



US007266555B1

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

(10) **Patent No.:** **US 7,266,555 B1**
(45) **Date of Patent:** **Sep. 4, 2007**

(54) **METHODS AND APPARATUS FOR ACCESSING REMOTE STORAGE THROUGH USE OF A LOCAL DEVICE**

(75) Inventors: **Joshua L. Coates**, Orinda, CA (US);
Patrick E. Bozeman, San Francisco, CA (US)

(73) Assignee: **Intel Corporation**, Santa Clara, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/733,314**

(22) Filed: **Dec. 8, 2000**

Related U.S. Application Data

(60) Provisional application No. 60/186,693, filed on Mar. 3, 2000, provisional application No. 60/186,774, filed on Mar. 3, 2000.

(51) **Int. Cl.**
G06F 17/30 (2006.01)

(52) **U.S. Cl.** **707/10; 707/4**

(58) **Field of Classification Search** **707/1-10, 707/100-102, 200-206; 709/200-203**
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,497,422 A	3/1996	Tysen et al.	
5,506,984 A	4/1996	Miller	
5,550,986 A	8/1996	DuLac	
5,692,155 A	11/1997	Iskiyn et al.	
5,708,832 A *	1/1998	Inniss et al.	709/229
5,757,920 A	5/1998	Misra et al.	
5,764,972 A	6/1998	Crouse et al.	

5,796,952 A	8/1998	Davis et al.	
5,805,699 A	9/1998	Akiyama et al.	
5,870,537 A	2/1999	Kern et al.	
5,923,846 A	7/1999	Gage et al.	
5,933,834 A	8/1999	Aichelen	
5,937,406 A *	8/1999	Balabine et al.	707/100
5,978,577 A	11/1999	Rierden et al.	

(Continued)

FOREIGN PATENT DOCUMENTS

EP 0646858 A1 8/1994

(Continued)

OTHER PUBLICATIONS

MOGUL, RFC0917: Internet Subnets, 1984, ACM, pp. 1-17.

(Continued)

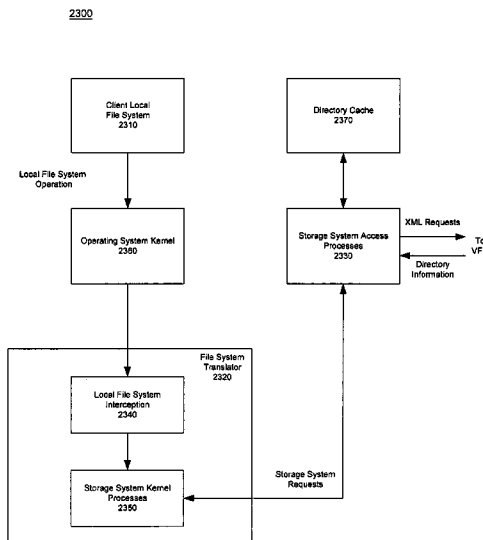
Primary Examiner—Joon Hwan Hwang

(74) *Attorney, Agent, or Firm*—Caroline M. Fleming

(57) **ABSTRACT**

A network storage system includes a virtual file system (“VFS”), to manage the files of the network storage system, and a storage center that stores the files. The VFS and the storage center are separated, such that a client accesses the VFS to conduct file system operations and the client accesses the storage center to upload/download files. The client accesses the network storage system through one or more storage ports. The storage center includes a plurality of distributed object storage managers (DOSMs) and a storage cluster that includes a plurality of intelligent storage nodes. The network storage system includes additional storage centers at geographically disparate locations. The network storage system uses a multi-cast protocol to maintain file information at the DOSMs regarding files stored in the intelligent storage nodes, including files stored in disparate storage centers.

23 Claims, 32 Drawing Sheets



U.S. PATENT DOCUMENTS

6,081,883 A * 6/2000 Popelka et al. 712/28
 6,108,155 A 8/2000 Tanaka et al.
 6,128,627 A * 10/2000 Mattis et al. 707/202
 6,148,349 A 11/2000 Chow et al.
 6,170,013 B1 1/2001 Murata
 6,173,374 B1 1/2001 Heil et al.
 6,236,999 B1 * 5/2001 Jacobs et al. 707/10
 6,256,673 B1 7/2001 Gayman
 6,263,402 B1 7/2001 Ronstrom et al.
 6,272,584 B1 8/2001 Stancil
 6,304,980 B1 10/2001 Beardsley et al.
 6,314,465 B1 11/2001 Paul et al.
 6,324,581 B1 11/2001 Xu et al.
 6,327,614 B1 * 12/2001 Asano et al. 709/213
 6,351,775 B1 2/2002 Yu
 6,356,929 B1 3/2002 Gall et al.
 6,360,306 B1 3/2002 Bergsten
 6,389,462 B1 5/2002 Cohen et al.
 6,393,466 B1 5/2002 Hickman et al.
 6,405,201 B1 6/2002 Nazari
 6,438,125 B1 8/2002 Brothers
 6,442,548 B1 8/2002 Balabine et al.
 6,507,883 B1 1/2003 Bello et al.
 6,553,376 B1 4/2003 Lewis et al.
 6,553,389 B1 4/2003 Golding et al.
 6,574,641 B1 6/2003 Dawson et al.
 6,611,869 B1 8/2003 Eschelbeck et al.
 6,622,247 B1 9/2003 Isaak
 6,654,772 B1 11/2003 Crow et al.
 6,704,838 B2 3/2004 Anderson
 6,718,347 B1 * 4/2004 Wilson 707/201
 6,782,389 B1 8/2004 Chrin et al.
 6,895,418 B1 5/2005 Crow et al.
 6,912,548 B1 6/2005 Black

6,931,450 B2 8/2005 Howard et al.
 6,948,062 B1 9/2005 Clapper
 2002/0010757 A1 1/2002 Granik et al.
 2002/0054114 A1 5/2002 Shuping et al.
 2002/0083120 A1 6/2002 Soltis
 2002/0133491 A1 9/2002 Sim et al.
 2002/0133539 A1 9/2002 Monday
 2004/0078465 A1 4/2004 Coates et al.
 2004/0078466 A1 4/2004 Coates et al.
 2004/0088297 A1 5/2004 Coates

FOREIGN PATENT DOCUMENTS

WO WO99/45491 9/1999
 WO WO 01/66707 A1 9/2001
 WO WO 01/67707 A2 9/2001

OTHER PUBLICATIONS

Microsoft Press, Computer Dictionary 3rd Edition, 1997, p. 337.
 Kline: Distributed File Systems for Storage Area Networks; Advanced Digital Info Corp; 11 pages.
 Apache-SSL: Certificates, Configuration and More Information Systems and Technology; University of Waterloo; Sep. 15, 1998; 16 pages.
 Schroeder: Implementing Multi-Protocol Authentication/Security Systems; Grid (GSI) Secure Socket Layer (X.509 Certificates), Kerberos, DCE, and Custom Systems for Secure Distributed Data Access; Jul. 19, 1999; 4 pages.
 BEA WebLogic SSL; Server 4.5; 20 pages.
 Certificate to LDAP Mapping in Netscape Servers, Rev 1.2; Aug. 28, 1997; Structured Arts Technical Notes.
 U.S. Appl. No. 10/367,541 Office action dated Oct. 11, 2006, 1-15.
 U.S. Appl. No. 09/753,332, Office action dated Oct. 19, 2006, 1-26.
 U.S. Appl. No. 09/695,499, Office action, (Dec. 11, 2006), 1-16.

* cited by examiner

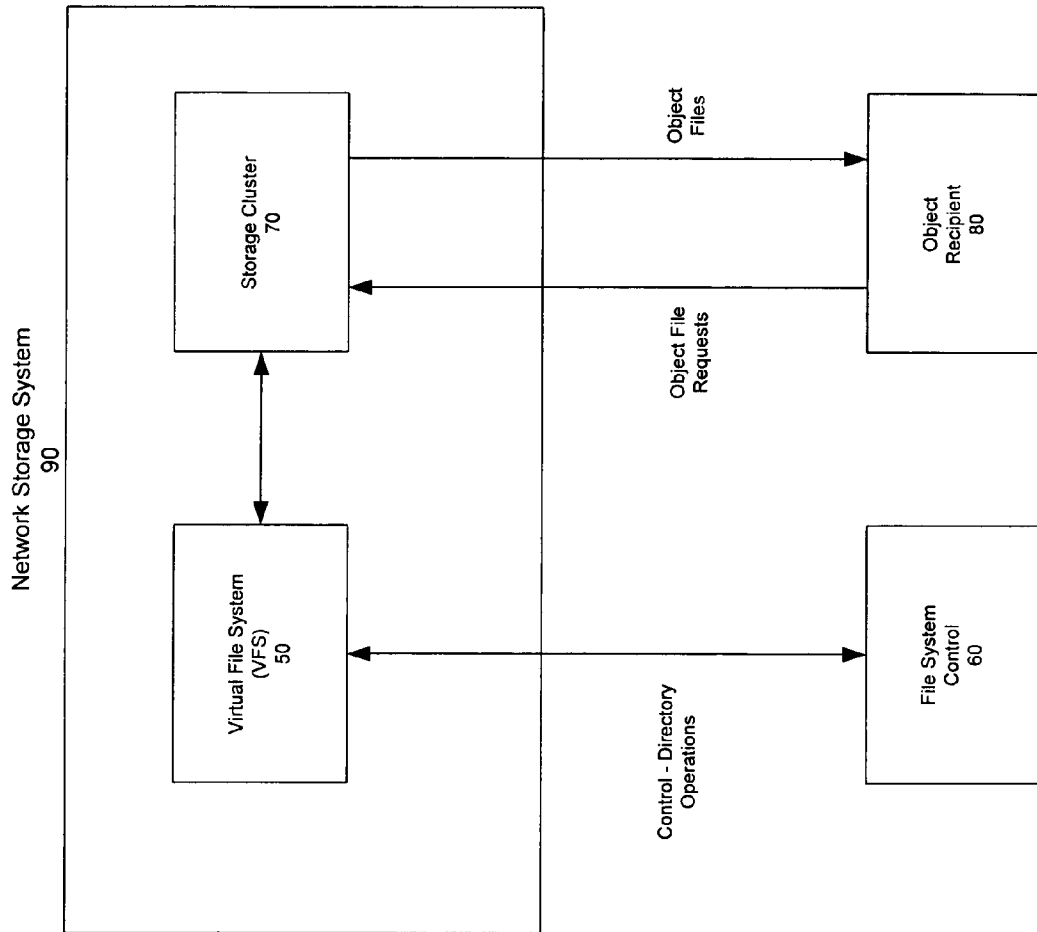


Figure 1

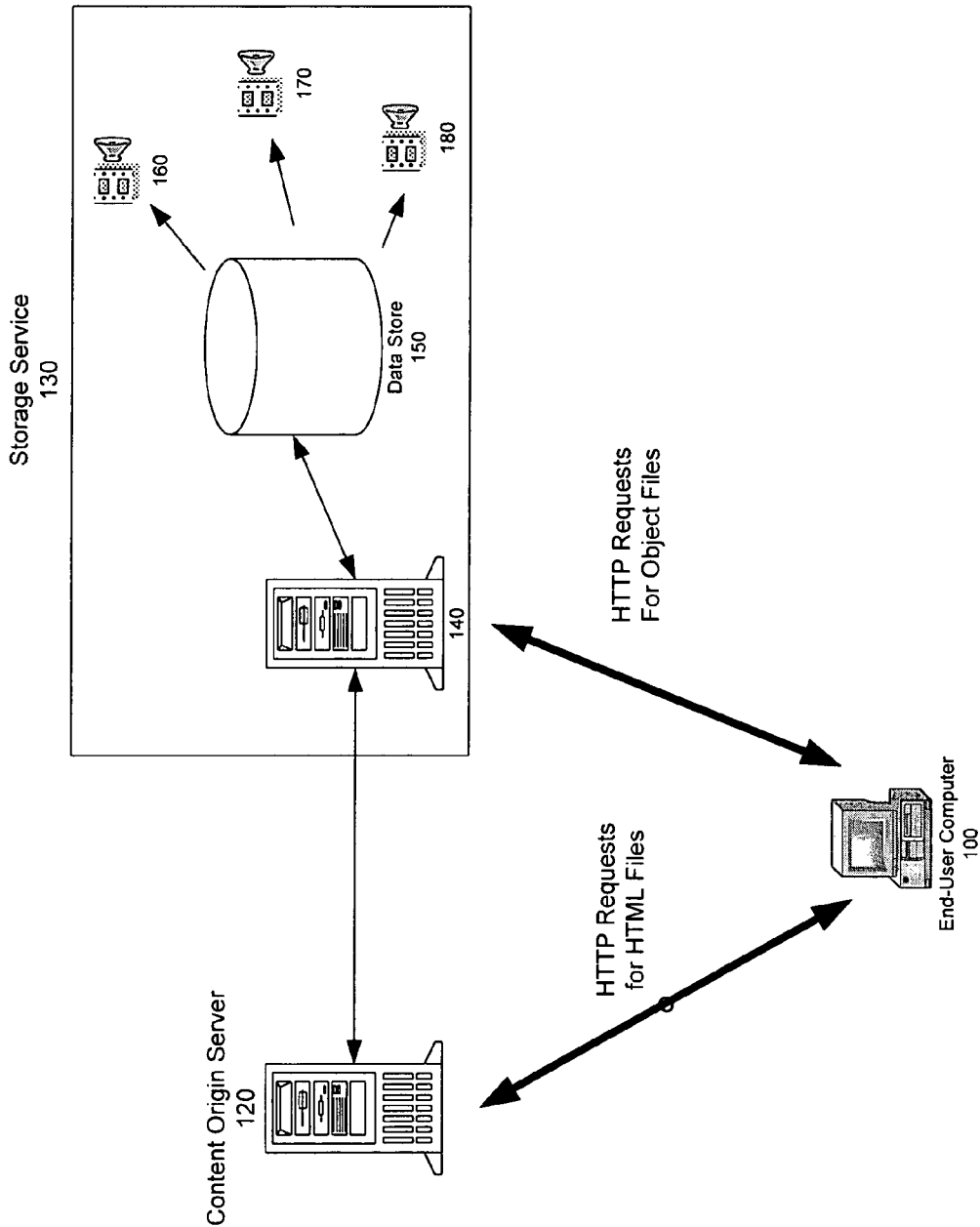


Figure 2

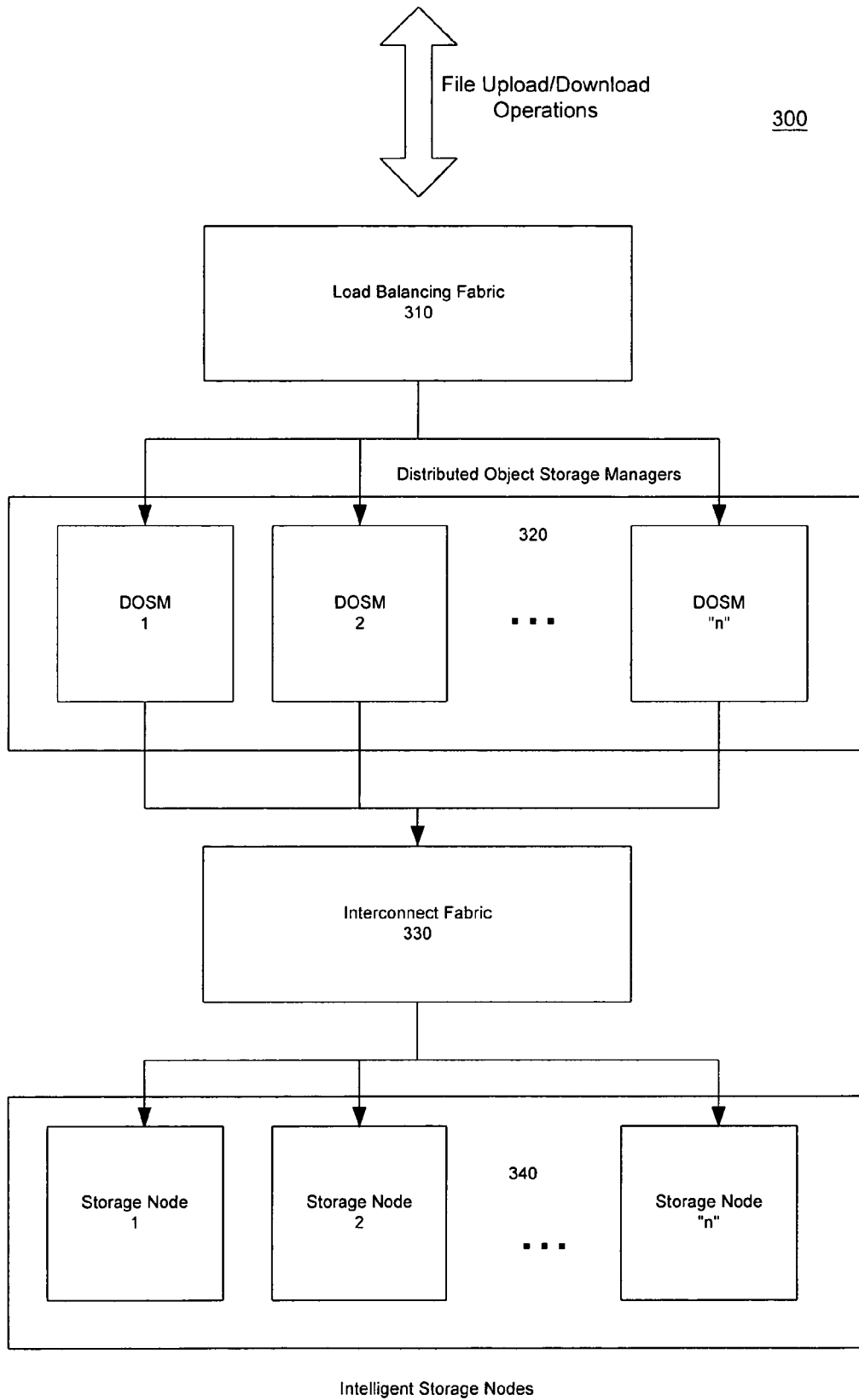


Figure 3

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.