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Coates et al.

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(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)

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Related U.S. Application Data

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(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)

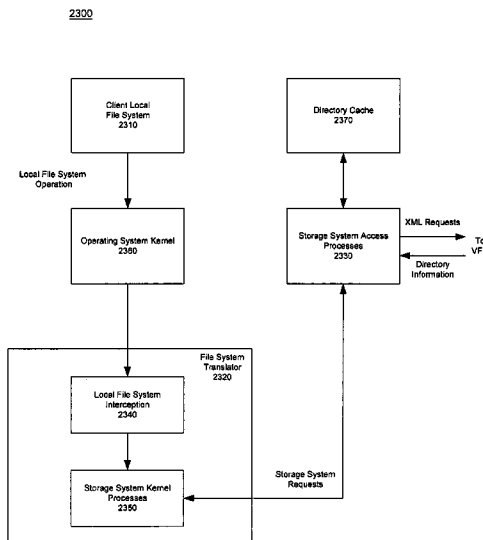
Primary Examiner—Joon Hwan Hwang

(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 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

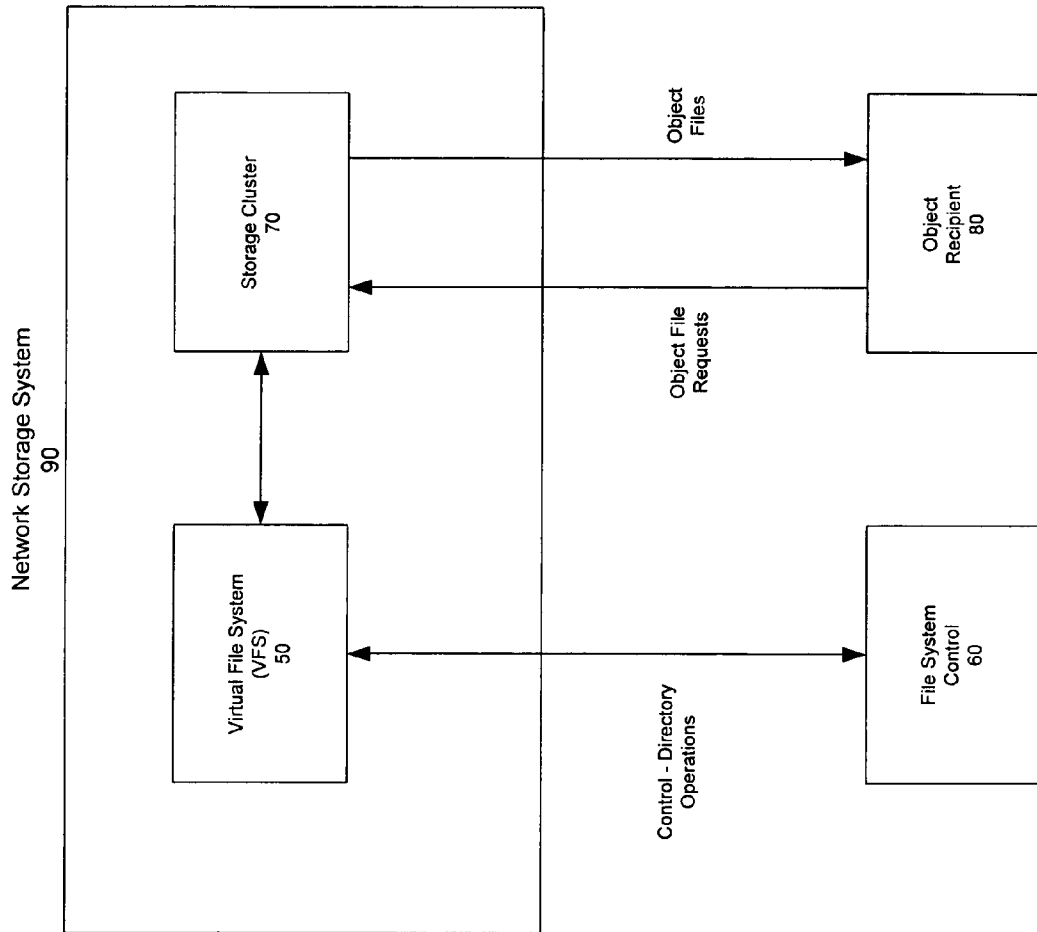


Figure 1

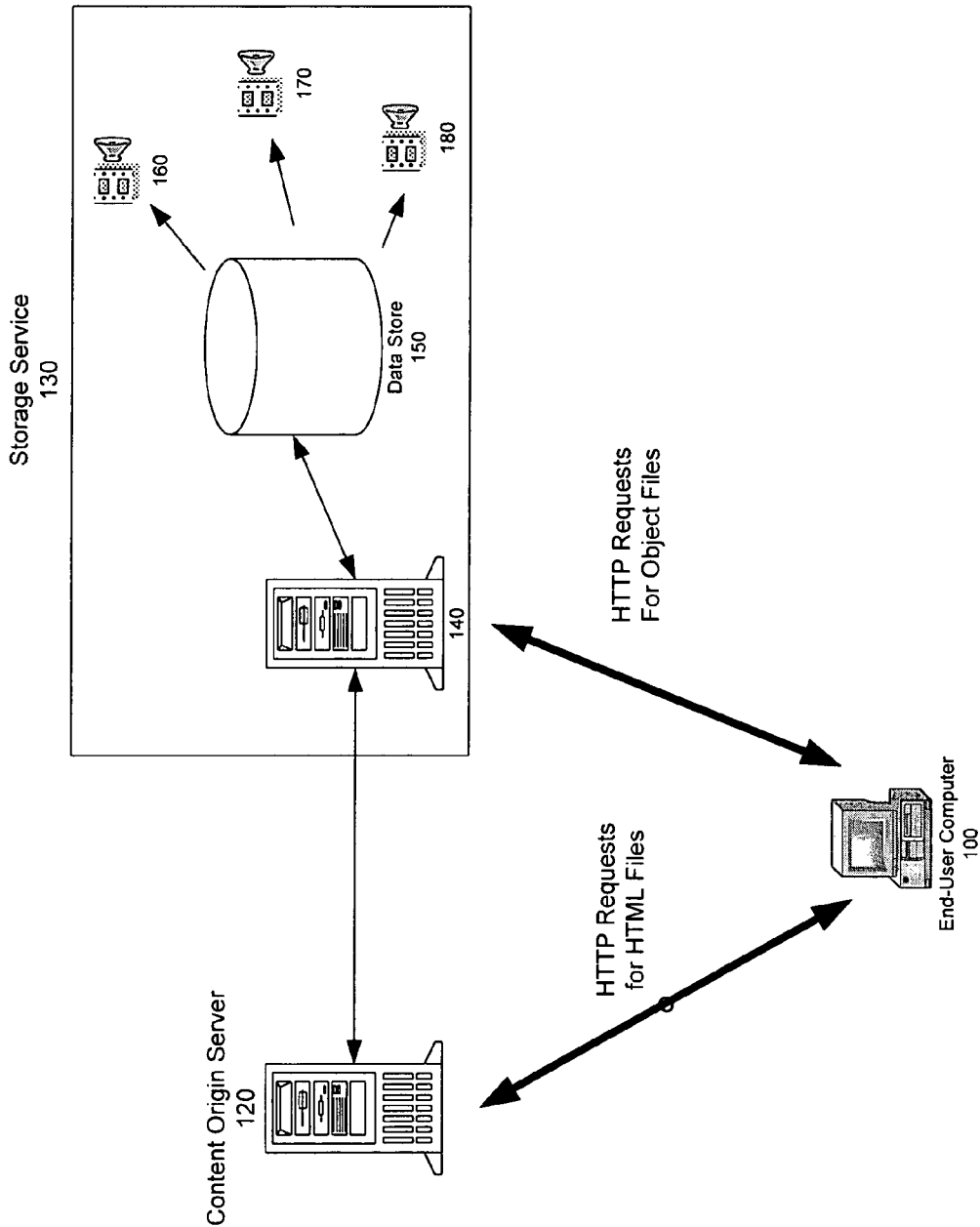


Figure 2

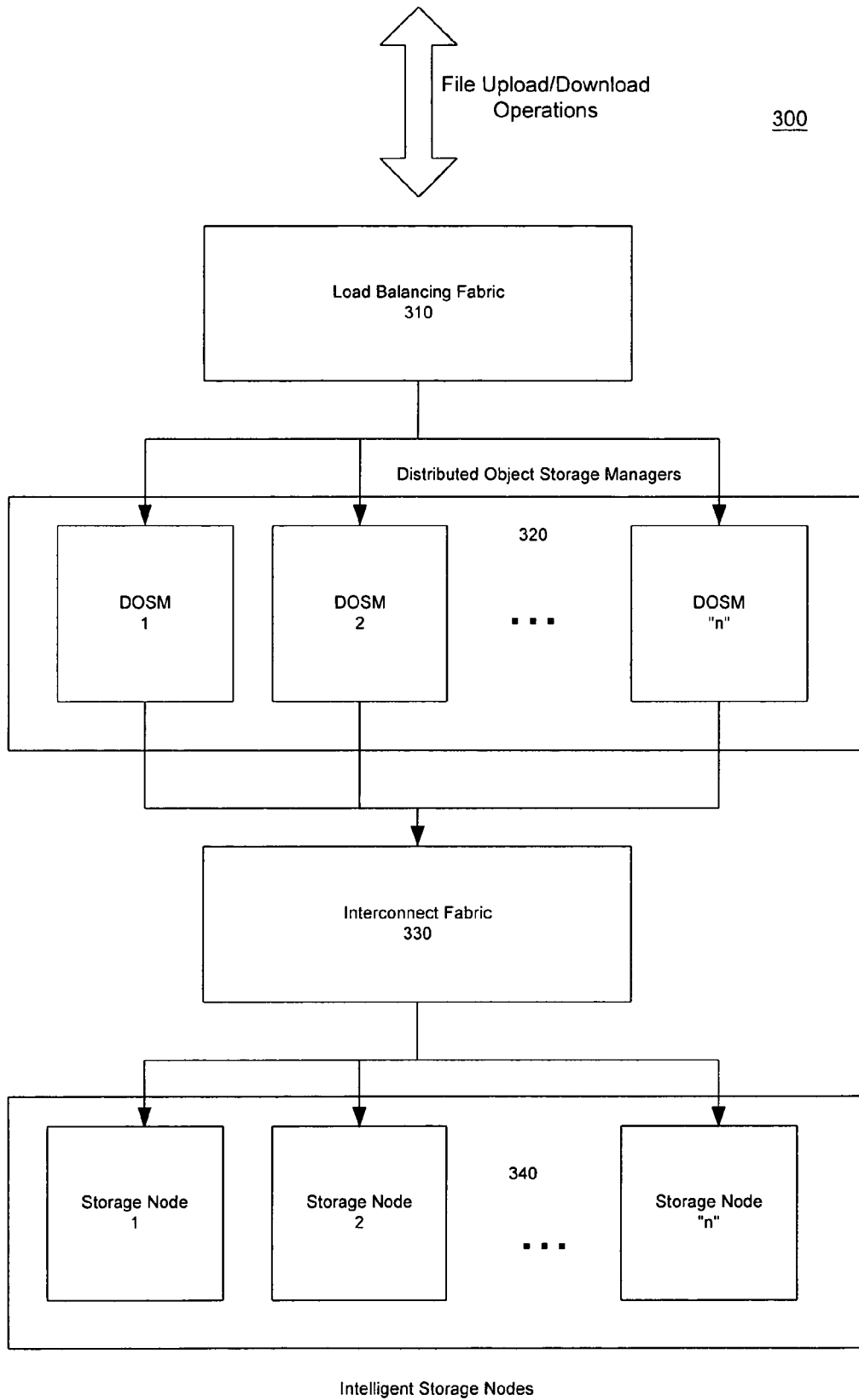


Figure 3

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