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United States Patent [19]

Vaid et al.

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[54] **METHOD AND APPARATUS FOR QUALITY OF SERVICE MANAGEMENT**

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[21] Appl. No.: **08/999,096**

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Related U.S. Application Data

[60] Provisional application No. 60/047,752, May 27, 1997.

[51] **Int. Cl.**[7] **G06F 11/34**; G06F 13/36; H04L 12/26

[52] **U.S. Cl.** **709/224**; 709/225; 714/38; 714/39; 370/449

[58] **Field of Search** 709/221, 228, 709/203, 230, 233, 224, 225; 707/10; 714/38, 39; 340/825.52; 370/445, 449, 231; 712/1

[56] **References Cited**

U.S. PATENT DOCUMENTS

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Attorney, Agent, or Firm—Townsend and Townsend and Crew LLP

[57] **ABSTRACT**

A novel method for a network of computers to improve quality of services using a combination of a bandwidth management tool in a firewall. The method includes the steps of providing a network directory services server providing network directory services to a plurality of network servers, each of the plurality of network servers coupled to one of the plurality of network quality of service devices, implementing a quality of service policy for the plurality of network quality of service devices on the network directory services server, and using the network directory services to provide configuration information for the plurality of network quality of service devices, in response to the quality of service policy.

20 Claims, 11 Drawing Sheets
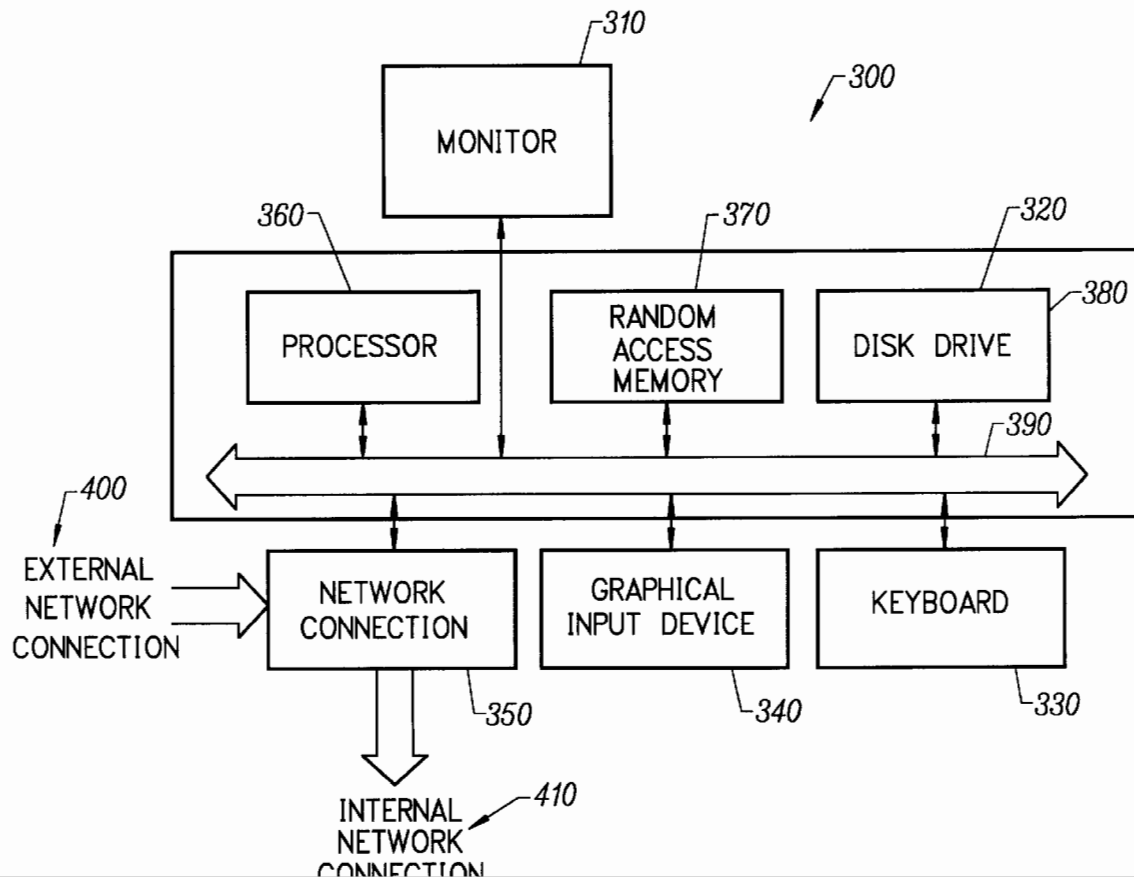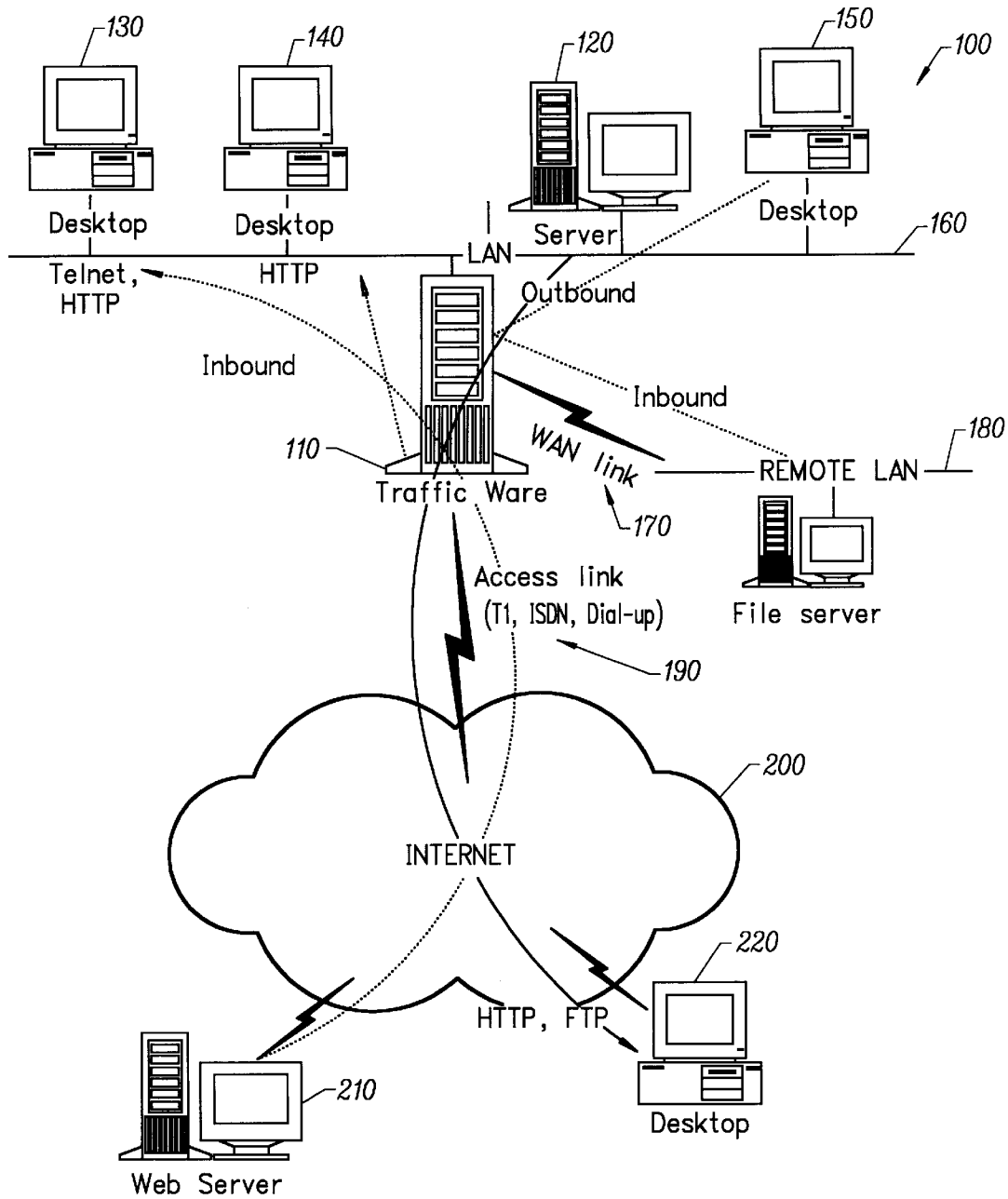
SCHEMATIC OF QOS SYSTEM DEPLOYED FOR INTERNET ACCESS
AND A PRIVATE WAN

FIG. 1

FIG. 2

FIG. 3

LIKELY TRAFFIC CLASSES AND POLICIES

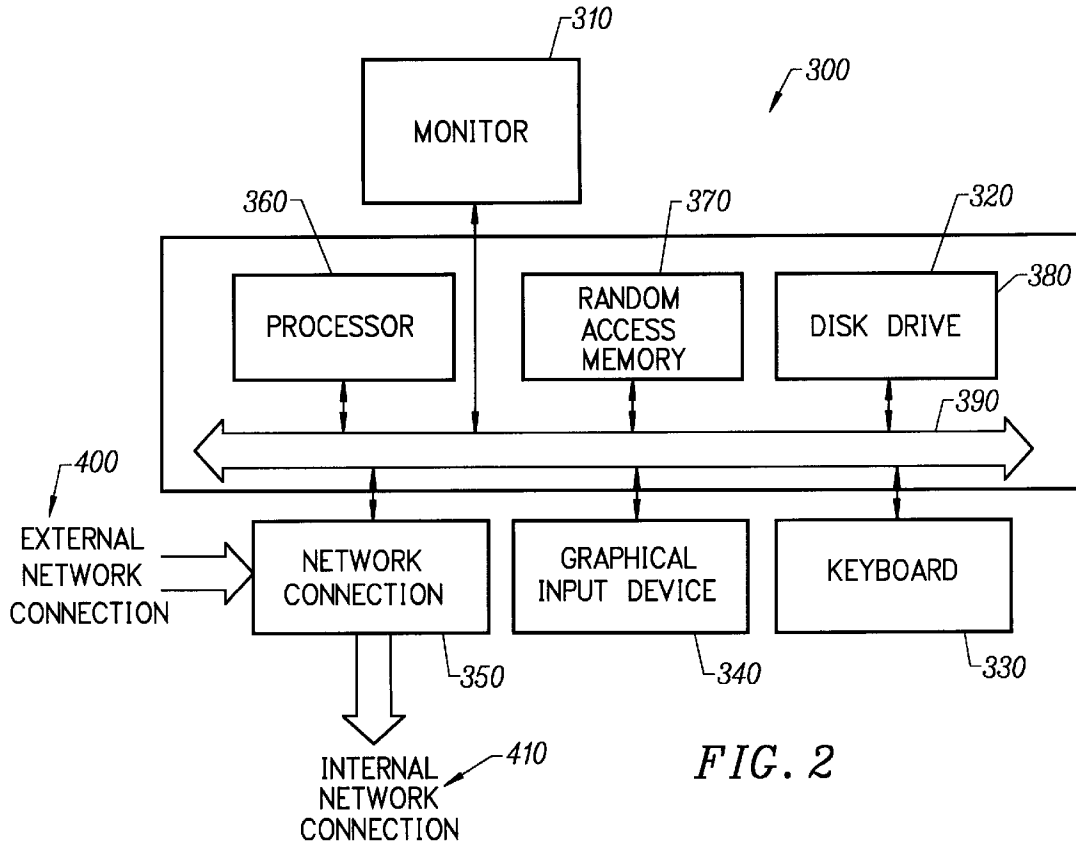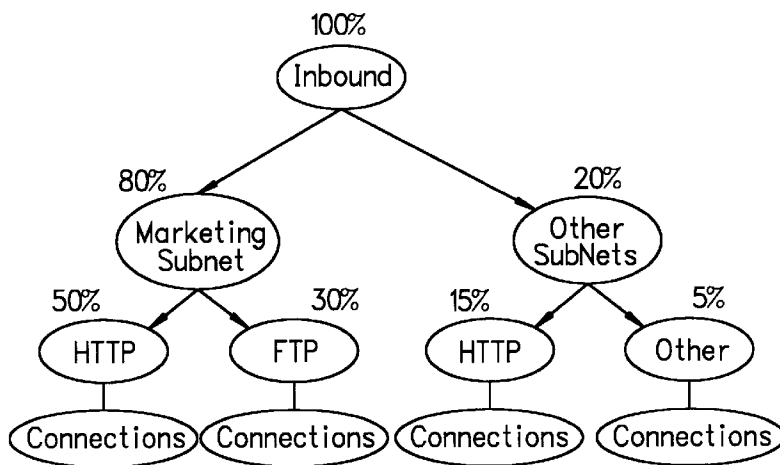| Traffic class	Base class (Traffic type) []=Application dependent	Applied Policy Y=Always N=Rarely P=Policy/Application dependent		Exception Control AC=Admission Control DP=Drop packets TS=Throttle source LS=Load Share			
		Rate	Latency	AC	DP	TS	LS
HTTP	Interactive, [All]	Y	P	P	N	P	P
HTML	Interactive	Y	P	P	N	P	P
GIF, JPEG	Bandwidth−intense, [Interactive]	Y	P	P	Y	P	P
RealAudio	Real−Time, [Interactive]	Y	Y	Y	Y	N	Y
Realtime Video	Bandwidth−intense, Real−Time, [Interactive]	Y	Y	Y	Y	N	Y
SMTP, NNTP	None	Y	N	N	N	N	N
FTP	Bandwidth−intense, [Interactive]	Y	N	P	N	Y	P
TELNET	Interactive	N	Y	N	N	N	N
DNS	Interactive	N	Y	N	N	N	N
RPC	[Interactive]	P	Y	P	N	P	N
Novell NCP	[All]	P	P	P	P	P	P

FIG. 4

```
┌──────────────────────────────┐
│   CLASSIFY TCP CONNECTION     │─── 500
│         REQUEST              │
└──────────────────────────────┘
               │
               ▼
┌──────────────────────────────┐
│   ESTIMATE ROUND-TRIP-TIME    │─── 510
└──────────────────────────────┘
               │
               ▼
┌──────────────────────────────┐
│    RAMP-UP SOURCE FLOW        │─── 520
└──────────────────────────────┘
               │
               ▼
┌──────────────────────────────┐
│  DETERMINE ROUND-TRIP-TIME    │─── 530
└──────────────────────────────┘
               │
               ▼
┌──────────────────────────────┐
│     DETERMINE AVAILABLE       │─── 540
│        BANDWIDTH             │
└──────────────────────────────┘
               │
               ▼
          ╱─────────────╲
         ╱ ROUND-TRIP-TIME> ╲── 550
        ⟨ AVAILABLE BANDWIDTH ⟩── NO
         ╲        ?        ╱
          ╲─────────────╱
               │ YES
               ▼
┌──────────────────────────────┐
│     DELAY ACK SIGNAL/         │─── 560
│    MODIFY WINDOW SIZE         │
└──────────────────────────────┘
```
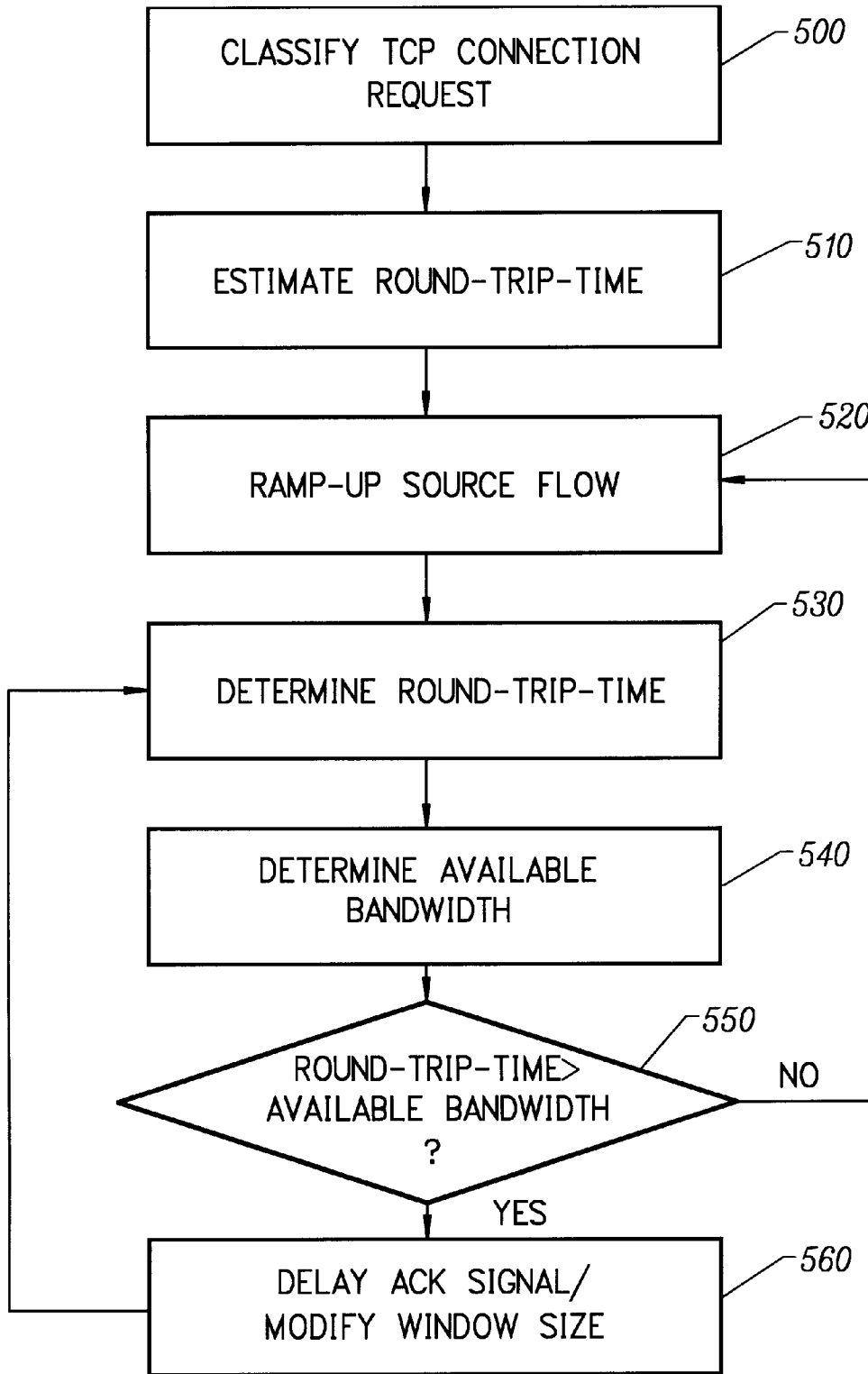
FIG. 5

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