



US006073209A

United States Patent [19]
Bergsten

[11] Patent Number: 6,073,209
[45] Date of Patent: Jun. 6, 2000

[54] DATA STORAGE CONTROLLER
PROVIDING MULTIPLE HOSTS WITH
ACCESS TO MULTIPLE STORAGE
SUBSYSTEMS

5,794,013 8/1998 McBrearty 395/500.48
5,926,833 7/1999 Rasulian et al. 711/147

FOREIGN PATENT DOCUMENTS

PCT/US93/
05853 6/1993 WIPO .
WO 94/00816 1/1994 WIPO .
PCT/US94/
01447 2/1994 WIPO .
WO 94/19743 9/1994 WIPO .

OTHER PUBLICATIONS

Brochure, "CacheXchange: General Description, Legacy Series 690/9090," Andor International, Ltd., 1991.

Primary Examiner—Hiep T. Nguyen
Attorney, Agent, or Firm—Blakely, Sokoloff, Taylor & Zafman LLP

[57] ABSTRACT

A computer network comprises a number of storage controllers, each coupled to one of a plurality of storage arrays, each storage array including at least one mass storage device. Each storage controller may be coupled to at least one host processing system and to at least one other storage controller to control access of the host processing systems to the mass storage devices. Multiple copies of data are maintained in storage arrays that are geographically remote to each other, such that any copy can be accessed by any host. Each storage controllers includes an interface with a host that emulates a mass storage device and an interface with a local storage array that emulates a host. The interfaces to the host and local storage arrays are independent of the type of host or devices in the local storage array. Two or more hosts may be dissimilar to each other, and two or more storage arrays may include dissimilar mass storage devices. Hosts access stored data using virtual addressing. During a data access, the storage controller connected to the accessing host maps a virtual address provided by the host to a real physical location in any of the storage arrays, such that the actual location of the data is transparent to the host. The storage controllers provide automatic back-up and error correction as well as write protection of back-up copies.

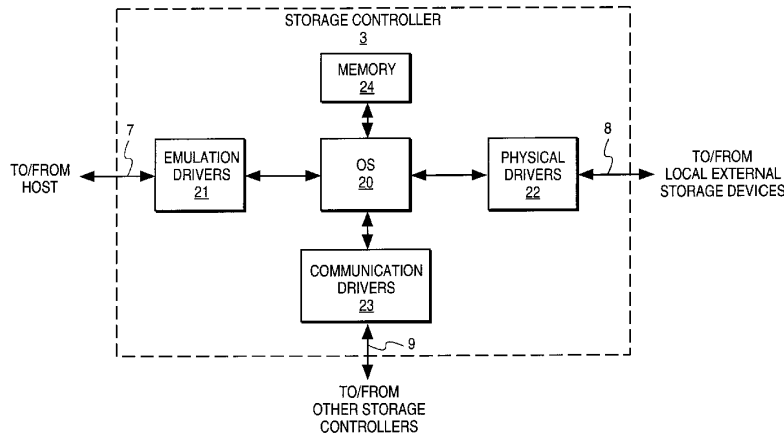
40 Claims, 18 Drawing Sheets

- [75] Inventor: James R. Bergsten, Saratoga, Calif.
- [73] Assignee: Ark Research Corporation, San Jose, Calif.
- [21] Appl. No.: 08/828,888
- [22] Filed: Mar. 31, 1997
- [51] Int. Cl.⁷ G06F 12/02
- [52] U.S. Cl. 711/114; 711/148; 711/153; 711/162; 707/204; 714/204
- [58] Field of Search 707/204; 711/162, 711/148, 114, 153; 714/6

[56] References Cited

U.S. PATENT DOCUMENTS

3,889,237	6/1975	Alferness et al.	711/148
4,718,006	1/1988	Nishida	711/148
5,155,845	10/1992	Beal et al.	395/575
5,408,629	4/1995	Tsuchiva et al.	711/151
5,455,932	10/1995	Major et al.	711/162
5,459,842	10/1995	Begun et al. .	
5,459,857	10/1995	Ludlam et al.	395/182.04
5,481,276	1/1996	Dickey et al. .	
5,504,882	4/1996	Chai et al.	395/182.03
5,530,845	6/1996	Hiatt et al. .	
5,588,132	12/1996	Cardoza	711/148
5,615,364	3/1997	Marks	707/202
5,673,381	9/1997	Huai et al.	395/180
5,673,382	9/1997	Cannon et al.	395/182.04
5,675,802	10/1997	Allen et al.	395/703
5,680,580	10/1997	Beardsley et al.	711/162
5,692,147	11/1997	Larson et al. .	
5,699,510	12/1997	Petersen et al.	385/185.07
5,708,769	1/1998	Stallmo	714/6
5,729,735	3/1998	Mayering	707/10
5,740,433	4/1998	Carr et al.	707/202
5,742,792	4/1998	Yanai et al.	711/162
5,765,200	6/1998	McIlvain et al.	711/170
5,768,623	6/1998	Judd et al.	395/857



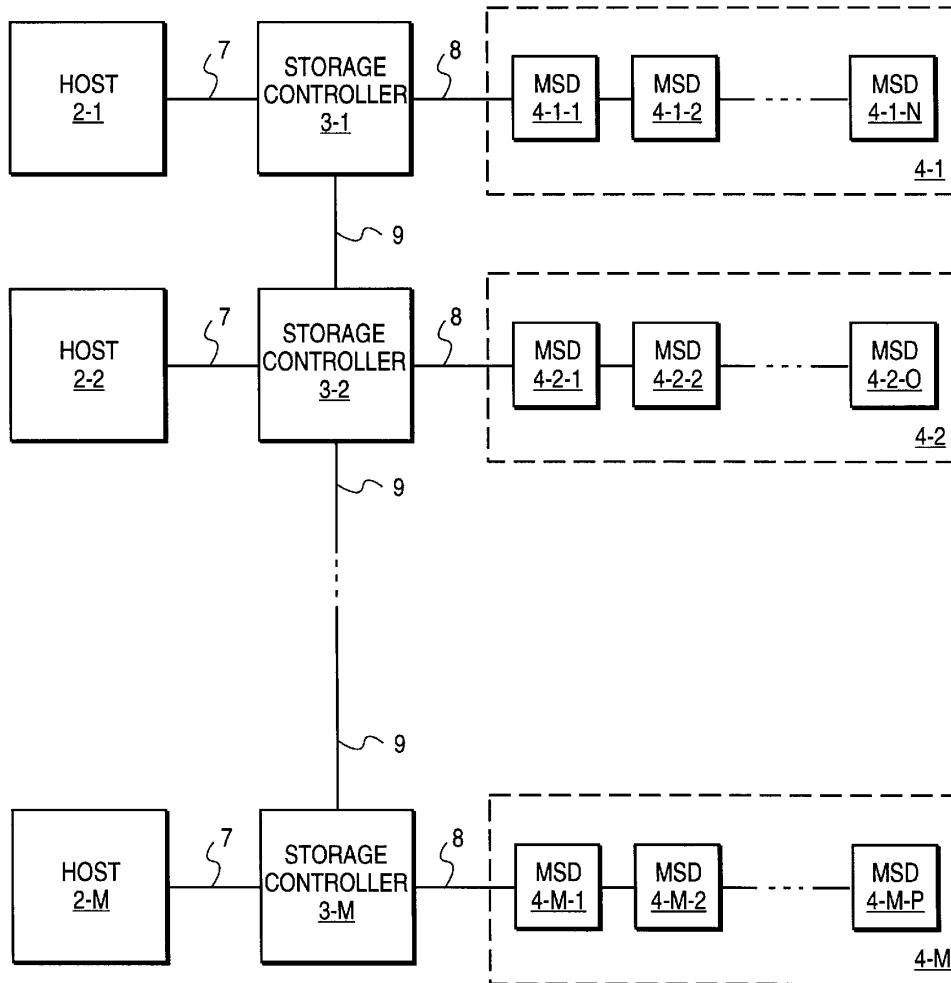


FIG. 1

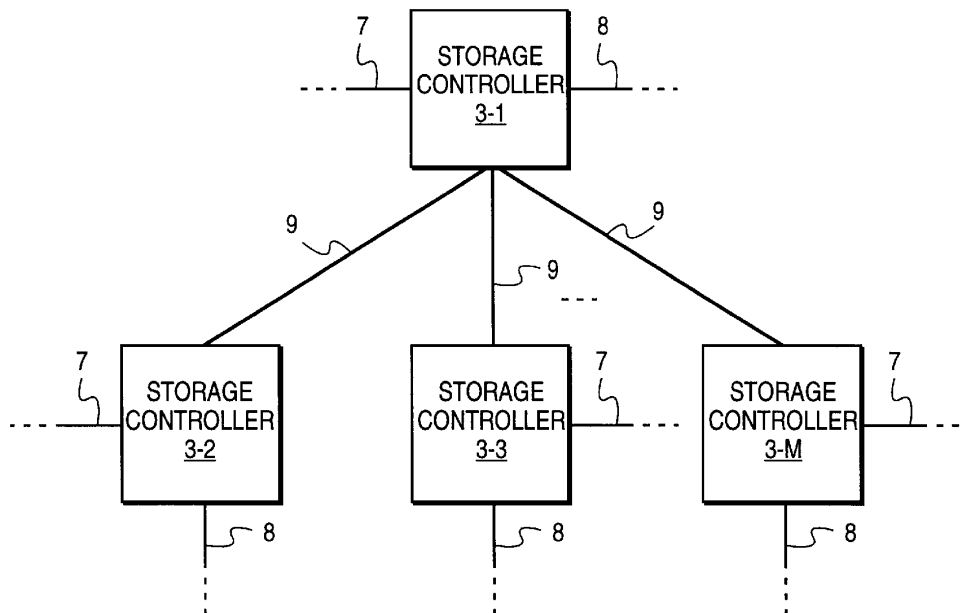


FIG. 2

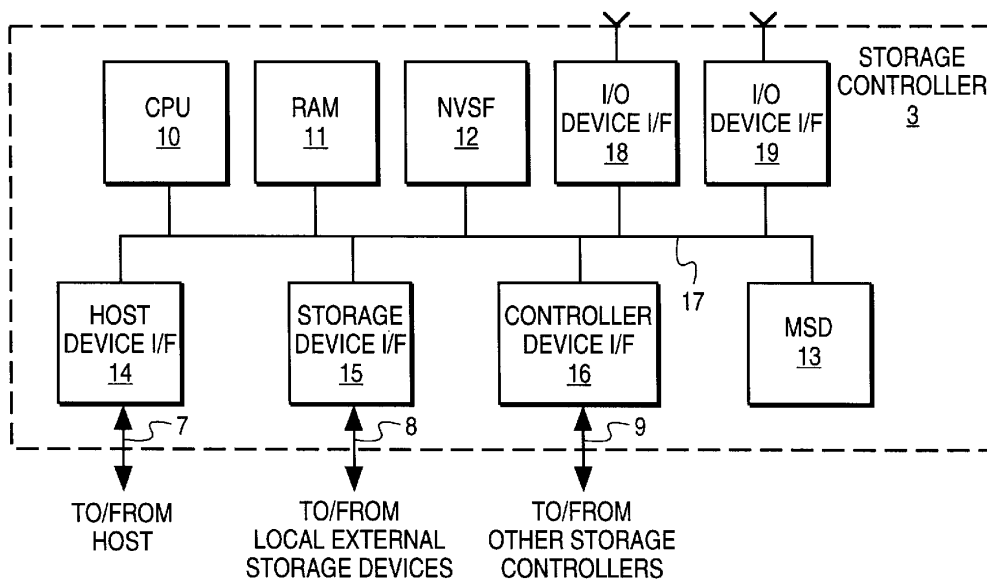


FIG. 3

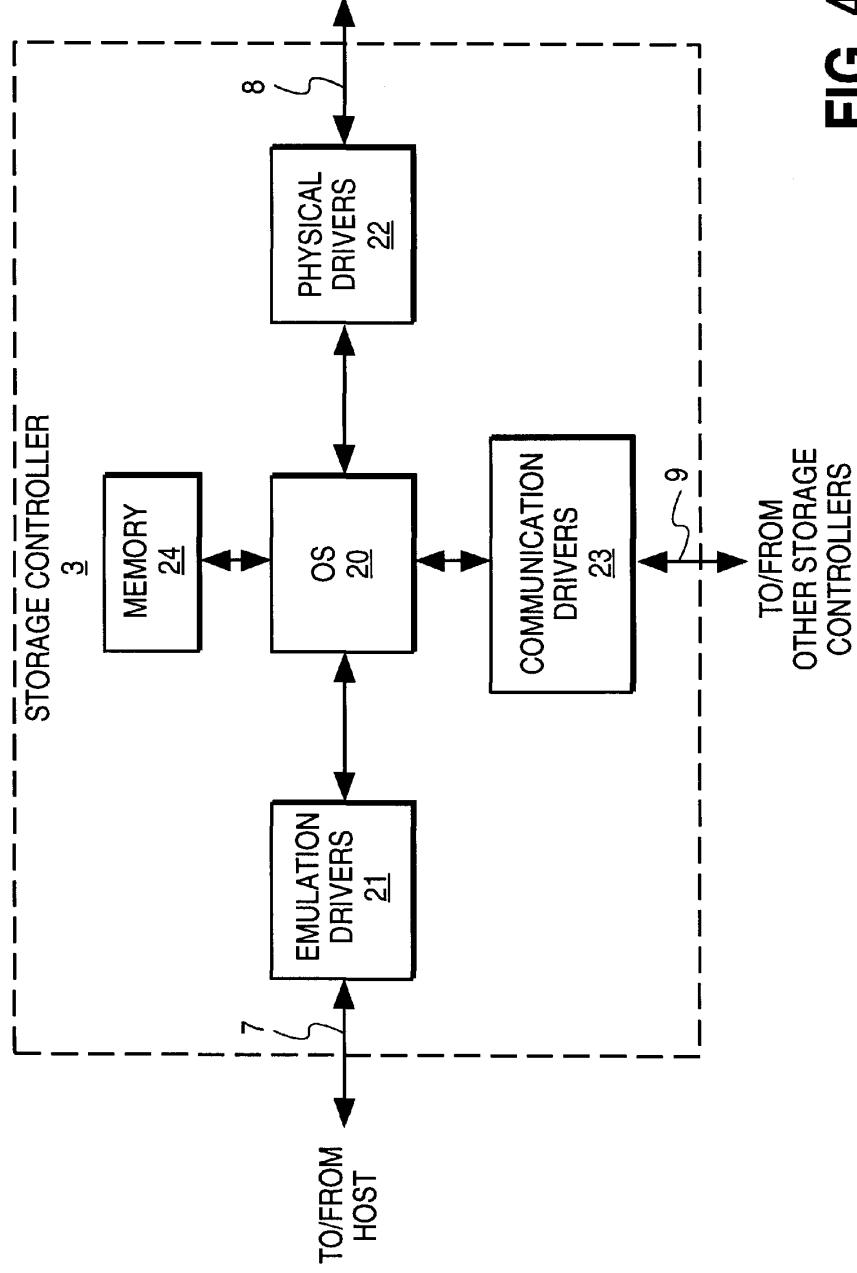


FIG. 4

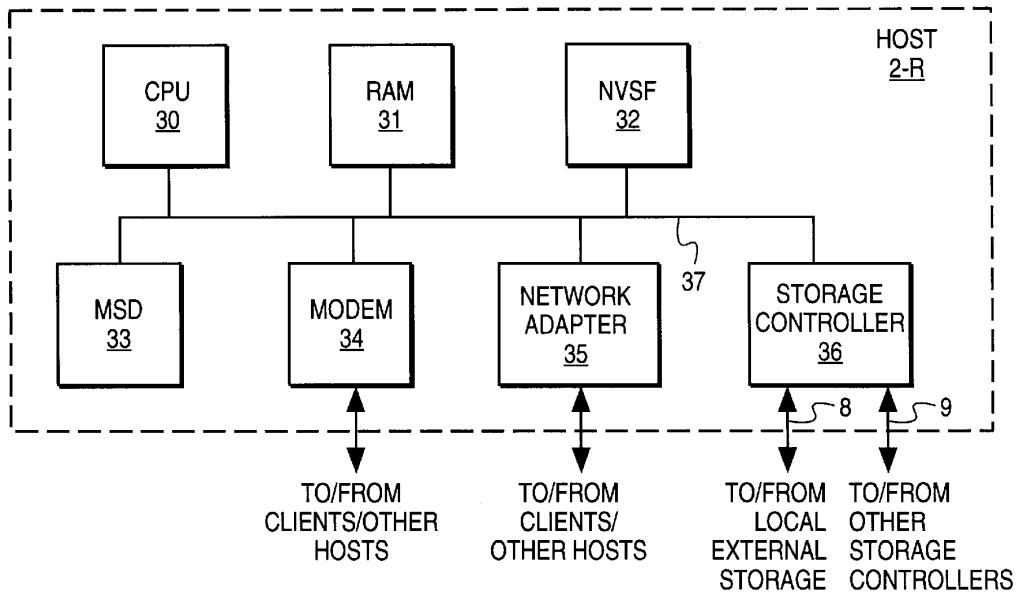


FIG. 5

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.