringement of the Patent-in-Suit in an amount no less than a reasonable royalty or lost profits, together with pre-judgment and post-judgment interest and costs under 35 U.S.C. § 284;

c. award PacSec3 an accounting for acts of infringement not presented at trial and an award by the Court of additional damage for any such acts of infringement;

d. declare this case to be "exceptional" under 35 U.S.C. § 285 and award PacSec3 its attorneys' fees, expenses, and costs incurred in this action;

e. declare Defendant's infringement to be willful and treble the damages, including attorneys' fees, expenses, and costs incurred in this action and an increase in the damage award pursuant to 35 U.S.C. § 284;

f. a decree addressing future infringement that either (if) awards a permanent injunction enjoining Defendant and its agents, servants, employees, affiliates, divisions, and subsidiaries, and those in association with Defendant from infringing the claims of the Patent-in-Suit, or (ii) awards damages for future infringement in lieu of an injunction in an amount consistent with the fact that for future infringement the Defendant will be an adjudicated infringer of a valid patent, and trebles that amount in view of the fact that the future infringement will be willful as a matter of law; and

g. award PacSec3 such other and further relief as this Court deems just and proper

This 11th day of April 2024.

Respectfully submitted,

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Alexander Shunnarah Trial Attorneys, of Counsel

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Attorneys for PacSec3, LLC

EXHIBIT A

US007523497B2

(12) **United States Patent**
Cohen

(10) **Patent No.: US 7,523,497 B2**
(45) **Date of Patent: Apr. 21, 2009**

(54) PACKET FLOODING DEFENSE SYSTEM

(76) Inventor: **Donald N. Cohen**, 2815 Haddington Dr., Los Angeles, CA (US) 90064

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 719 days.

(21) Appl. No.: **10/841,064**

(22) Filed: **May 7, 2004**

(65) **Prior Publication Data**

US 2004/0230839 A1 Nov. 18, 2004

Related U.S. Application Data

(63) Continuation of application No. 09/715,813, filed on Nov. 16, 2000, now Pat. No. 6,789,190.

(51) **Int. Cl.**
G06F 11/30 (2006.01)

(52) **U.S. Cl.** **726/22**; 726/25; 709/235; 709/238; 709/239; 709/240; 370/229; 370/231; 370/235; 370/237

(58) **Field of Classification Search** 726/22
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,007,052	A *	4/1991	Flammer	370/389
5,353,353	A *	10/1994	Vijeh et al.	380/29
5,367,523	A *	11/1994	Chang et al.	370/235
5,434,860	A *	7/1995	Riddle	370/232
5,455,865	A *	10/1995	Perlman	713/153
5,581,559	A *	12/1996	Crayford et al.	370/392
5,850,515	A *	12/1998	Lo et al.	714/43
6,044,402	A *	3/2000	Jacobson et al.	709/225
6,088,804	A *	7/2000	Hill et al.	726/25
6,412,000	B1 *	6/2002	Riddle et al.	709/224
2002/0032871	A1 *	3/2002	Malan et al.	713/201

OTHER PUBLICATIONS

Yaar, A., et al, 'StackPi: New Packet Marking and Filtering Mechanisms for DDoS and IP Spoofing Defense', IEEE Journal on Selected Areas in Communications, vol. 24, No. 10, Oct. 2006, entire document, http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=01705617.*

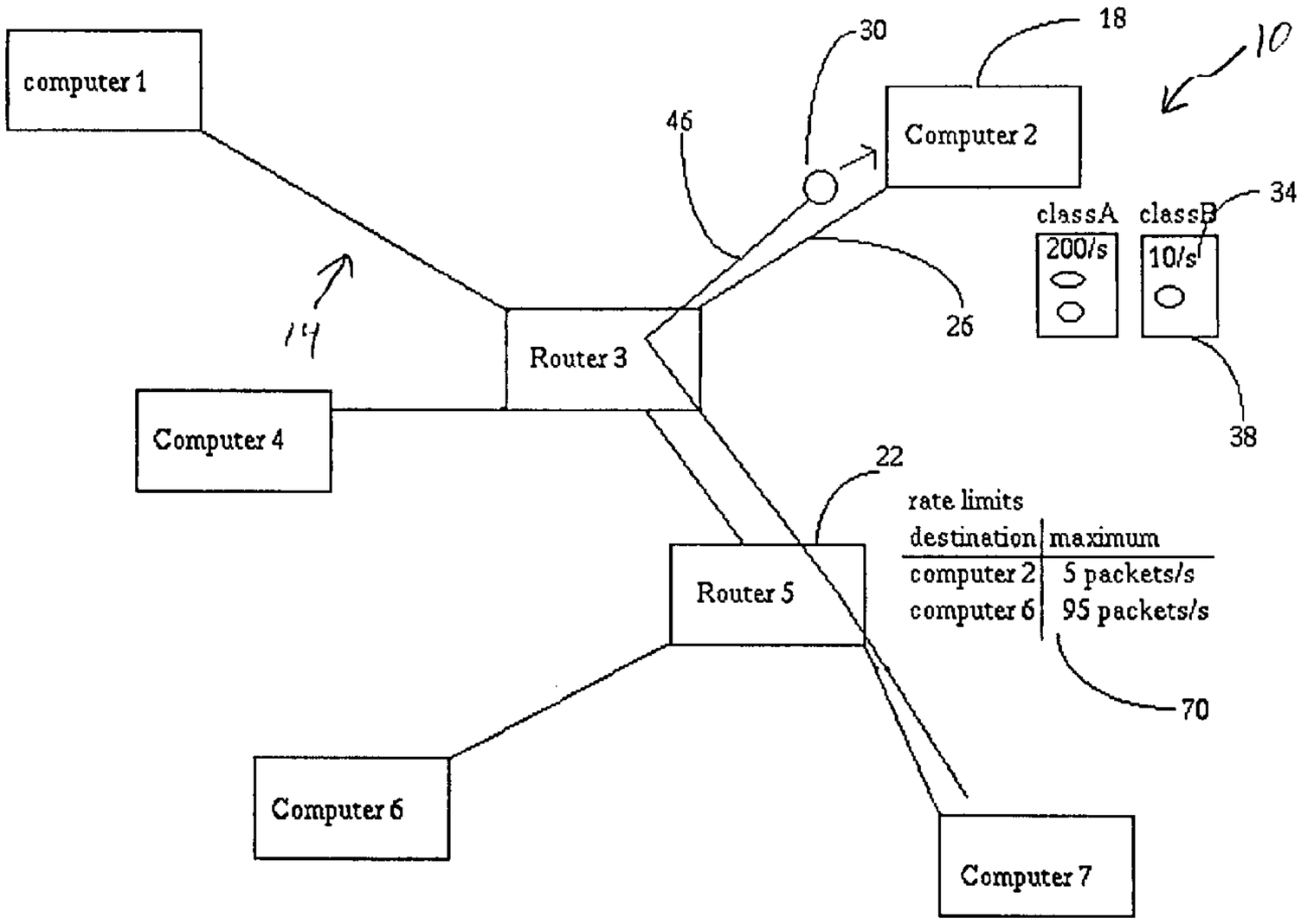
* cited by examiner

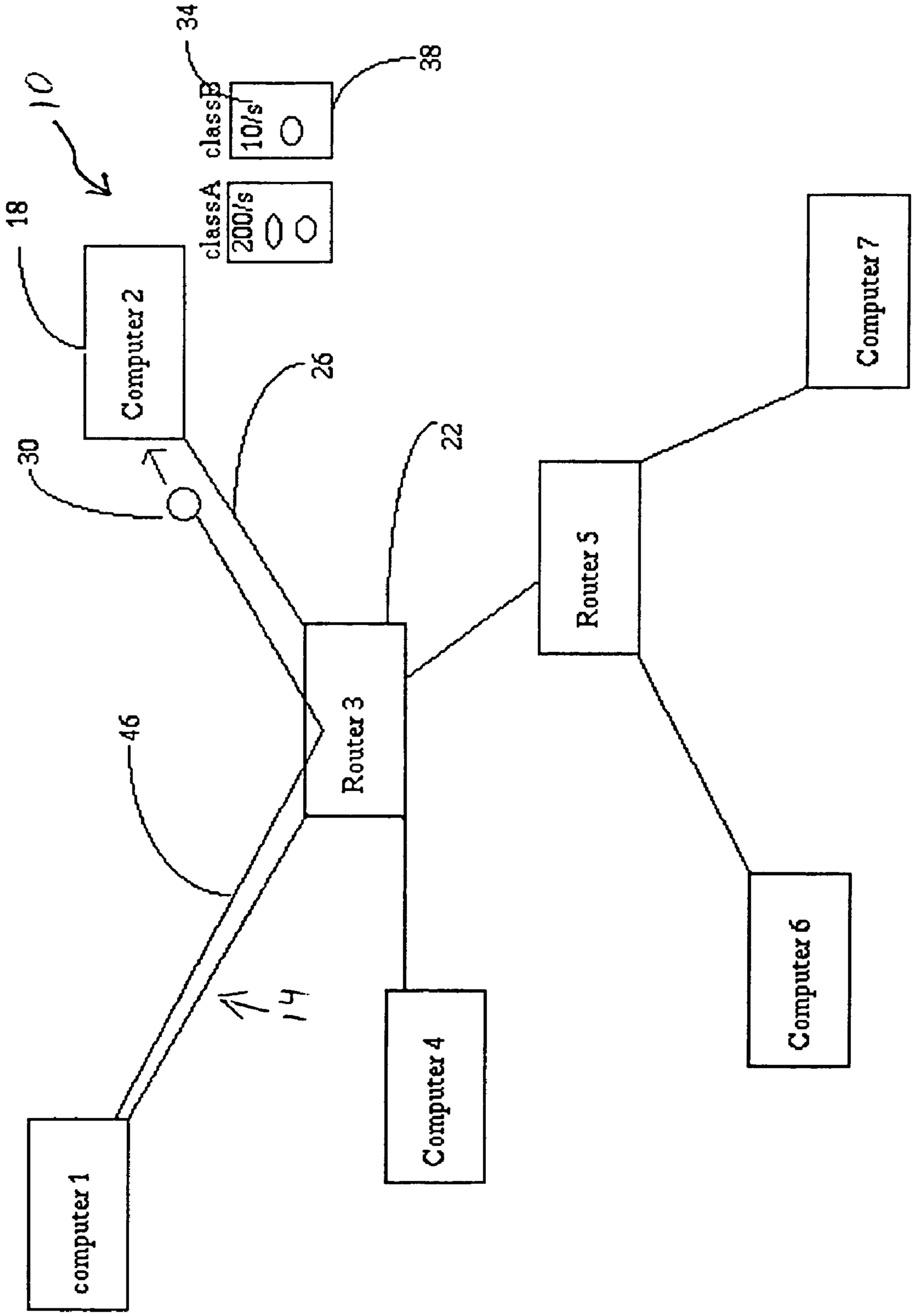
Primary Examiner—Kambiz Zand
Assistant Examiner—Ronald Baum
(74) *Attorney, Agent, or Firm*—David A. Belasco; Belasco Jacobs & Townsley, LLP

(57) **ABSTRACT**

The invention prevents "packet flooding", where an attacker uses up all available bandwidth to a victim with useless data. It can also be used to prevent some other related denial of service attacks. The defense is distributed among cooperating sites and routers. The sites identify data they don't want. The routers help sites to determine which routers forward that data. The sites then ask these routers to reduce the rate at which such data is forwarded. Variations of the defense protect against packet flooding attacks on routers and attacks in which an attacker tries to use up some service offered by a site.

18 Claims, 9 Drawing Sheets

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18
Computer 2
34
classB
10/s
38
classA
200/s
26
30
22
Router 5
Computer 7
Router 3
46
14
Computer 4
Computer 6
computer 1

Figure 1

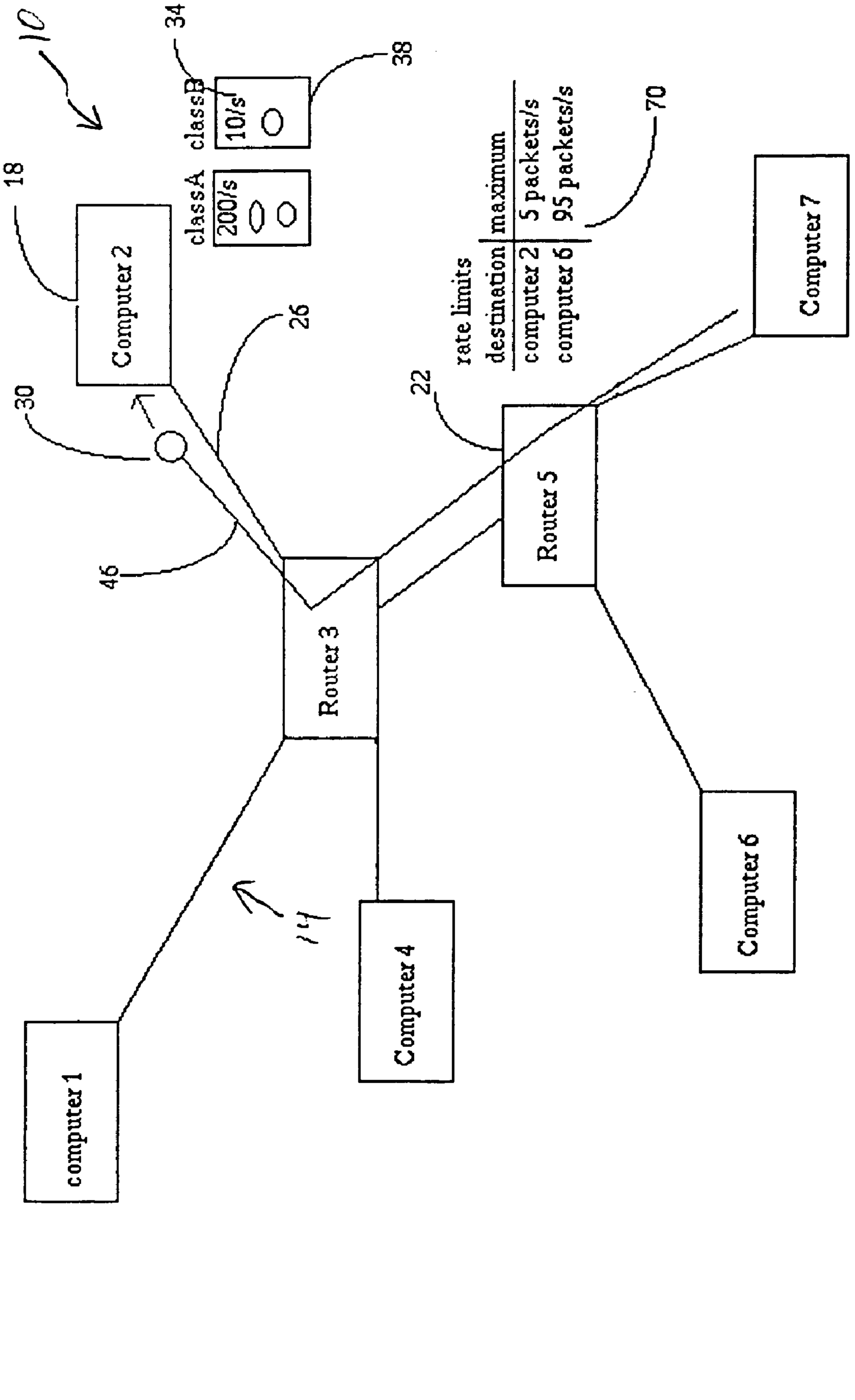

10
18
Computer 2
34
classB
10/s
38
classA
200/s
26
30
46
Router 3
22
Router 5
rate limits
destination
maximum
computer 2
5 packets/s
computer 6
95 packets/s
70
Computer 7
Computer 6
computer 1
Computer 4

Figure 2

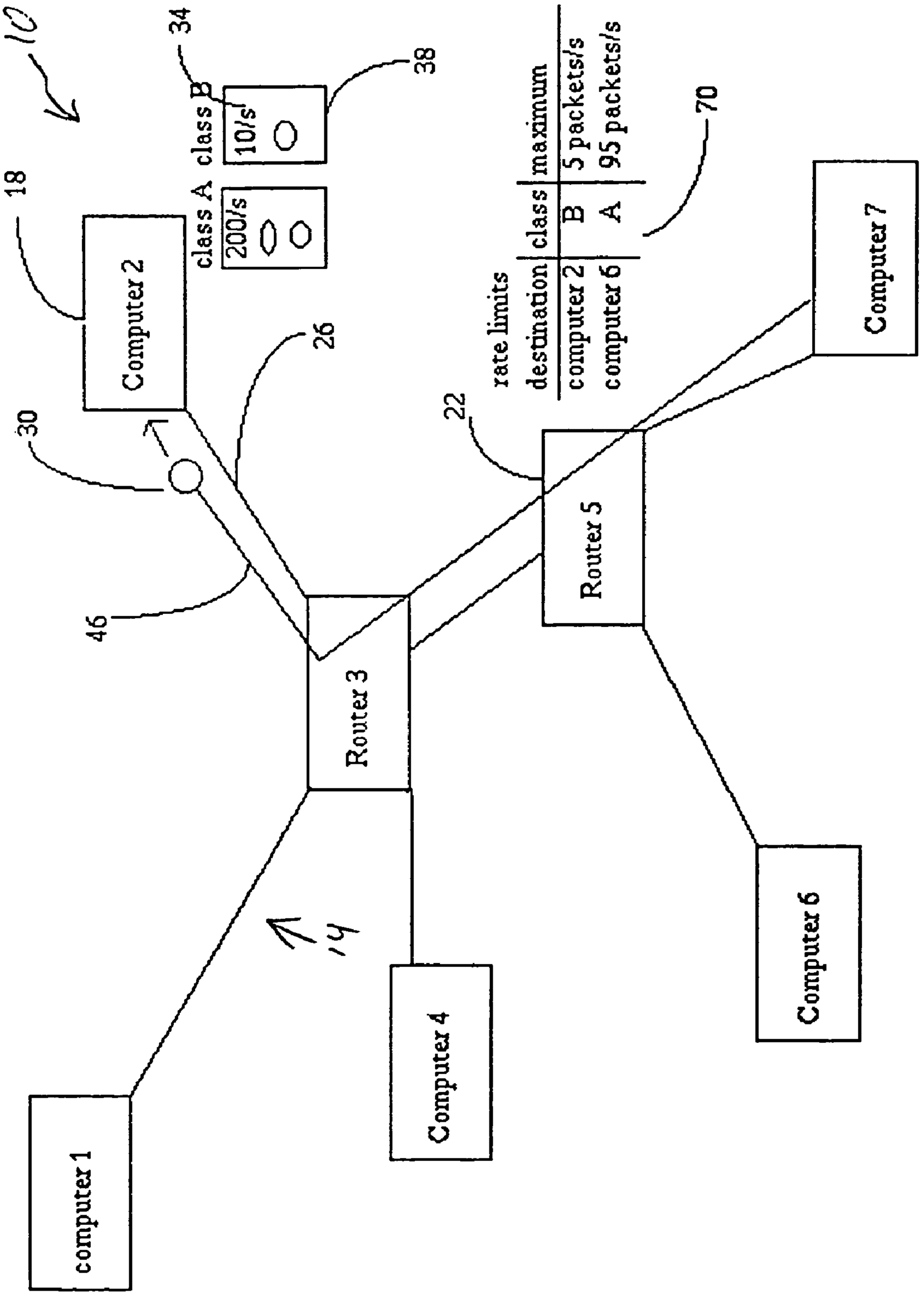
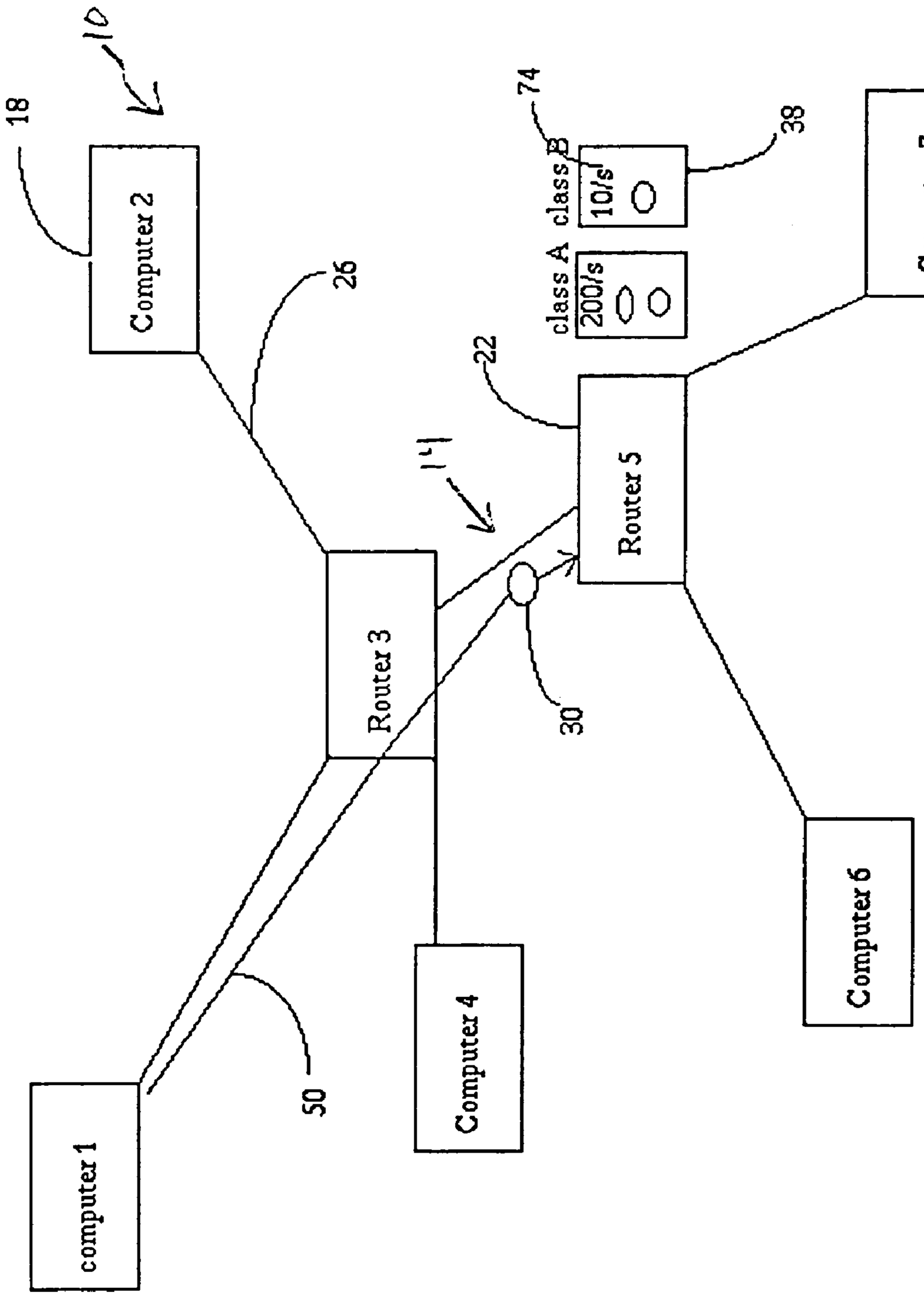

10
18
Computer 2
class A
200/s
class B
10/s
34
38
26
30
46
Router 3
Router 5
22
14
rate limits
destination
class
maximum
computer 2
B
5 packets/s
computer 6
A
95 packets/s
70
Computer 7
computer 1
Computer 4
Computer 6

Figure 3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18
Computer 2
25
74
class B
10/s
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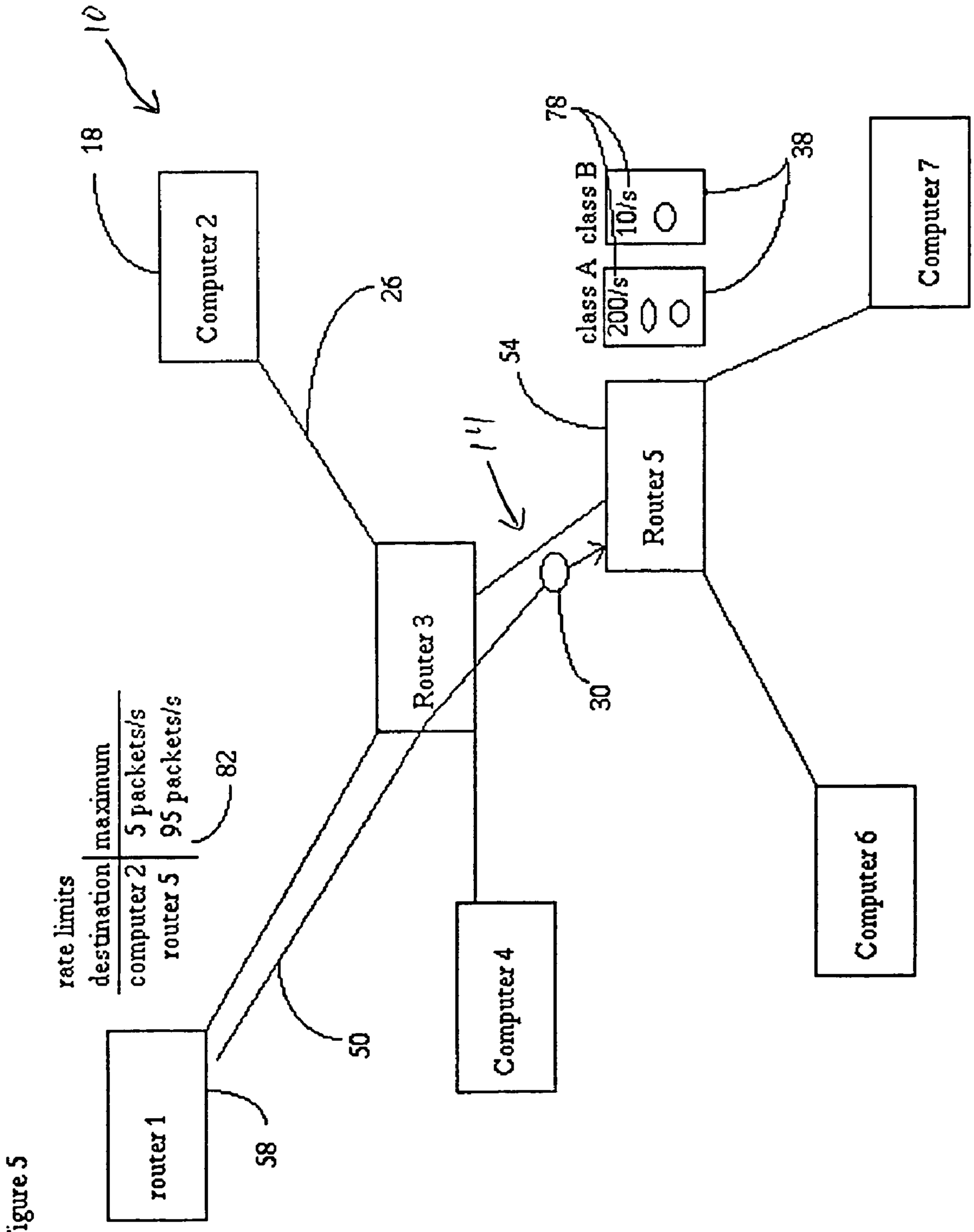
class A
200/s
Computer 7
22
14
Router 5
Router 3
30
Router 6
Computer 4
50
computer 1

Figure 4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18
Computer 2
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class A
class B
200/s
10/s
38
Computer 7
54
11
Router 5
Router 3
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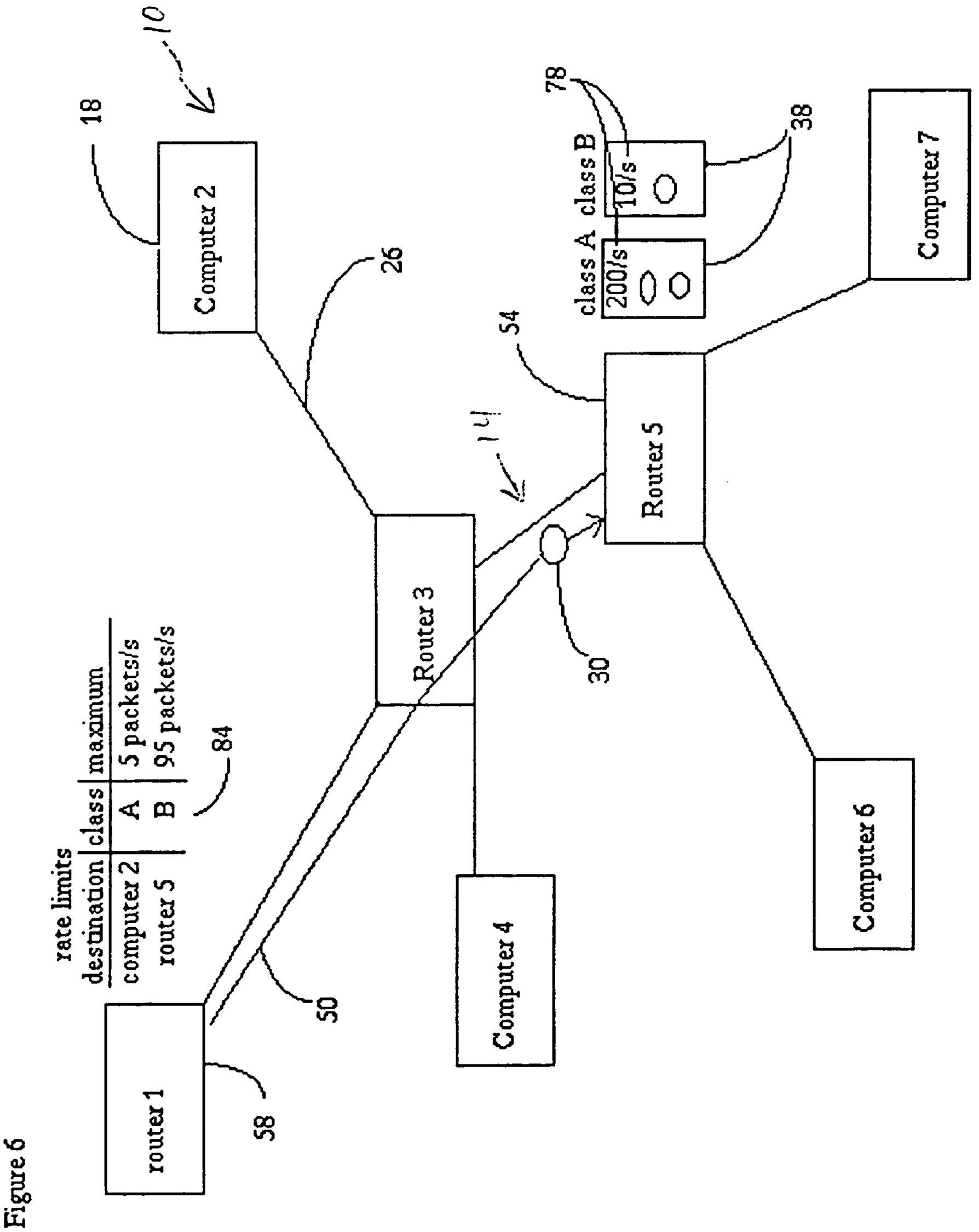
rate limits
destination
maximum
computer 2
5 packets/s
router 5
95 packets/s
82
Computer 6
router 1
58
50
Computer 4

Figure 5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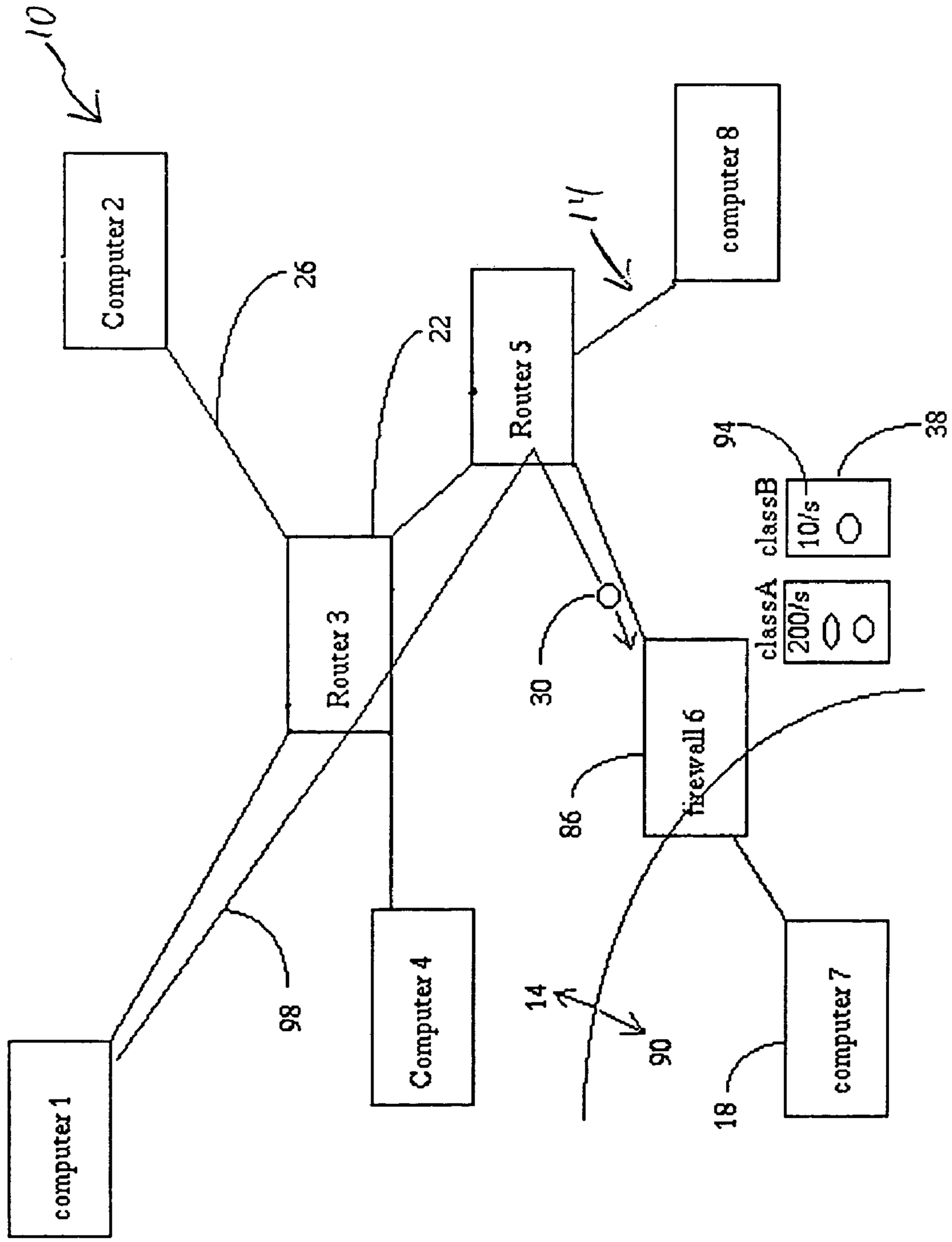
18
Computer 2
26
78
class B
10/s
38
class A
200/s
Computer 7
54
14
Router 5
Router 3
30
Computer 4
Computer 6
rate limits
destination
class
maximum
computer 2
A
5 packets/s
router 5
B
95 packets/s
84
router 1
58
50

Figure 6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Computer 2
26
22
Router 5
94
38
classB
10/s
classA
200/s
30
Router 3
86
firewall 6
98
Computer 4
14
90
18
computer 7
computer 1

Figure 7

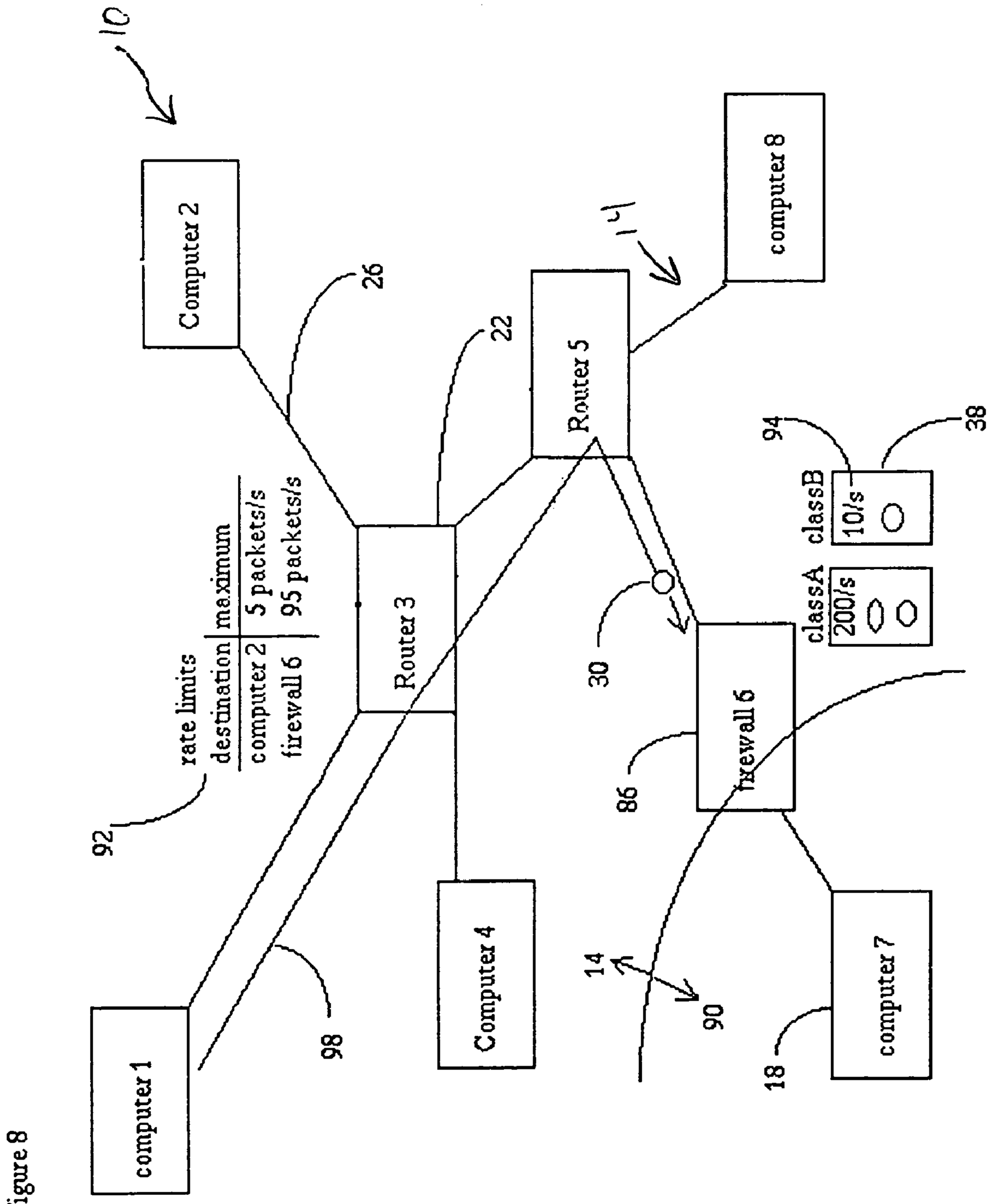
10
Computer 2
26
22
Router 5
14
computer 8
rate limits
destination | maximum
computer 2 | 5 packets/s
firewall 6 | 95 packets/s
92
Router 3
30
94
classB
10/s
38
classA
200/s
86
firewall 6
Computer 4
14
90
18
computer 7
98
computer 1

Figure 8

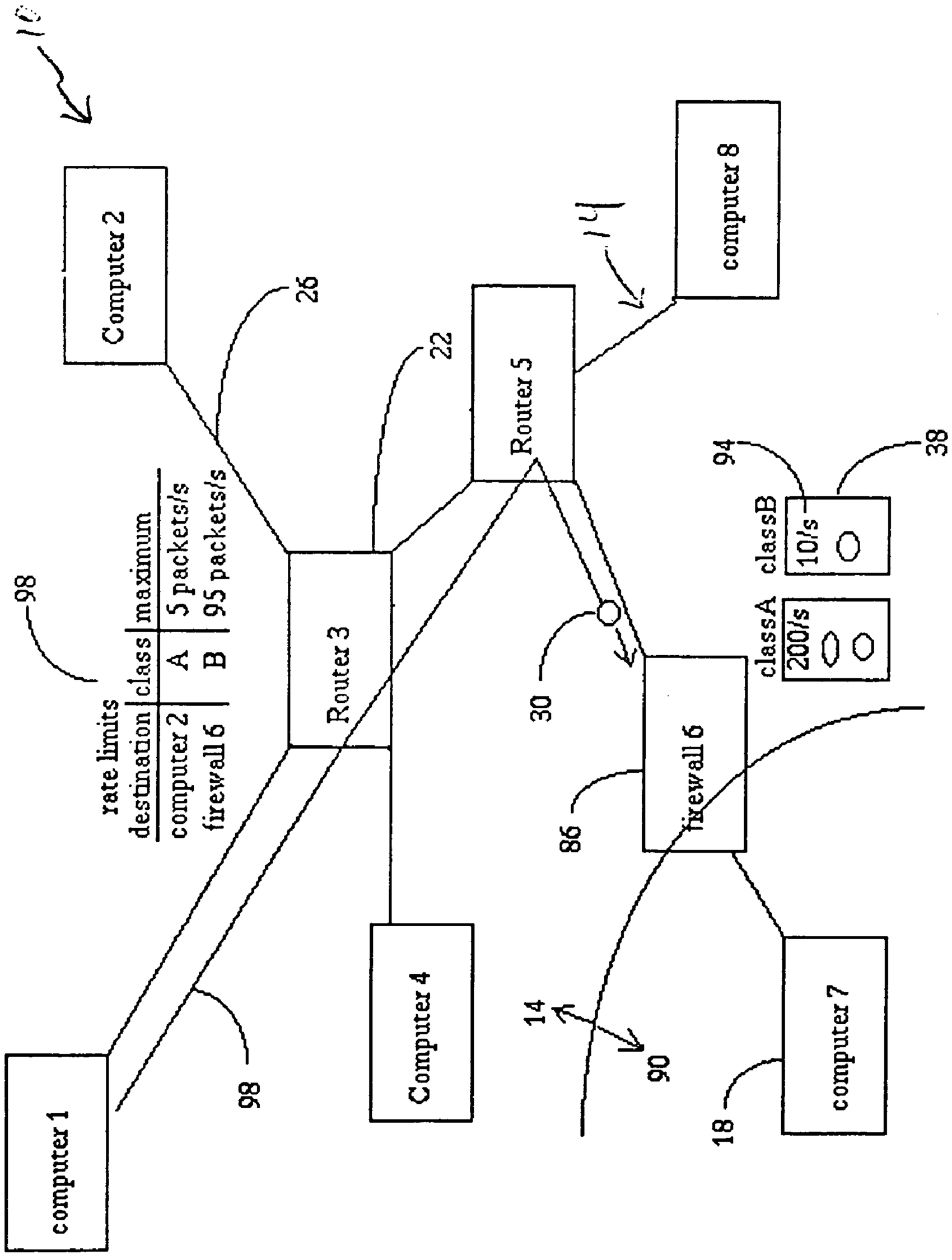
rate limits
destination | class | maximum
computer 2 | A | 5 packets/s
firewall 6 | B | 95 packets/s
98
computer 1
Computer 2
26
Router 3
98
Computer 4
22
Router 5
14
computer 8
30
86
firewall 6
94
classB
10/s
38
classA
200/s
14
90
18
computer 7

Figure 9

PACKET FLOODING DEFENSE SYSTEM

CROSS REFERENCE TO RELATED APPLICATIONS

This Application is a continuation of U.S. patent application Ser. No. 09/715,813, filed 11/16/2000 now U.S. Pat. No. 6,789,190.

FIELD OF INVENTION

The invention pertains to network data transmission controls. More particularly, the invention relates to systems for minimizing the effects of packet flooding attacks directed against computers or routers connected to a network.

BACKGROUND OF THE INVENTION

Various types of systems have been developed for handling unwanted network data transmission incorporating a number of different technologies. U.S. Pat. No. 5,581,559 issued to Crayford et al. discloses a method that verifies the integrity of data transmitted over a network by comparing the destination address for a data packet with end station addresses stored on network repeaters. Where the destination address fails to match the stored end station addresses, the data packet will be disrupted.

U.S. Pat. No. 6,044,402 issued to Jacobson et al., describes a system in which the only data packets that are transmitted between source and destination network addresses are those that satisfy the blocking policies stored by the blocking data structure. Thus only, "pre-approved" data can flow through such a control mechanism. U.S. Pat. No. 5,455,865, issued to Perlman discloses a system that relies upon a stored list of acceptable packet identifiers at each node in the network. U.S. Pat. No. 5,353,353 issued to Vijeh et al. describes a system that determines the acceptability of data packets based upon a destination address/source address match and will disrupt any packet not satisfying these criteria. U.S. Pat. No. 5,850,515 issued to Lo et al. discloses a system that uses source and destination address matching to determine if packets should be transmitted to an end station or the end station disabled from participating in the network. It also employs a system where an end station can be disabled by a program that determines that a certain number of unauthorized packets have been detected. While other variations exist, the above-described designs for handling unwanted network data transmissions are typical of those encountered in the prior art.

U.S. Pat. No. 5,367,523 to Chang et al. discloses an end-to-end, closed loop flow and congestion control system for packet communications networks which exchanges rate request and rate response messages between data senders and receivers to allow the sender to adjust the data rate to avoid congestion and to control the data flow. Requests and responses are piggy-backed on data packets and result in changes in the input data rate in a direction to optimize data throughput. GREEN, YELLOW and RED operating modes are defined to increase data input, reduce data input and reduce data input drastically, respectively. Incremental changes in data input are altered non-linearly to change more quickly when further away from the optimum operating point than when closer to the optimum operating point. Chang, et al, is intended for end-to-end congestion control. Congestion control assumes cooperation between sender and receiver in solving the problem. In a packet flooding defense, the sender, who is the attacker, will never cooperate with the receiver, his victim. In Chang, et al, the information used is the source/

destination address pairs in the packet. Chang, et al, assume this information is accurate. In an attack, this information will not be. The attacker will falsify the source address in order to confound the defense if it uses information the attacker controls, such as the source address.

The primary objective of the present invention is to defend against "packet flooding attacks" in which an attacker tries to use up all the bandwidth to the victim by sending data of little or no value (at least to the victim), thereby making more valuable communication with the victim slow or unreliable. A secondary objective is to defend against a related class of attacks in which the attacker tries to use up some other resource by sending more requests of some particular type to the victim than the victim can handle.

One way to view all these attacks is that a resource is being allocated in an unfair way. Well-behaved users request reasonable amounts, while attackers request unreasonable amounts. The most straight-forward allocation mechanism, which might be called "first come first served", ends up allocating almost all of the resource to the attackers. A more "fair" allocation would reduce the impact of an attacker to that of a normal user.

There are two obvious impediments to the "fair service" goal above. One is lack of a reliable way to associate incoming packets with those users among whom bandwidth should be fairly allocated. The other is lack of control over what packets arrive. The solution described here to both of these problems requires help from the routers that forward packets to the victim.

The defense is distributed among cooperating sites and routers. A set of transitively connected cooperating machines is called a "cooperating neighborhood". The quality of the defense is related to the size of the cooperating neighborhood, a larger neighborhood providing better defense. Within the neighborhood it is possible to trace the forwarding path of packets. The association of packets with the "users" is approximated by associating packets with "places" in the cooperating neighborhood from which those packets are forwarded. That is, service will be allocated in a fair (or otherwise reasonable) manner among these places. A "place" in this sense is typically a particular interface from which a packet arrived at a cooperating router.

One such place is likely to be shared by many actual users. An attack will deny service to those users sharing the same place. The advantage of a large number of such places is that each place is shared by fewer users, so an attack will deny service to fewer users. It is advantageous to a user who wants to communicate with a particular machine, to be in the cooperating neighborhood of that machine, since no attacker from another machine can deny him service. Conversely, an attacker wishing to deny service to as many users as possible prefers to share an entry point into the cooperating neighborhood with as many users as possible.

Routers will supply data about the forwarding path of the packets that arrive at a site. The site can use this data to allocate service as described above among the packets that arrive. This would solve the problem of unfair service if the packets that arrived were a fair sample of those that were sent to the site. This may not be the case, however, if routers are unable to forward all the packets they receive. To some extent fair service is limited by network topology, i.e., too many legitimate users trying to share parts of the same path will inevitably suffer relative to users of uncrowded paths. However another potential cause for this problem is a flooding attack against a router. That problem is solved by letting routers allocate their services in a similar way to that described above for sites. That is, they allocate the limited

resource of forwarding bandwidth along any given output in a reasonable way among some set of places in the cooperating neighborhood.

The final step in the defense is that cooperating routers will limit the rate at which they forward packets to places that so request. This may not be essential in the allocation of service, but it is useful for limiting the bandwidth used by "unwanted" packets. The rate-limiting request is to be made when a site detects a high rate of unwanted packets coming from one place. This helps the site because it no longer has to process as many unwanted packets. It helps the network by freeing some of the bandwidth for other use.

Even if the traffic is not reduced, the distinction between "wanted" and "unwanted" packets plays an important role in "reasonable" allocation. For a site there are normally some packets (in fact, the great majority) that are expected in a very strong sense. It is reasonable to process these at the highest possible rate. All other packets are not exactly unwanted, but the site is willing to process them at only a limited rate. A reasonable approach is to schedule these as described above (using the places from which they were forwarded) at a limited rate, and regard as "unwanted" those that end up being significantly delayed (or discarded).

SUMMARY OF THE INVENTION

The present invention addresses many of the deficiencies of prior network defense systems and satisfies all of the objectives described above.

A packet flooding defense system for a network providing the desired features may be constructed from the following components. The network includes a plurality of host computers, routers, communication lines and transmitted data packets. Means are provided for classifying data packets received at a host computer as are means for associating a maximum acceptable processing rate with each class of data packet received at the computer. Means are also provided for the computer to find information for packets it receives regarding the path by which the packets came to the computer. Thus, the computer can use the information to allocate the processing rate available for packets of each class in a desired way.

In another variant, a packet flooding defense system for a network including a plurality of host computers, routers, communication lines and transmitted data packets includes means for classifying data packets received at a host computer and means for associating a maximum acceptable processing rate with each class of data packet received at the computer. Means are provided for the computer to determine the rate at which data packets of each class are transmitted from a router to the computer as are means for the router to receive information regarding maximum acceptable transmission rate for data packets being transmitted to the computer. Means are provided for the router to control the rate of transmission of data packets from the router to the computer. Thus, the rate of data packet transmissions received at the computer is kept below the maximum acceptable processing rate for each data packet class by the control of the rate of transmission of data packets from the router, thereby freeing a portion of the network providing data packet transmission to the computer.

In this invention a path (which is not controlled by the attacker) is used to determine the actual direction of the packet flow towards the victim. Bandwidth is allocated based upon path (which is done via packet marks provided by routers leading up to the victim). In other words this invention uses attacker-independent information about the path a packet takes to allocate forwarding bandwidth in a router. The part that makes this invention completely different from Chang, et al, is that the information has to be attacker-independent (i.e., sender-independent) in order to work as a defense.

In yet another variant, the router is capable of receiving information regarding maximum acceptable transmission rate for each class of data packet being transmitted to the computer and the router is capable of controlling the rate of transmission of each class of data packets to the computer.

In still another variant, a packet flooding defense system for a network including a plurality of host computers, routers, communication lines and transmitted data packets includes means for classifying data packets received at a router and means for associating a maximum acceptable transmission rate with each class of data packet received at the router. Means are provided for the router to find information for packets it receives regarding the path by which the packets came to the router. Thus, the router can use the information to allocate the transmission rate for each class in a desired way.

In a further variant of the invention, a packet flooding defense system for a network including a plurality of host computers, routers, communication lines and transmitted data packets includes means for classifying data packets received at a first router and means for associating a maximum acceptable transmission rate with each class of data packet received at the first router. Means are provided for the first router to determine the rate at which data packets of each class are transmitted from a second router to the first router as are means for the second router to receive information regarding maximum acceptable transmission rate for data packets being transmitted to the first router. Means are provided for the second router to control the rate of transmission of data packets from the second router to the first router. Thus, the rate of data packet transmissions received at the first router is kept below the maximum acceptable transmission rate for each data packet class by the control of the rate of transmission of data packets from the second router, thereby freeing a portion of the network providing data packet transmission to the first router.

In yet a further variant, the second router is capable of receiving information regarding maximum acceptable transmission rate for each class of data packet being transmitted to the first router and the second router is capable of controlling the rate of transmission of each class of data packets to the first router.

In another variant, a packet flooding defense system for a network including a plurality of host computers, routers, communication lines and transmitted data packets includes at least one firewall. The firewall includes hardware and software serving to control packet transmission between the network and a host computer connected to an internal network. Means are provided for classifying data packets received at the firewall as are means for associating a maximum acceptable transmission rate with each class of data packet received at the firewall. Means are provided for the firewall to find information for packets it receives regarding the path by which the packets came to the firewall. Thus, the firewall can use the information to allocate the transmission rate for each class in a desired way.

In still another variant of the invention, a packet flooding defense system for a network including a plurality of host computers, routers, communication lines and transmitted data packets includes at least one firewall. The firewall includes hardware and software serving to control packet transmission between the network and a host computer connected to an internal network and means for classifying data

packets received at the firewall. Means are provided for associating a maximum acceptable transmission rate with each class of data packet received at the firewall as are means for the firewall to determine the rate at which data packets of each class are transmitted from a router to the firewall. Means are provided for the router to receive information regarding maximum acceptable transmission rate for data packets being transmitted to the firewall as are means for the router to control the rate of transmission of data packets from the router to the firewall. Thus, the rate of data packet transmissions received at the firewall is kept below the maximum acceptable transmission rate for each data packet class by the control of the rate of transmission of data packets from the router, thereby freeing a portion of the network providing data packet transmission to the firewall.

In a final variant of the invention, the router is capable of receiving information regarding maximum acceptable transmission rate for each class of data packet being transmitted to the firewall and the router is capable of controlling the rate of transmission of each class of data packets to the firewall.

An appreciation of the other aims and objectives of the present invention and an understanding of it may be achieved by referring to the accompanying drawings and the detailed description of a preferred embodiment.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic view of a first embodiment of the invention illustrating the association of maximum acceptable processing rates for each class of packet received at a computer and a path by which the packets came to the computer;

FIG. **2** is a schematic view of a second embodiment illustrating the association of maximum acceptable processing rates for each class of packet received at a computer, a path by which the packets came to the computer and illustrating information received at a router regarding maximum acceptable transmission rate for data packets being transmitted to the computer;

FIG. **3** is a schematic view of a third embodiment illustrating information received at a router regarding maximum acceptable transmission rate for each class of data packets being transmitted to the computer;

FIG. **4** is a schematic view of a fourth embodiment illustrating association of maximum acceptable transmission rates for each class of packet received at a router and a path by which the packets came to the router;

FIG. **5** is a schematic view of a fifth embodiment illustrating the association of maximum acceptable transmission rates for each class of packet received at a first router, a path by which the packets came to the first router and illustrating information received at a second router regarding maximum acceptable transmission rate for data packets being transmitted to the first router;

FIG. **6** is a schematic view of a sixth embodiment illustrating information received at the second router regarding maximum acceptable transmission rate for each class of data packets being transmitted to the first router;

FIG. **7** is a schematic view of a seventh embodiment of the invention illustrating the association of maximum acceptable transmission rates for each class of packet received at a firewall and a path by which the packets came to the firewall;

FIG. **8** is a schematic view of an eighth embodiment illustrating the association of maximum acceptable transmission rates for each class of packet received at the firewall, a path by which the packets came to the firewall and illustrating information received at a router regarding maximum acceptable transmission rate for data packets being transmitted to the firewall; and

FIG. **9** is a schematic view of a ninth embodiment illustrating information received at a router regarding maximum acceptable transmission rate for each class of data packets being transmitted to the firewall.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. **1** illustrates a packet flooding defense system **10** for a network **14** providing the desired features that may be constructed from the following components. The network **14** includes a plurality of host computers **18**, routers **22**, communication lines **26** and transmitted data packets **30**. Means are provided for classifying data packets **30** received at a host computer **18** as are means for associating a maximum acceptable processing rate **34** with each class **38** of data packet **30** received at the computer **18**. Means are also provided for the computer **18** to find information for packets **30** it receives regarding the path **46** by which the packets **30** came to the computer **18**. Thus, the computer **18** can use the information to allocate the processing rate for each class **38** in a desired way among the places from which packets **30** are transmitted.

In another variant, as illustrated in FIG. **2**, a packet flooding defense system **10** for a network **14** including a plurality of host computers **18**, routers **22**, communication lines **26** and transmitted data packets **30** includes means for classifying data packets **30** received at a host computer **18** and means for associating a maximum acceptable processing rate **34** with each class **38** of data packet **30** received at the computer **18**. Means are provided for the computer **18** to determine the rate at which data packets **30** of each class **38** are transmitted from a router **22** to the computer **18** as are means for the router **22** to receive information regarding maximum acceptable transmission rate **70** for data packets **30** being transmitted to the computer **18**. Means are provided for the router **22** to control the rate of transmission of data packets **30** from the router **22** to the computer **18**. Thus, the rate of data packet transmissions received at the computer **18** is kept below the maximum acceptable processing rate **34** for each data packet class **38** by the control of the rate of transmission of data packets **30** from the router **22**, thereby freeing a portion of the network **14** providing data packet transmission to the computer **18**.

In yet another variant, as illustrated in FIG. **3**, the router **22** is capable of receiving information regarding maximum acceptable transmission rate **70** for each class **38** of data packet **30** being transmitted to the computer **18** and the router **22** is capable of controlling the rate of transmission of each class **38** of data packets **30** to the computer **18**.

In still another variant, as illustrated in FIG. **4**, a packet flooding defense system **10** for a network **14** including a plurality of host computers **18**, routers **22**, communication lines **26** and transmitted data packets **30**, includes means for classifying data packets **30** received at a router **22** and means for associating a maximum acceptable transmission rate **74** with each class **38** of data packet **30** received at the router **22**. Means are provided for the router **22** to find information for packets **30** it receives regarding the path **50** by which the packets **30** came to the router **22**. Thus, the router **22** can use the information to allocate the transmission rate for each class **38** in a desired way.

In a further variant of the invention, as illustrated in FIG. **5**, a packet flooding defense system **10** for a network **14** including a plurality of host computers **18**, routers **22**, communication lines **26** and transmitted data packets **30** includes means

for classifying data packets **30** received at a first router **54** and means for associating a maximum acceptable transmission rate **78** with each class **38** of data packet **30** received at the first router **54**. Means are provided for the first router **54** to determine the rate at which data packets **30** of each class **38** are transmitted from a second router **58** to the first router **54** as are means for the second router **58** to receive information regarding maximum acceptable transmission rate **82** for data packets **30** being transmitted to the first router **54**. Means are provided for the second router **58** to control the rate of transmission of data packets **30** from the second router **58** to the first router **54**. Thus, the rate of data packet transmissions received at the first router **54** is kept below the maximum acceptable transmission rate **78** for each data packet class **38** by the control of the rate of transmission of data packets **30** from the second router **58**, thereby freeing a portion of the network **14** providing data packet transmission to the first router **54**.

In yet a further variant, as illustrated in FIG. **6**, the second router **58** is capable of receiving information regarding maximum acceptable transmission rate **84** for each class **38** of data packet **30** being transmitted to the first router **54** and the second router **58** is capable of controlling the rate of transmission of each class **38** of data packets **30** to the first router **54**.

In another variant, as illustrated in FIG. **7**, a packet flooding defense system **10** for a network **14** including a plurality of host computers **18**, routers **22**, communication lines **26** and transmitted data packets **30** includes at least one firewall **86**. The firewall **86** includes hardware and software serving to control packet transmission between the network **14** and a host computer **18** connected to an internal network **90**. Means are provided for classifying data packets **30** received at the firewall **86** as are means for associating a maximum acceptable transmission rate **94** with each class **38** of data packet **30** received at the firewall **86**. Means are provided for the firewall **86** to find information for packets **30** it receives regarding the path **98** by which the packets **30** came to the firewall **86**. Thus, the firewall **86** can use the information to allocate the transmission rate for each class **38** in a desired way.

In still another variant of the invention, as illustrated in FIG. **8**, a packet flooding defense system **10** for a network **14** including a plurality of host computers **18**, routers **22**, communication lines **26** and transmitted data packets **30** includes at least one firewall **86**. The firewall **86** includes hardware and software serving to control packet transmission between the network **14** and a host computer **18** connected to an internal network **90** and means for classifying data packets **30** received at the firewall **86**. Means are provided for associating a maximum acceptable transmission rate **94** with each class **38** of data packet **30** received at the firewall **86** as are means for the firewall **86** to determine the rate at which data packets **30** of each class **38** are transmitted from a router **22** to the firewall **86**. Means are provided for the router **22** to receive information regarding maximum acceptable transmission rate **92** for data packets **30** being transmitted to the firewall **86** as are means for the router **22** to control the rate of transmission of data packets **30** from the router **22** to the firewall **86**. Thus, the rate of data packet transmissions received at the firewall **86** is kept below the maximum acceptable transmission rate **94** for each data packet class **38** by the control of the rate of transmission of data packets **30** from the router **22**, thereby freeing a portion of the network **14** providing data packet transmission to the firewall **86**.

In a final variant of the invention, as illustrated in FIG. **9**, the router **22** is capable of receiving information regarding maximum acceptable transmission rate **98** for each class **38** of data packet **30** being transmitted to the firewall **86** and the router **22** is capable of controlling the rate of transmission of each class **38** of data packets **30** to the firewall **86**.

The packet flooding defense system **10** has been described with reference to particular embodiments. Other modifications and enhancements can be made without departing from the spirit and scope of the claims that follow.

The invention claimed is:

1. A packet flooding defense system for a network comprising a plurality of host computers, routers, communication lines and transmitted data packets, said system comprising:

means for classifying data packets received at a host computer into wanted data packets and unwanted data packets;

means for associating a maximum acceptable processing rate with each class of data packet received at said computer;

means for said computer to find information for packets it receives regarding the path by which said packets came to said computer via packet marks provided by routers leading to said host computer; said path comprising all routers in said network via which said packets are routed to said computer; and

means in said computer for using said information to allocate the processing rate available for unwanted data packets to be less than or equal to said maximum acceptable processing rate.

2. A packet flooding defense system for a network comprising a plurality of host computers, routers, communication lines and transmitted data packets, said system comprising:

means for classifying data packets received at a host computer into wanted data packets and unwanted data packets; said data packets comprising data packets from all routers in said network via which said data packets are routed to said computer;

means for associating a maximum acceptable processing rate with each class of data packet received at said computer;

means for said computer to determine the rate at which data packets of each class are transmitted from a router to said computer;

means for said router to receive information regarding maximum acceptable transmission rate for data packets being transmitted to said computer;

means for said router to control the rate of transmission of data packets from said router to said computer; and

means in said computer for keeping the rate of data packet transmissions received at said computer below the maximum acceptable processing rate for each data packet class by said control of the rate of transmission of data packets from said router, and freeing a portion of the network providing data packet transmission to said computer.

3. A packet flooding defense system as described in claim **2**, wherein:

said router receives information regarding maximum acceptable transmission rate for each class of data packet being transmitted to said computer; and said router controls the rate of transmission of each class of data packet to said computer.

4. A packet flooding defense system for a network comprising a plurality of host computers, routers, communication lines and transmitted data packets, said system comprising:

means for classifying data packets received at a router into wanted data packets and unwanted data packets;

means for associating a maximum acceptable transmission rate with each class of data packet received at said router;

means for said router to find information for packets it receives regarding the path by which said packets came to said router via packet marks provided by routers leading to said host computer;

said path comprising all routers in said network via which said packets are routed to said computer; and

means in said router for said router to use said information to allocate the transmission rate for unwanted data packets to be less than equal to said maximum acceptable transmission rate.

5. A packet flooding defense system for a network comprising a plurality of host computers, routers, communication lines and transmitted data packets, said system comprising:

means for classifying data packets received at a first router into wanted data packets and unwanted data packets; said data packets comprising data packets from all routers in said network via which said data packets are routed to said computer;

means for associating a maximum acceptable transmission rate with each class of data packet received at said first router;

means for said first router to determine the rate at which data packets of each class are transmitted from a second router to said first router;

means for said second router to receive information regarding maximum acceptable transmission rate for data packets being transmitted to said first router;

means for said second router to control the rate of transmission of data packets from said second router to said first router; and

means in said first router for keeping the rate of data packet transmissions received at said first router below the maximum acceptable transmission rate for unwanted data packets by said control of the rate of transmission of data packets from said second router, and freeing a portion of the network providing data packet transmission to said first router.

6. A packet flooding defense system as described in claim **5**, wherein:

said second router receives information regarding maximum acceptable transmission rate for each class of data packet being transmitted to said first router; and

said second router controls the rate of transmission of each class of data packet to said first router.

7. A method of providing packet flooding defense for a network comprising a plurality of host computers, routers, communication lines and transmitted data packets, said method comprising the steps of:

determining a path by which data packets arrive at a host computer via packet marks provided by routers leading to said host computer; said path comprising all routers in said network via which said packets are routed to said computer;

classifying data packets received at said host computer into wanted data packets and unwanted data packets by path;

associating a maximum acceptable processing rate with each class of data packet received at said host computer; and

allocating a processing rate less than or equal to said maximum acceptable processing rate for unwanted data packets.

8. A method of providing packet flooding defense for a network comprising a plurality of host computers, routers, communication lines and transmitted data packets, said method comprising the steps of:

classifying data packets received at a host computer into wanted data packets and unwanted data packets; said data packets comprising data packets from all routers in said network via which said data packets are routed to said computer;

associating a maximum acceptable processing rate with each class of data packet received at said computer;

determining the rate at which data packets of each class are transmitted from a router to said computer;

receiving a maximum acceptable transmission rate for data packets being transmitted to said computer in said router; and

controlling the rate of transmission of data packets from said router to said computer by said router so that data packet transmissions received at said computer are kept below the maximum acceptable processing rate for each data packet class; and

freeing a portion of the network providing data packet transmission to said computer.

9. A method as described in claim **8**, in which:

said router receives information regarding maximum acceptable transmission rate for each class of data packet being transmitted to said computer; and

said router controls the rate of transmission of each class of data packet to said computer.

10. A method of providing packet flooding defense for a network comprising a plurality of host computers, routers, communication lines and transmitted data packets, said method comprising the steps of:

determining a path by which data packets arrive at said router via packet marks provided by routers leading to said host computer; said path comprising all routers in said network via which said packets are routed to said computer;

classifying data packets received at said router via packet marks provided by routers leading to said host computer by path;

associating a maximum acceptable transmission rate with each class of data packet received at said router; and

allocating a transmission rate equal to or less than said maximum acceptable transmission rate for unwanted data packets.

11. A method of providing packet flooding defense for a network comprising a plurality of host computers, routers, communication lines and transmitted data packets, said method comprising the steps of:

classifying data packets received at a first router into wanted data packets and unwanted data packets; said data packets comprising data packets from all routers in said network via which said data packets are routed to said computer;

associating a maximum acceptable transmission rate with each class of data packet received at said first router;

determining by said first router of the rate at which data packets of each class are transmitted from a second router to said first router;

receiving by said second router of information regarding maximum acceptable transmission rate for data packets being transmitted to said first router; and

controlling by said second router of the rate of transmission of data packets from said second router to said first router so that said rate of transmission is below the maximum acceptable transmission rate for each data packet class; and

freeing a portion of the network providing data packet transmission to said first router.

12. A method as described in claim 11, in which:

said second router receives information regarding maximum acceptable transmission rate for each class of data packet being transmitted to said first router; and

said second router controls the rate of transmission of each class of data packets to said first router.

13. A packet flooding defense system for a network comprising a plurality of host computers, routers, communication lines and transmitted data packets, said system comprising:

means for determining a path by which data packets arrive at a host computer via packet marks provided by routers leading to said host computer; said path comprising all routers in said network via which said packets are routed to said computer;

means for classifying data packets received at said host computer into wanted data packets and unwanted data packets by path;

means for assigning a maximum acceptable processing rate to each class of data packet; and

means for allocating a processing rate equal to or less than said maximum acceptable processing rate to said unwanted data packets.

14. A packet flooding defense system for a network comprising a plurality of host computers, routers, communication lines and transmitted data packets, said system comprising:

means for classifying data packets received at a host computer into wanted data packets and unwanted data packets; said data packets comprising data packets from all routers in said network via which said data packets are routed to said computer;

means for associating a maximum acceptable processing rate with each class of data packet received at said computer;

means for said computer to determine the rate at which data packets of each class are transmitted from a router to said computer;

means for said router to receive information regarding maximum acceptable transmission rate for data packets being transmitted to said computer; and

means for said router to control the rate of transmission of data packets from said router to said computer so that the rate of data packet transmissions received at said computer is kept below the maximum acceptable processing rate for each data packet class; and

freeing a portion of the network providing data packet transmission to said computer.

15. A packet flooding defense system as described in claim 14, in which:

said router receives information regarding maximum acceptable transmission rate for each class of data packet being transmitted to said computer; and

said router controls the rate of transmission of each class of data packet to said computer.

16. A packet flooding defense system for a network comprising a plurality of host computers, routers, communication lines and transmitted data packets, said system comprising:

means for a router to determine a path by which said packets came to said router via packet marks provided by routers leading to said router; said path comprising all routers in said network via which said packets are routed to said computer;

means for classifying data packets received at said router into wanted data packets and unwanted data packets by path;

means for associating a maximum acceptable transmission rate with each class of data packet received at said router; and

means for said router to allocate the transmission rate for unwanted data packets to be less than equal to said maximum acceptable processing rate.

17. A packet flooding defense system for a network comprising a plurality of host computers, routers, communication lines and transmitted data packets, said system comprising:

means for classifying data packets received at a first router into wanted data packets and unwanted data packets; said data packets comprising data packets from all routers in said network via which said data packets are routed to said computer;

means for associating a maximum acceptable transmission rate with each class of data packet received at said first router;

means for said first router to determine the rate at which data packets of each class are transmitted from a second router to said first router;

means for said second router to receive information regarding maximum acceptable transmission rate for data packets being transmitted to said first router; and

means for said second router to control the rate of transmission of data packets from said second router to said first router so that the rate of data packet transmission received at said first router is kept below the maximum acceptable transmission rate for each data packet class; and

freeing a portion of the network providing data packet transmission to said first router.

18. A packet flooding defense system as described in claim 17, wherein:

said second router receives information regarding maximum acceptable transmission rate for each class of data packet being transmitted to said first router; and

said second router controls the rate of transmission of each class of data packet to said first router.

* * * * *

US007523497C1

(12) EX PARTE REEXAMINATION CERTIFICATE (12302nd)

United States Patent

Cohen

(10) Number: US 7,523,497 C1

(45) Certificate Issued: May 22, 2023

(54) **PACKET FLOODING DEFENSE SYSTEM**

(75) Inventor: **Donald N. Cohen**, Los Angeles, CA (US)

(73) Assignee: **PACSEC3 LLC**

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Filed:	**May 7, 2004**

Related U.S. Application Data

(63) Continuation of application No. 09/715,813, filed on Nov. 16, 2000, now Pat. No. 6,789,190.

(51) **Int. Cl.**

G06F 11/30	(2006.01)
H04L 47/10	(2022.01)
H04L 47/2441	(2022.01)
H04L 47/32	(2022.01)
H04L 9/40	(2022.01)

(52) **U.S. Cl.**
CPC ***H04L 47/10*** (2013.01); ***H04L 47/2441*** (2013.01); ***H04L 47/32*** (2013.01); ***H04L 63/1458*** (2013.01)

(58) **Field of Classification Search**
None
See application file for complete search history.

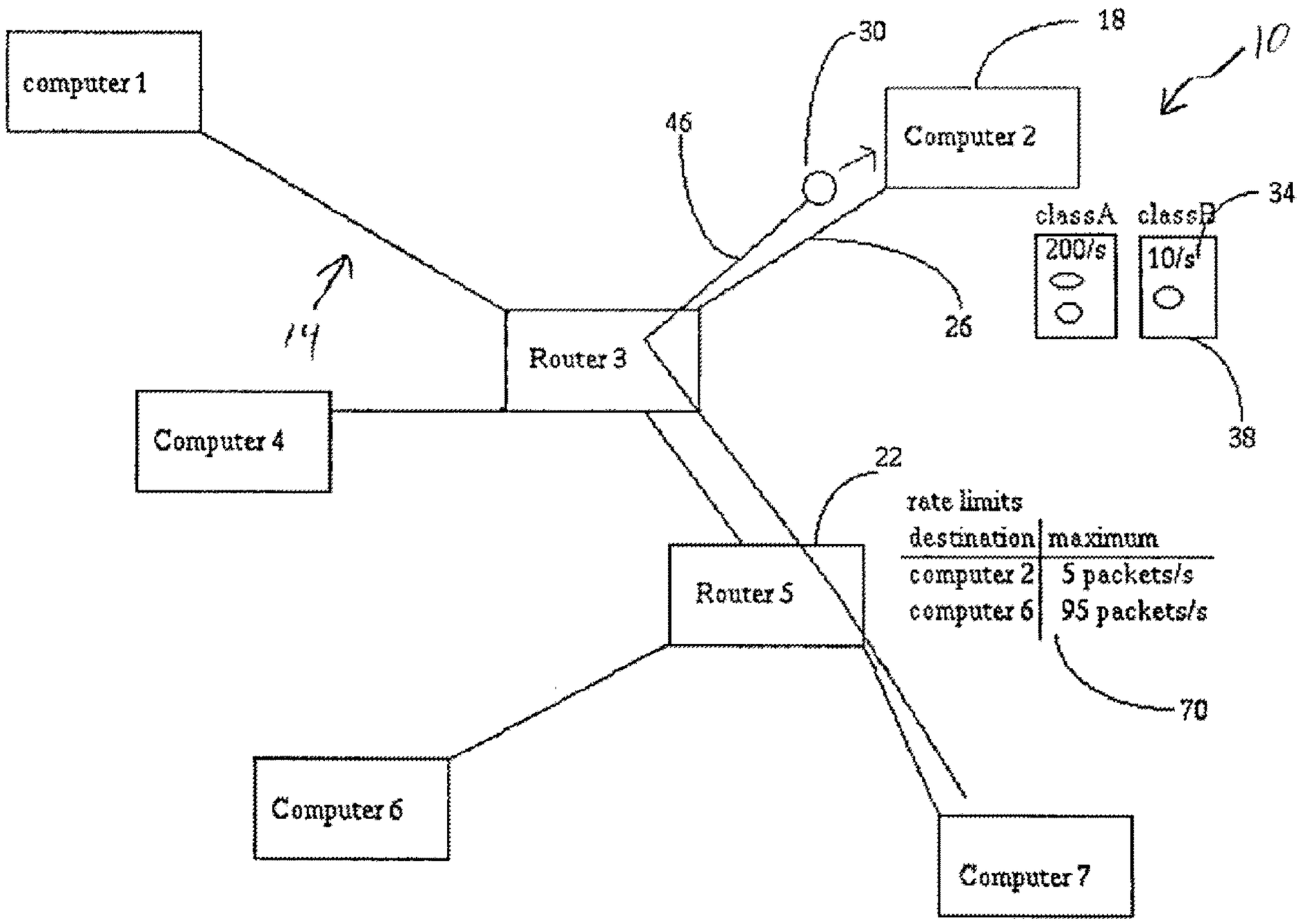
(56) **References Cited**

To view the complete listing of prior art documents cited during the proceeding for Reexamination Control Number 90/014,746, please refer to the USPTO's Patent Electronic System.

Primary Examiner — Colin M LaRose

(57) **ABSTRACT**

The invention prevents "packet flooding", where an attacker uses up all available bandwidth to a victim with useless data. It can also be used to prevent some other related denial of service attacks. The defense is distributed among cooperating sites and routers. The sites identify data they don't want. The routers help sites to determine which routers forward that data. The sites then ask these routers to reduce the rate at which such data is forwarded. Variations of the defense protect against pocket flooding attacks on routers and attacks in which an attacker tries to use up some service offered by a site.



EX PARTE REEXAMINATION CERTIFICATE

THE PATENT IS HEREBY AMENDED AS INDICATED BELOW.

AS A RESULT OF REEXAMINATION, IT HAS BEEN DETERMINED THAT:

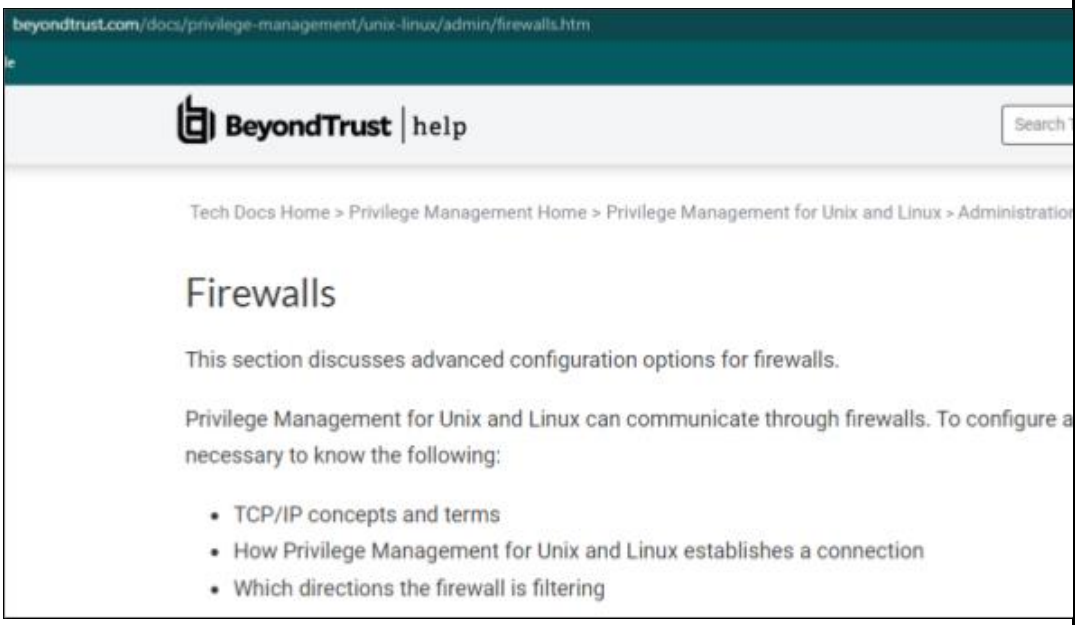
The patentability of claims **7** and **10** is confirmed.

Claims **1**, **4**, **13** and **16** are cancelled.

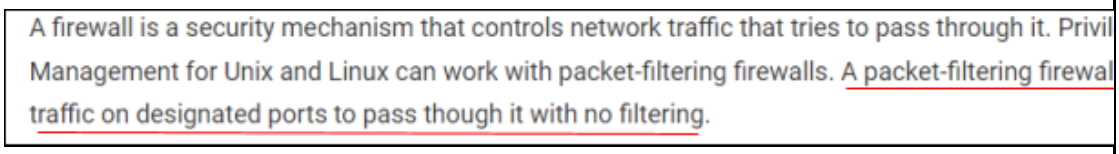
Claims **2**, **3**, **5**, **6**, **8**, **9**, **11**, **12**, **14**, **15**, **17** and **18** were not reexamined.

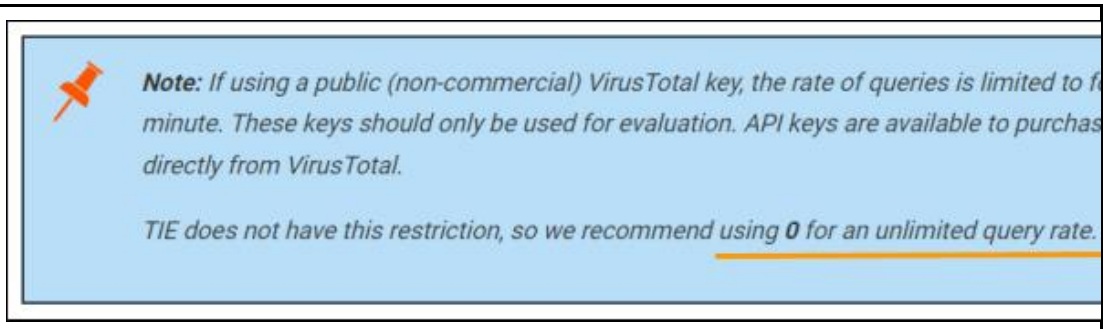
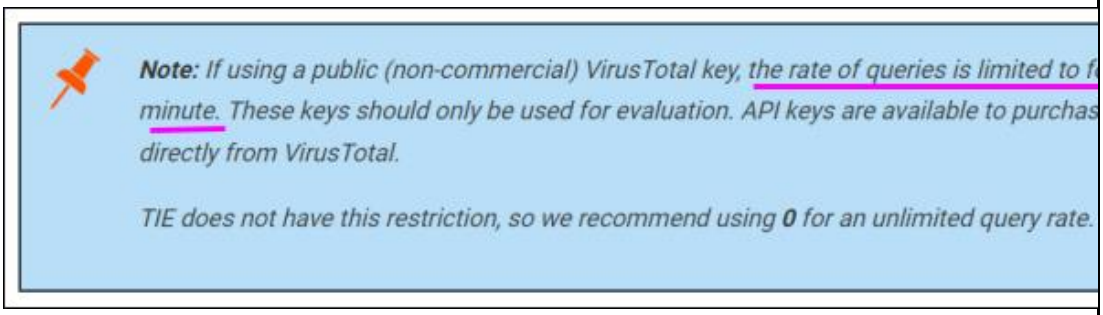
* * * * *

EXHIBIT B

US7523497 B2 Claim 10	**BeyondTrust**
10. A method of providing packet flooding defense for a network comprising a plurality of host computers, routers, communication lines and transmitted data packets, said method comprising the steps of:	 BeyondTrust has a packet flooding defense system for a network comprising a plurality of host computers, routers, communication lines and transmitted data packets. https://www.beyondtrust.com/docs/privilege-management/unix-linux/admin/firewalls.htm The reference includes subject matter disclosed by the claims of the patent after the priority date. The venue of the company is: 20 Cabot Road Suite 403 Medford, Massachusetts 02155 https://www.beyondtrust.com/contact

US7523497 B2 Claim 10	**BeyondTrust**
determining a path by which data packets arrive at	If the target machine is filtering incoming traffic, then the firewall should be configured to pass the ports, and the settings file on the submit host and the log host should set the same port range in t respective settings files, using the **minlisteningport** and **maxlisteningport** settings (Privilege Mana Unix and Linux v3.2 and later). https://www.beyondtrust.com/docs/privilege-management/unix-

said router via packet marks provided by routers leading to said host computer; said path comprising all routers in said network via which said packets are routed to said computer;	linux/admin/firewalls.htm The reference describes determining a path by which data packets arrive at a host computer via packet marks provided by routers leading to said host computer; said path comprising all routers in said network via which said packets are routed to said computer.
US7523497 B2 Claim 10	**BeyondTrust**
classifying data packets received at said router via packet marks provided by routers leading to said host computer by path;	 https://www.beyondtrust.com/docs/privilege-management/unix-linux/admin/firewalls.htm The reference describes classifying data packets received at said host computer into wanted data packets and unwanted data packets by path.
US7523497 B2 Claim 10	**BeyondTrust**

associating a maximum acceptable transmission rate with each class of data packet received at said router; and	 https://www.beyondtrust.com/docs/privilege-management/windows/epo-admin/reputation-settings.htm The reference describes associating a maximum acceptable processing rate with each class of data packet received at said host computer.
US7523497 B2 Claim 10	**BeyondTrust**
allocating a transmission rate equal to or less than said maximum acceptable transmission rate for unwanted data packets.	 https://www.beyondtrust.com/docs/privilege-management/windows/epo-admin/reputation-settings.htm The reference describes allocating a processing rate less than or equal to said maximum acceptable processing rate for unwanted data packets..