



US006128623A

United States Patent [19]
Mattis et al.

[11] **Patent Number:** **6,128,623**
[45] **Date of Patent:** **Oct. 3, 2000**

[54] **HIGH PERFORMANCE OBJECT CACHE**

0 834 819 A2 4/1998 European Pat. Off. .

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[57] **ABSTRACT**

[21] Appl. No.: **09/060,866**

[22] Filed: **Apr. 15, 1998**

[51] **Int. Cl.**⁷ **G06F 17/30**

[52] **U.S. Cl.** **707/103; 707/100; 711/118**

[58] **Field of Search** **707/100, 103; 711/118, 119, 120, 121, 122**

A high-performance cache is disclosed. The cache is designed for time- and space-efficiency for a diverse range of information objects. Information objects are stored in portions of a non-volatile storage device called arenas, which are contiguous regions from which space is allocated in parallel. Objects are substantially contiguously allocated within an arena and are mapped by name keys and content-based object keys to a tag table, an open directory, and a directory table. The tag table is indexed by the name keys, and stores references to sets in the directory table. The tag table is compact and therefore can be stored in fast main memory, facilitating rapid lookups. The directory table is organized so that at least a frequently-accessed portion of it also usually resides in fast main memory, which further speeds lookups. The tag and directory tables are organized to quickly determine non-presence of objects. Large objects may be chunked into fragments, which are chained using a forward functional-iteration mechanism, to prevent the need for mutating existing on-disk data structures. Garbage collection periodically moves objects within an arena or to other arenas so that inactive objects are deleted and free space becomes contiguous. Because the objects are substantially contiguously allocated, reading and writing an typical object requires only one or two disk head actuator movements; thus, the cache can efficiently and smoothly stream data off of the storage device, providing optimal delivery of multimedia objects. The disclosure also encompasses a computer apparatus, computer program product, and computer data signal embodied in a carrier wave that are similarly configured.

[56] **References Cited**

U.S. PATENT DOCUMENTS

5,542,087	7/1996	Neimat et al.	707/103
5,611,049	3/1997	Pitts	395/200.09
5,701,432	12/1997	Wong et al.	395/457
5,727,159	3/1998	Kikinis	395/200.76
5,732,267	3/1998	Smith	713/1
5,748,954	5/1998	Mauldin	395/610
5,826,242	10/1998	Montulli	705/27
5,852,717	12/1998	Bhide et al.	395/200.33
5,864,852	1/1999	Luotonen	707/10
5,870,763	2/1999	Lomet	707/202
5,872,969	2/1999	Copeland, et al.	395/671
5,881,229	3/1999	Singh et al.	395/200.33
5,909,695	6/1999	Wong et al.	711/133
5,924,116	7/1999	Aggarwal et al.	711/122
5,935,207	8/1999	Logue et al.	709/219
5,950,205	9/1999	Aviani, Jr.	707/103
5,974,421	10/1999	Krishnaswamy et al.	707/103
5,987,233	11/1999	Humphrey	395/200.47

FOREIGN PATENT DOCUMENTS

0 811 939 A2 12/1997 European Pat. Off. .

22 Claims, 26 Drawing Sheets

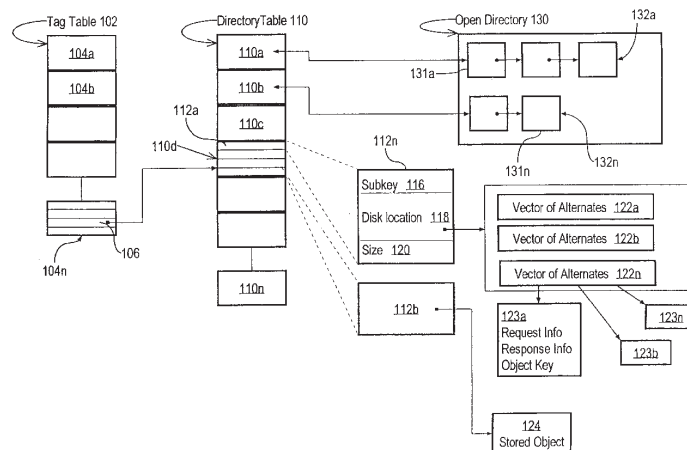


FIGURE 1 PRIOR ART

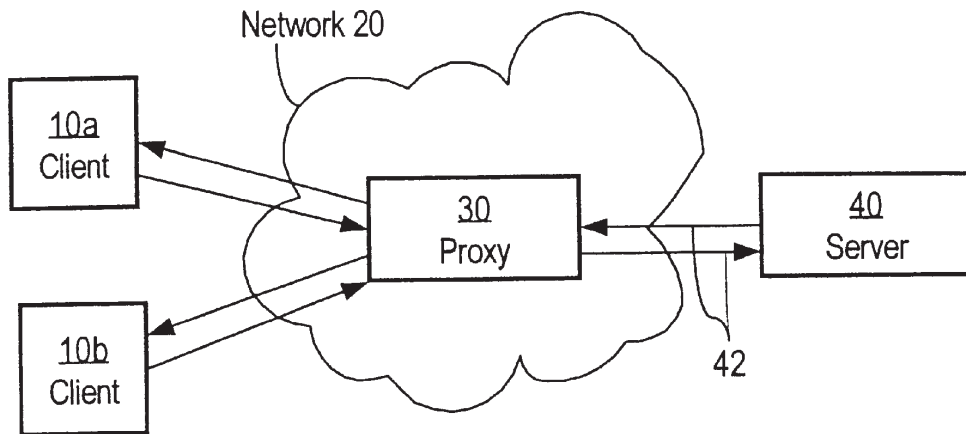


FIGURE 2

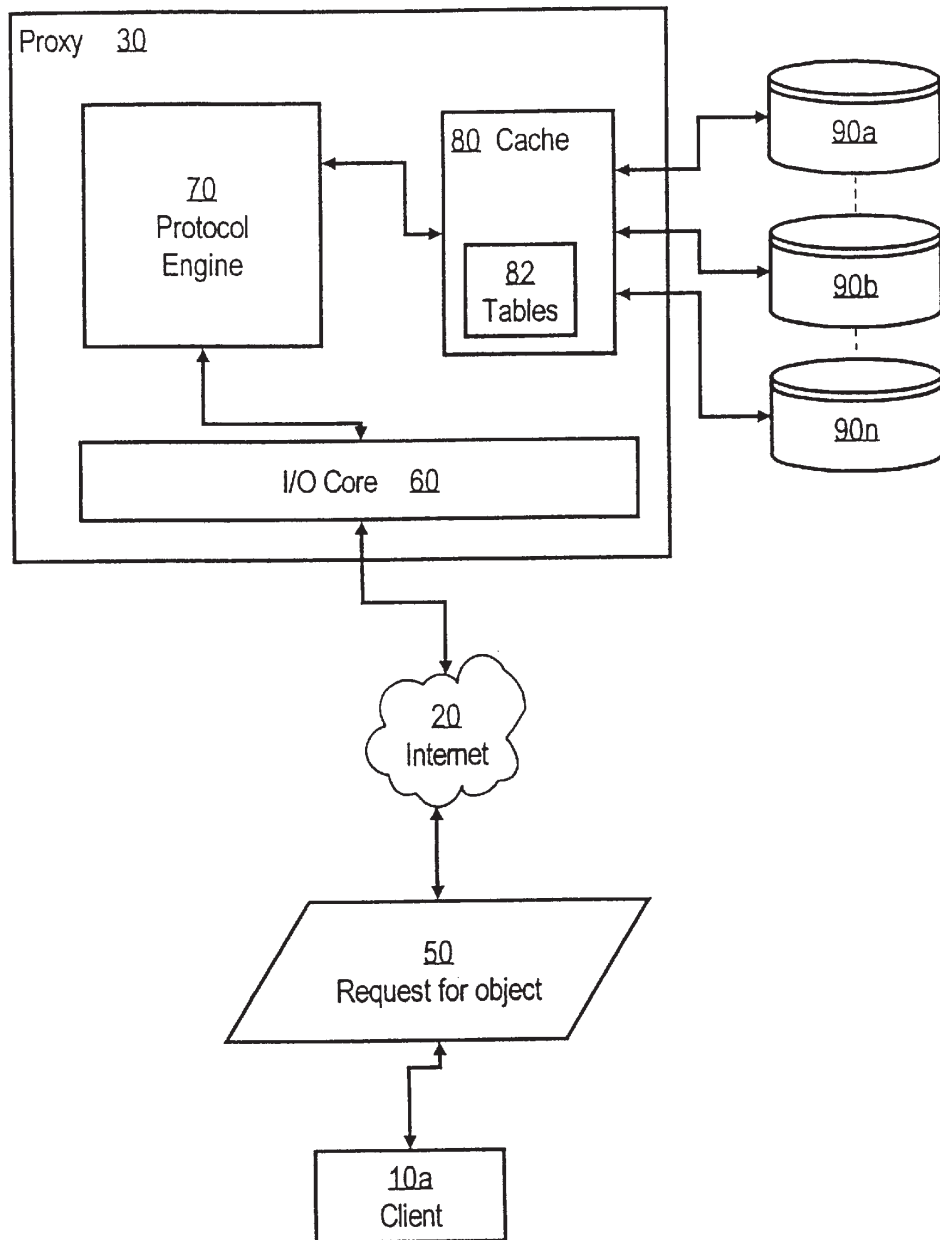


FIGURE 3A

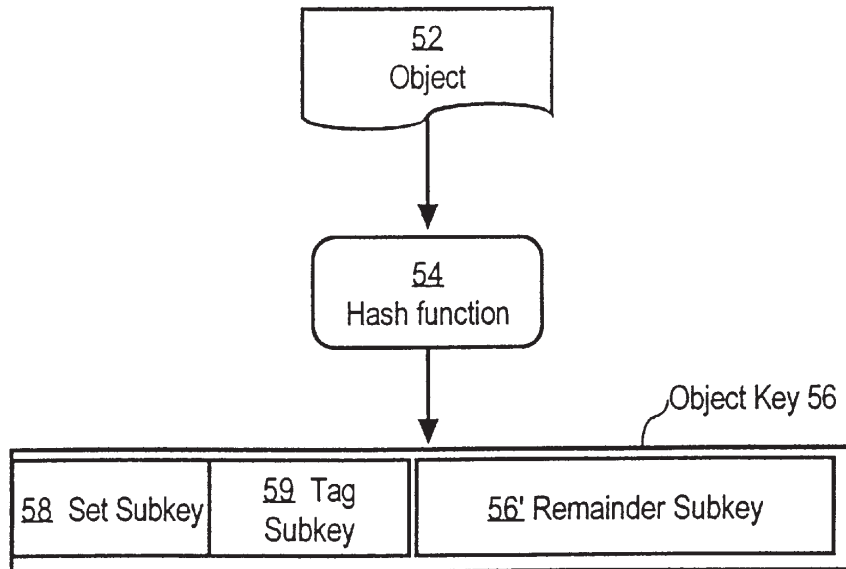
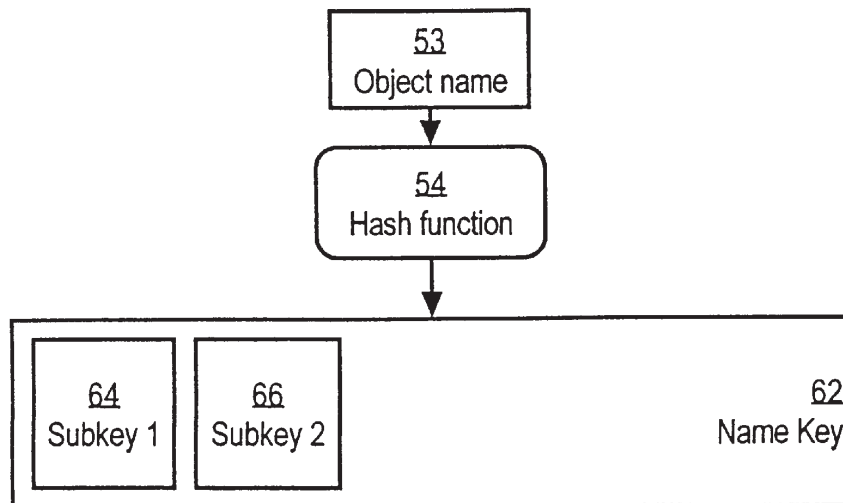


FIGURE 3B



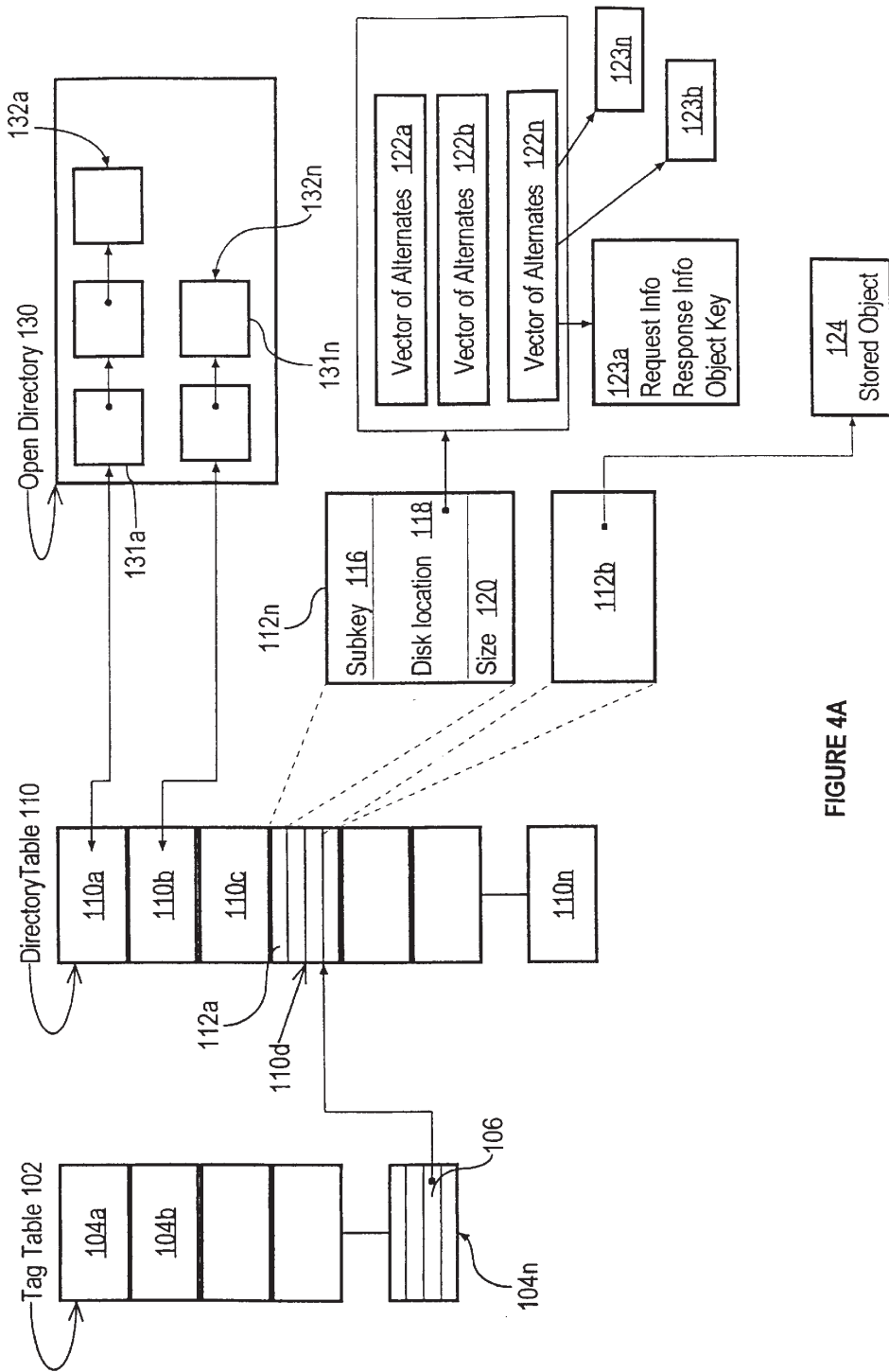


FIGURE 4A

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