



US005774660A

United States Patent [19]
Brendel et al.

[11] **Patent Number:** **5,774,660**
[45] **Date of Patent:** **Jun. 30, 1998**

[54] **WORLD-WIDE-WEB SERVER WITH DELAYED RESOURCE-BINDING FOR RESOURCE-BASED LOAD BALANCING ON A DISTRIBUTED RESOURCE MULTI-NODE NETWORK**

[75] Inventors: **Juergen Brendel**, Redwood City; **Charles J. Kring**, Sunnyvale; **Zaide Liu**, Santa Clara; **Christopher C. Marino**, Mountain View, all of Calif.

[73] Assignee: **Resonate, Inc.**, Mountain View, Calif.

[21] Appl. No.: **691,006**

[22] Filed: **Aug. 5, 1996**

[51] **Int. Cl.** **G06F 13/00; G06F 17/30**

[52] **U.S. Cl.** **395/200.31; 395/200.32; 395/200.33; 395/200.36; 395/200.49; 395/200.56; 395/200.59; 395/200.66; 395/200.69; 395/670; 395/674; 395/675**

[58] **Field of Search** **395/200.3-200.33, 395/200.36, 200.47-200.5, 200.54-200.6, 200.66, 200.69, 182.02, 182.08, 670-675**

[56] **References Cited**

U.S. PATENT DOCUMENTS

5,307,347	4/1994	Duault et al.	370/439
5,341,499	8/1994	Doragh	395/681
5,343,477	8/1994	Yamada	395/182.02
5,355,453	10/1994	Row et al.	395/200.49
5,355,472	10/1994	Lewis	707/101
5,400,335	3/1995	Yamada	370/524
5,404,534	4/1995	Foss et al.	395/683
5,426,427	6/1995	Chinnock et al.	395/200.69
5,442,749	8/1995	Northcutt et al.	395/200.49
5,442,771	8/1995	Filepp et al.	395/200.49
5,452,447	9/1995	Nelson et al.	707/205
5,455,932	10/1995	Major et al.	211/152
5,455,948	10/1995	Poole et al.	707/102
5,495,426	2/1996	Waclawsky et al.	395/200.56
5,539,883	7/1996	Allon et al.	395/675
5,603,029	2/1997	Aman et al.	395/675
5,612,897	3/1997	Rege	395/200.49

OTHER PUBLICATIONS

Dias et al., "A Scalable and Highly Available Web Server", Digest of Papers, Comcon 1996, Technologies for the Information Superhighway, Forty-First IEEE Computer Society International Conference (Cat. No. 96CB35911), pp. 85-92, Feb. 1996.

Attanasio & Smith, "A Virtual Multiprocessor Implemented by an Encapsulated Cluster of Loosely Coupled Computers", IBM Research Report RC18442, Apr. 1992.

(List continued on next page.)

Primary Examiner—Parshotam S. Lall

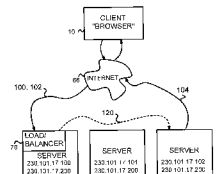
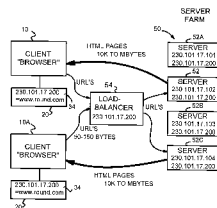
Assistant Examiner—Bharat Barot

Attorney, Agent, or Firm—Stuart T. Auvinen

[57] **ABSTRACT**

A multi-node server transmits world-wide-web pages to network-based browser clients. A load balancer receives all requests from clients because they use a virtual address for the entire site. The load balancer makes a connection with the client and waits for the URL from the client. The URL specifies the requested resource. The load balancer waits to perform load balancing until after the location of the requested resource is known. The connection and URL request are passed from the load balancer to a second node having the requested resource. The load balancer re-plays the initial connection packet sequence to the second node, but modifies the address to that for the second node. The network software is modified to generate the physical network address of the second node, but then changes the destination address back to the virtual address. The second node transmits the requested resource directly to the client, with the virtual address as its source. Since all requests are first received by the load balancer which determines the physical location of the requested resource, nodes may contain different resources. The entire contents of the web site is not mirrored onto all nodes. Network bottlenecks are avoided since the nodes transmit the large files back to the client directly, bypassing the load balancer. Client browsers can cache the virtual address, even though different nodes with different physical addresses service requests.

16 Claims, 18 Drawing Sheets



OTHER PUBLICATIONS

Balancing Act: Web Server Load Balancers, PC Magazine, Dec. 17, 1996, p. 42.

BIG/ip Product Spec, FAQ from Website www.f5.com, F5 Labs, 1996.

“How Your Browser Finds the Page You Want” PC Magazine Mar. 12, 1996 p. 107.

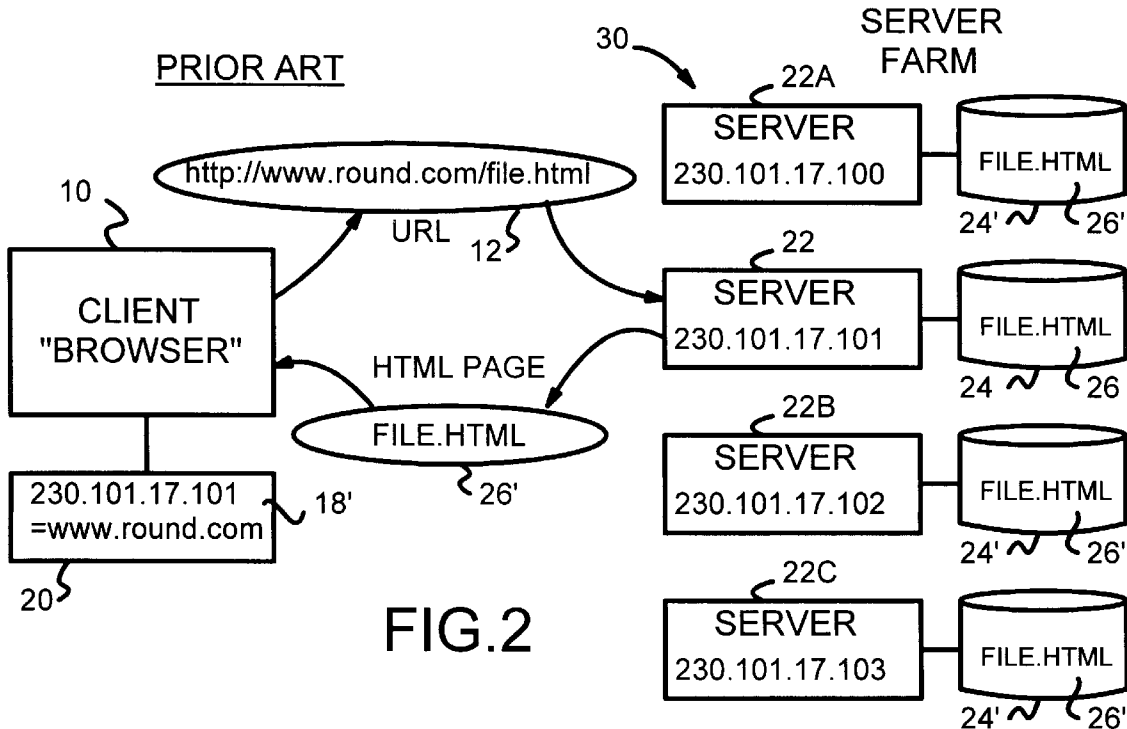
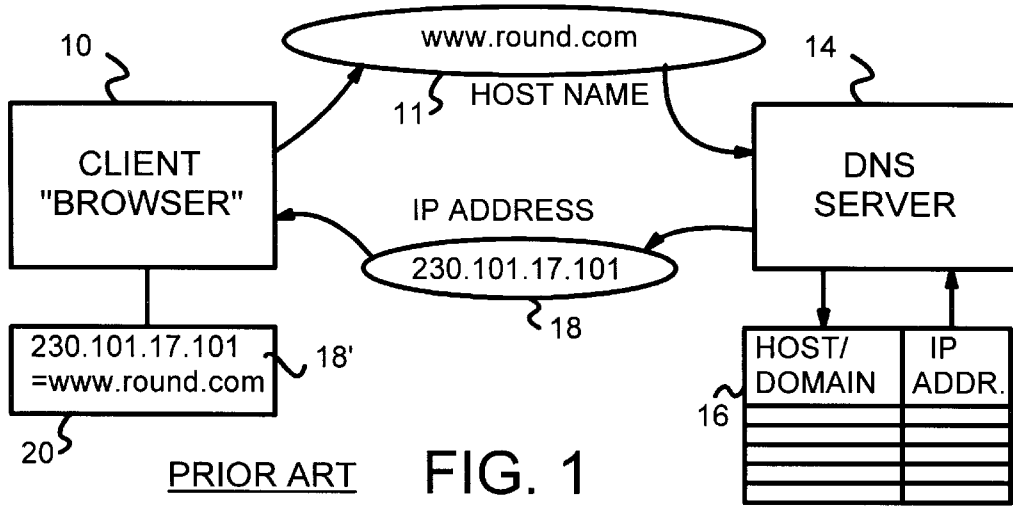
“Internet Server Market Draws Foes” San Jose Business Journal, Mar. 25, 1996, p. 8.

HydraWEB Frequently Asked Questions, Apr. 23, 1996, pp. 1–8.

HydraWEB Load–Balancer Product Literature, 1996.

Cisco Local Director WWW pp. 1–5, 1996.

WomPlex WWW pp. 1–3, 1996.



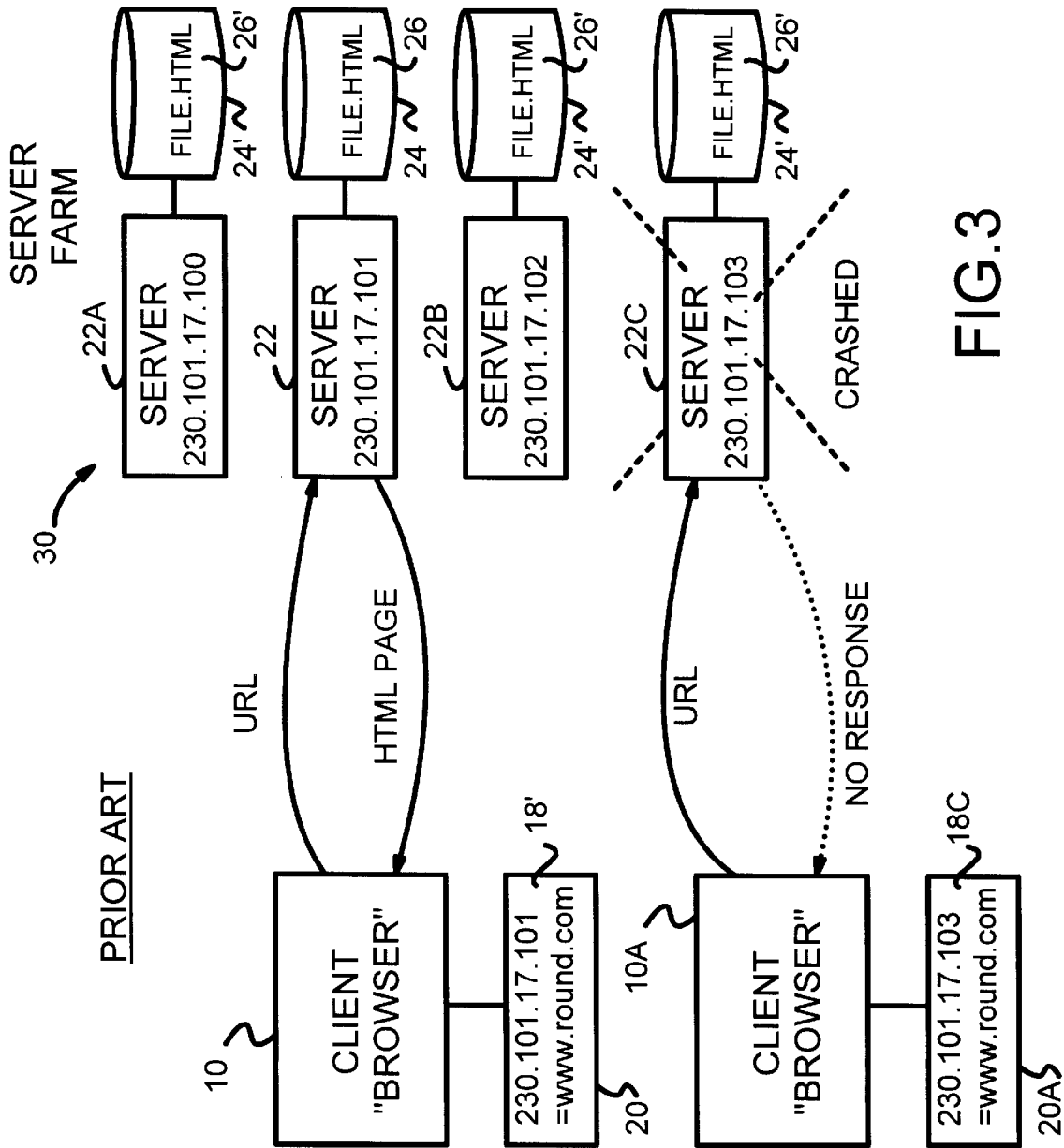


FIG. 3

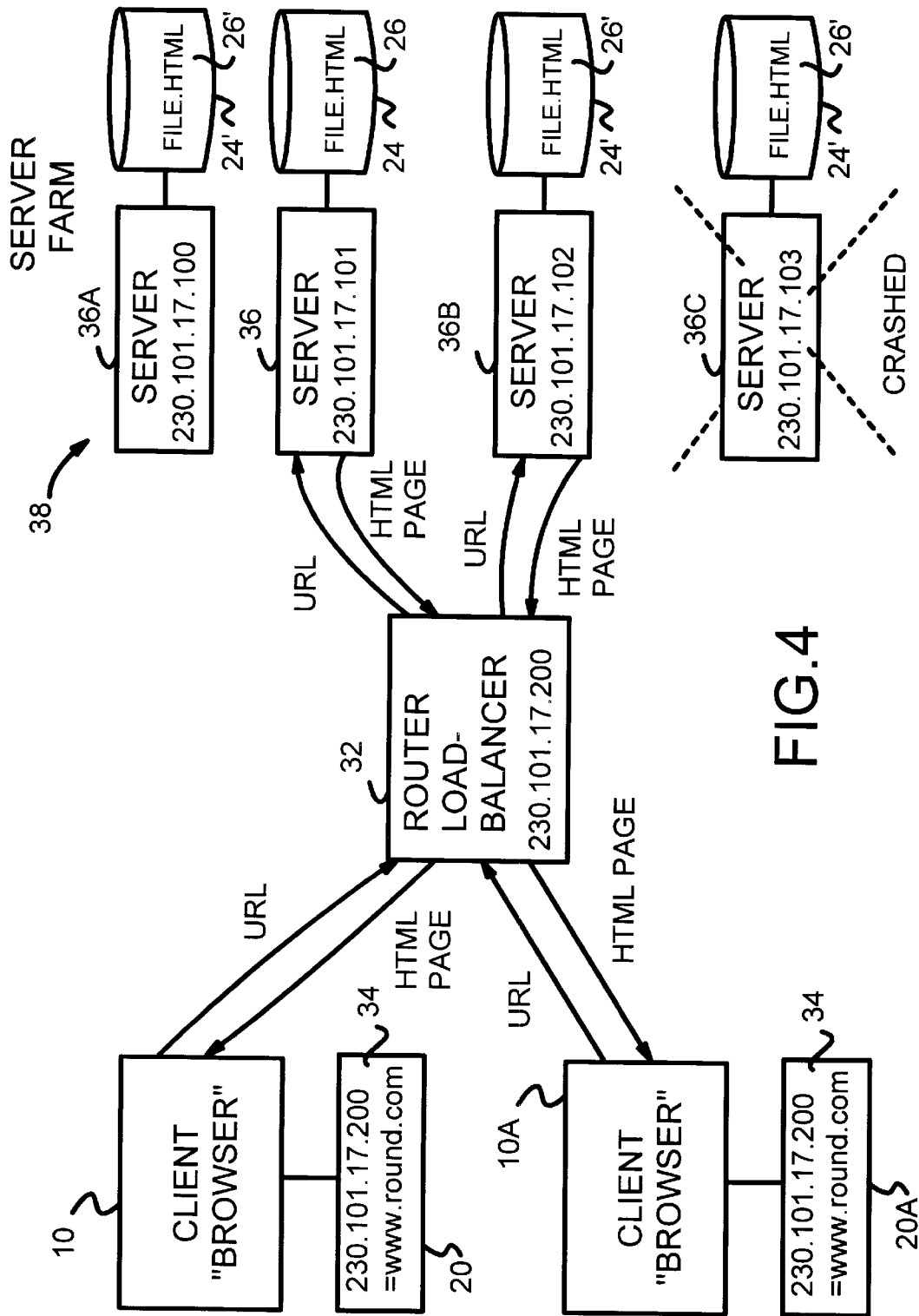


FIG.4

PRIOR ART

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.