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(54) **METHODS FOR ACCESSING DATA IN A COMPRESSED FILE SYSTEM AND DEVICES THEREOF**

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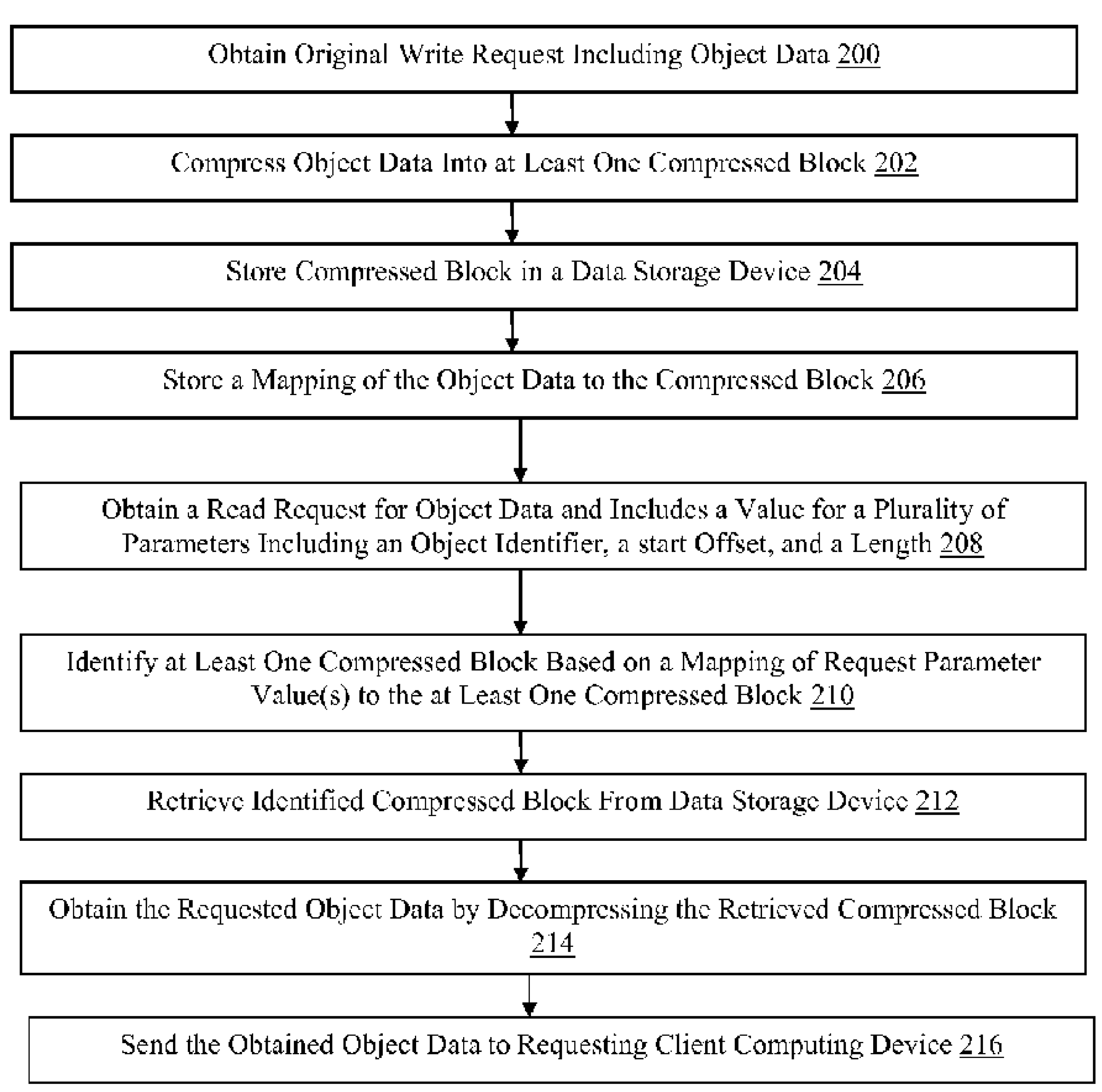
(57) **ABSTRACT**

A method, computer readable medium, and network traffic management apparatus that accesses data in a compressed file system includes obtaining an original write request from a client computing device including at least object data. The object data is compressed into a plurality of compressed blocks. A mapping of each compressed block to a portion of the object data compressed therein is generated, wherein the portion of the object data compressed therein is represented in the mapping by a unique object identifier, a start offset, and a length. The compressed blocks and the mapping are stored in at least one data storage device. At least one data access request for at least a portion of the object data is serviced based on the mapping.

24 Claims, 3 Drawing Sheets



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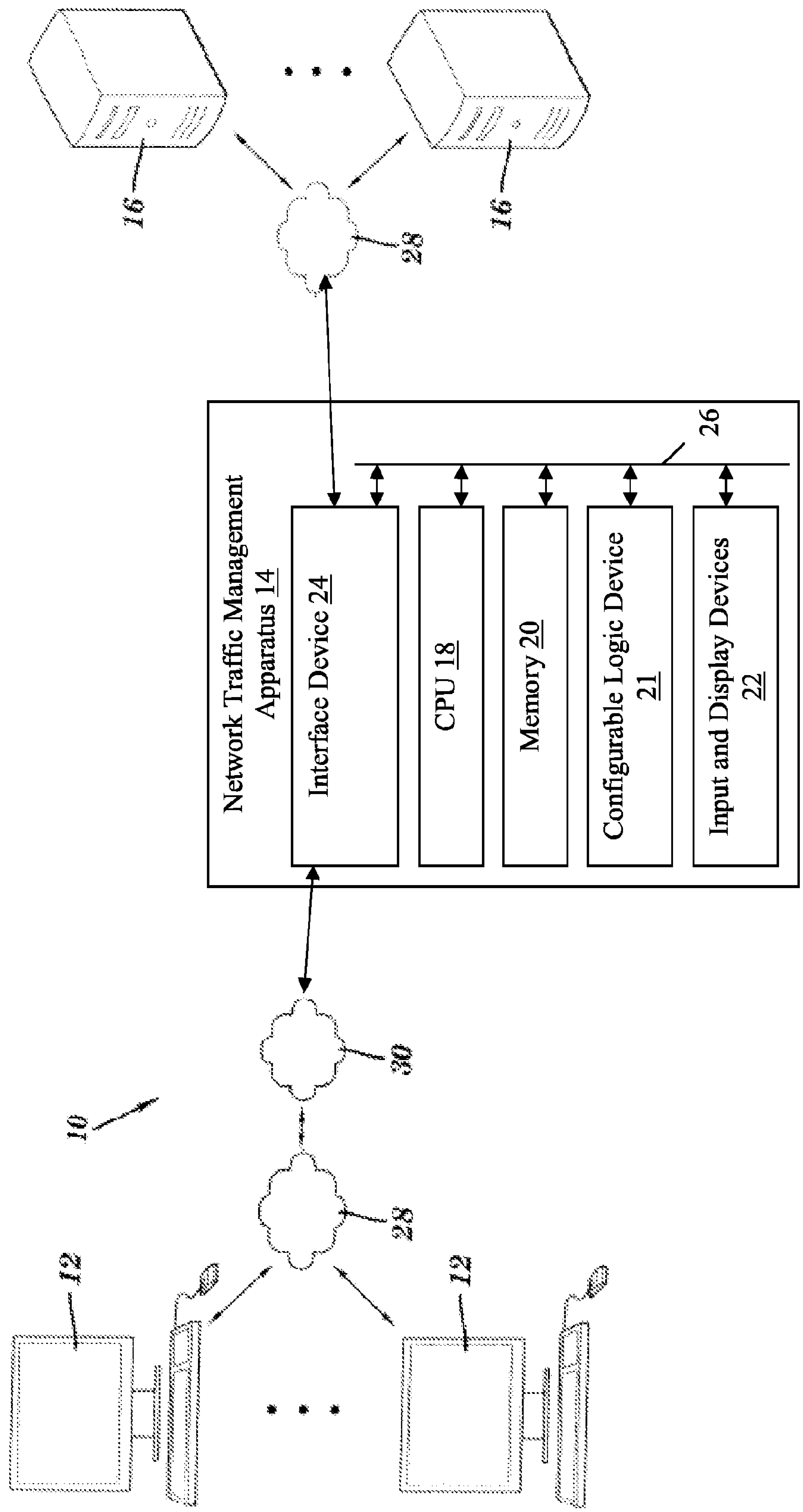
16
16
28
26
Network Traffic Management Apparatus 14
Interface Device 24
CPU 18
Memory 20
Configurable Logic Device 21
Input and Display Devices 22
30
10
28
12
12

FIG. 1

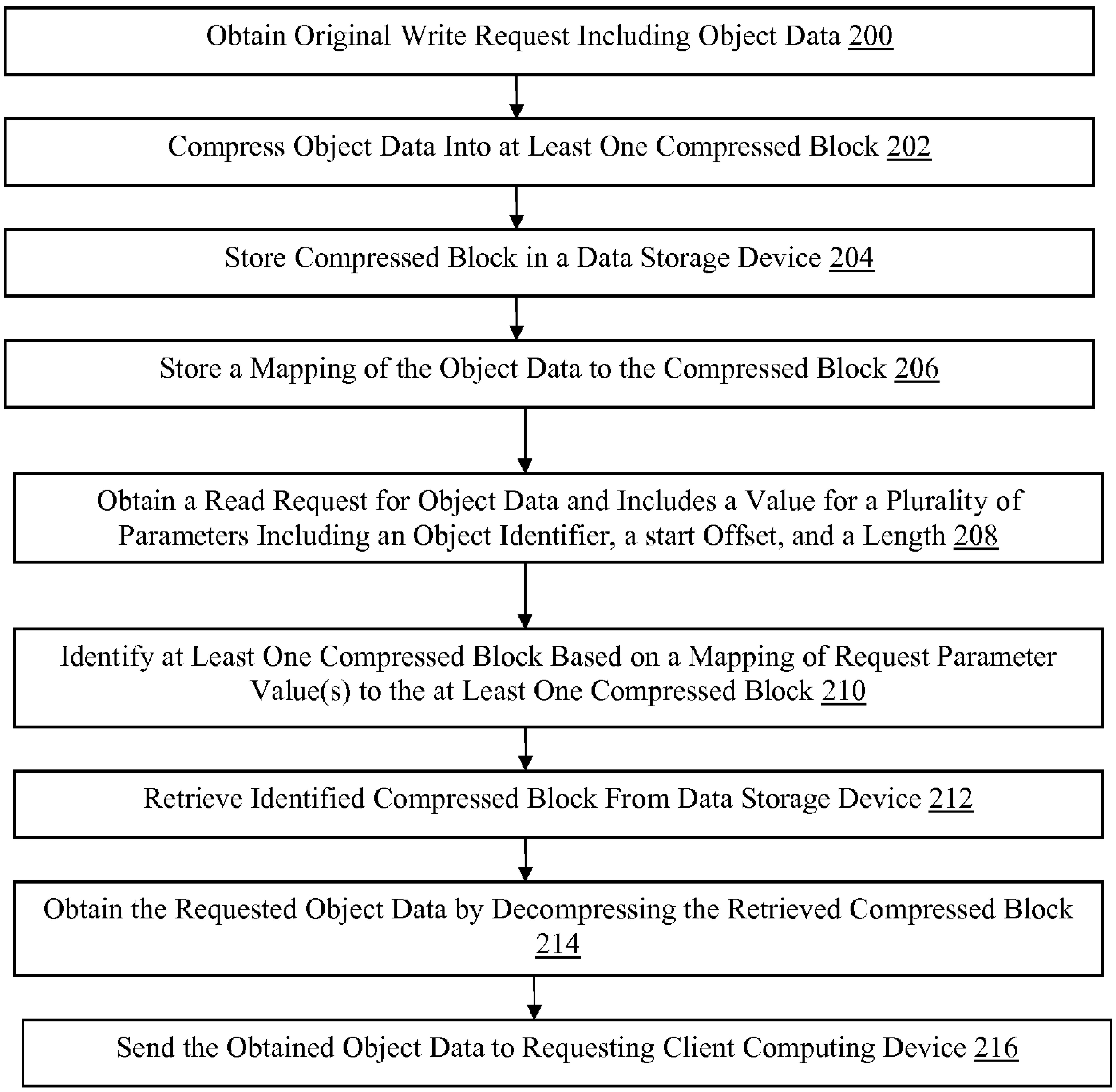
Obtain Original Write Request Including Object Data 200
Compress Object Data Into at Least One Compressed Block 202
Store Compressed Block in a Data Storage Device 204
Store a Mapping of the Object Data to the Compressed Block 206
Obtain a Read Request for Object Data and Includes a Value for a Plurality of Parameters Including an Object Identifier, a start Offset, and a Length 208
Identify at Least One Compressed Block Based on a Mapping of Request Parameter Value(s) to the at Least One Compressed Block 210
Retrieve Identified Compressed Block From Data Storage Device 212
Obtain the Requested Object Data by Decompressing the Retrieved Compressed Block 214
Send the Obtained Object Data to Requesting Client Computing Device 216

FIG. 2

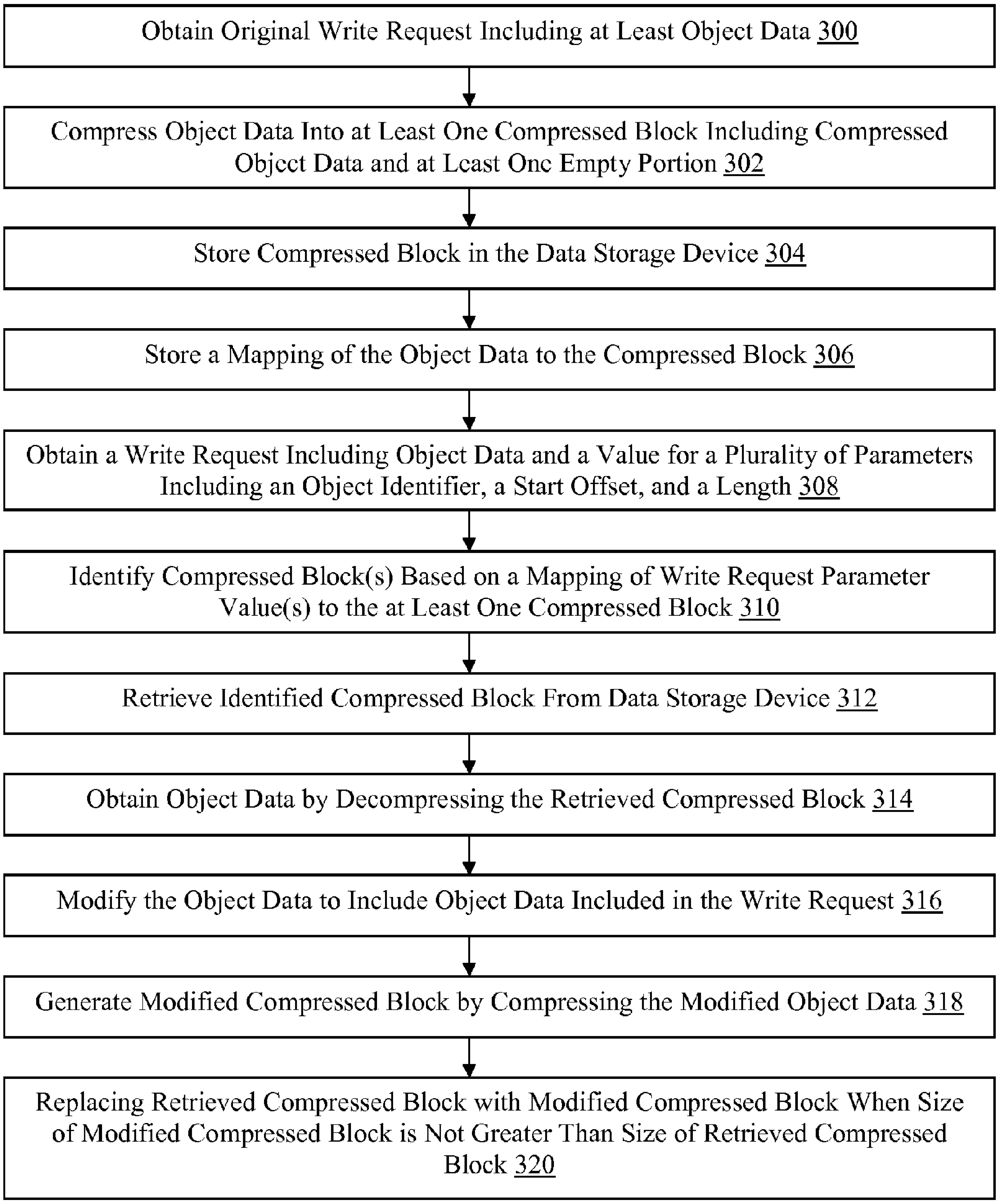
Obtain Original Write Request Including at Least Object Data 300
Compress Object Data Into at Least One Compressed Block Including Compressed Objcct Data and at Lcast Onc Empty Portion 302
Store Compressed Block in the Data Storage Device 304
Store a Mapping of the Object Data to the Compressed Block 306
Obtain a Write Request Including Object Data and a Value for a Plurality of Parameters Including an Object Identifier, a Start Offset, and a Length 308
Identify Compressed Block(s) Based on a Mapping of Write Request Parameter Value(s) to the at Least One Compressed Block 310
Retrieve Identified Compressed Block From Data Storage Device 312
Obtain Object Data by Decompressing the Retrieved Compressed Block 314
Modify the Object Data to Include Object Data Included in the Write Request 316
Generate Modified Compressed Block by Compressing the Modified Object Data 318
Replacing Retrieved Compressed Block with Modified Compressed Block When Size of Modified Compressed Block is Not Greater Than Size of Retrieved Compressed Block 320

FIG. 3

METHODS FOR ACCESSING DATA IN A COMPRESSED FILE SYSTEM AND DEVICES THEREOF

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue; a claim printed with strikethrough indicates that the claim was canceled, disclaimed, or held invalid by a prior post-patent action or proceeding.

FIELD

This technology generally relates to accessing object data in a compressed file system, and, more particularly, to efficient methods and devices for servicing read and write data access requests independent of protocol.

BACKGROUND

In order to optimize utilization of relatively fast storage devices having limited capacity, such as in a tiered file storage system, relatively infrequently accessed files are often compressed into blocks of data and archived in relatively slow storage devices of the tiered storage system. Accessing an archived file, such as in response to a read or write request, generally requires decompressing the entire file, as identified based on a file handle or other identifier included in the request, in order to locate a portion of the file identified by a start offset and/or a length included in the request.

Accordingly, although such read and write requests often identify only a portion of the original file, all of the compressed blocks associated with the original file must be retrieved and decompressed in order to locate the requested portion, in order to service a read request, or locate the portion to be written, in order to service a write request. Additionally, in order to service a write request, the entire original file generally must be recompressed, subsequent to the write procedure, even though only a portion of the original file may have been modified. Retrieving and decompressing all of the compressed blocks associated with a file, and in the case of a write request, recompressing an entire file, requires significant time and resources thereby increasing the response time to the requesting client computing device, which is undesirable.

SUMMARY

A method for managing requests for content includes obtaining with a network traffic management apparatus an original write request from a client computing device including at least object data. The object data is compressed with the network traffic management apparatus into a plurality of compressed blocks. A mapping of each compressed block to a portion of the object data compressed therein is generated with the network traffic management apparatus, wherein the portion of the object data compressed therein is represented in the mapping by a unique object identifier, a start offset, and a length. The compressed blocks and the mapping are stored with the network traffic management apparatus in at least one data storage device. At least one data access request for at least a portion of the object data is serviced with the network traffic management based on the mapping.

A non-transitory computer readable medium having stored thereon instructions for managing requests for content comprising machine executable code which when executed by at least one processor, causes the processor to perform steps including obtaining an original write request from a client computing device including at least object data. The object data is compressed into a plurality of compressed blocks. A mapping of each compressed block to a portion of the object data compressed therein is generated, wherein the portion of the object data compressed therein is represented in the mapping by a unique object identifier, a start offset, and a length. The compressed blocks and the mapping are stored in at least one data storage device. At least one data access request for at least a portion of the object data is serviced based on the mapping.

A network traffic management apparatus includes a memory, configurable logic, and a processor coupled to the memory and the configurable logic, at least one of the configurable logic configured to implement or the processor configured to execute programmed instructions stored in the memory including obtaining an original write request from a client computing device including at least object data. The object data is compressed into a plurality of compressed blocks. A mapping of each compressed block to a portion of the object data compressed therein is generated, wherein the portion of the object data compressed therein is represented in the mapping by a unique object identifier, a start offset, and a length. The compressed blocks and the mapping are stored in at least one data storage device. At least one data access request for at least a portion of the object data is serviced based on the mapping.

This technology provides a number of advantages including methods, non-transitory computer readable medium, and devices that efficiently access data in a compressed file system, the data being required to service read or write data access requests received from networked client computing devices. With this technology, a mapping of object data to compressed blocks including compressed object data is stored and utilized to retrieve only a portion of the compressed blocks storing the object data required to service a read or write request. Accordingly, only a subset of the compressed blocks storing object data needs to be decompressed to service a read request for only a portion of a file. Additionally, only a subset of the compressed blocks storing object data needs to be decompressed, modified, and rewritten to service a write request that does not require additional storage space beyond the fixed size of the compressed blocks. As a result, resource utilization is improved as well as response time, thereby improving the user experience with the file storage system.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram of a network environment with an exemplary network traffic management apparatus that accesses data in a compressed file system;

FIG. **2** is a flowchart of an exemplary method for servicing read data access requests in a compressed file system; and

FIG. **3** is a flowchart of an exemplary method for servicing write data access requests in a compressed file system.

DETAILED DESCRIPTION

A network environment **10** with an exemplary network traffic management apparatus **14** for accessing data in a compressed file system is illustrated in FIG. **1**. In this example, the environment **10** includes client computing devices **12**, network traffic management apparatus **14**, and servers **16**, which are coupled together by local area networks (LAN) **28** and wide area network (WAN) **30**, although other types and numbers of devices, components, and elements in other topologies could be used. While not shown, the environment **10** also may include additional network components, such as routers, switches and other devices, which are well known to those of ordinary skill in the art and thus will not be described here. This technology provides a number of advantages including methods, non-transitory computer readable medium, and apparatus that efficiently service data access requests in a compressed file storage system.

In this example, the network traffic management apparatus **14** is coupled to client computing devices **12** through one of the LANs **28**, although the client computing devices **12**, or other devices, and network traffic management apparatus **14** may be coupled together via other topologies. Additionally, the network traffic management apparatus **14** is coupled to the servers **16** through another one of the LANs **28**, although the servers **16**, or other devices, and the network traffic management apparatus **14** may be coupled together via other topologies. LANs **28** each may employ any suitable interface mechanisms and network communication technologies including, for example, teletraffic in any suitable form (e.g., voice, modem, and the like), Public Switched Telephone Network (PSTNs), Ethernet-based Packet Data Networks (PDNs), combinations thereof, and the like. The network traffic management apparatus **14** is further coupled to client computing devices **12** through WAN **30**, which may comprise any wide area network (e.g., Internet), although any other type of traffic network topology may be used. Various network processing applications, such as CIFS applications, NFS applications, HTTP Web Server applications, and/or FTP applications, may be operating on servers **16** and transmitting data (e.g., files, Web pages) through the network traffic management apparatus **14** in response to requests for content from client computing devices **12**.

The network traffic management apparatus **14** facilitates servicing of data access requests in a compressed file storage system as illustrated and described with the examples herein, although network traffic management apparatus **14** may perform other types and numbers of functions, such as optimizing, securing and accelerating the traffic between client computing devices **12** and servers **16**, and/or one or more applications. Network traffic management apparatus **14** includes at least one processor **18**, memory **20**, optional configurable logic device **21**, I/O interface **22**, and interface device **24** which are coupled together by bus **26**, although network traffic management apparatus **14** may comprise other types and numbers of elements in other configurations. Although network traffic management apparatus **14** is shown in this example as being a standalone device, such as a BIGIP® device offered by F5 Networks, Inc., of Seattle, Wash., it should be appreciated that the network traffic management apparatus **14** could also be one of several blades servers coupled to a chassis device, such as a VIPRION® device, also offered by F5 Networks, Inc., of Seattle, Wash.

Processor(s) **18** may execute one or more computer-executable instructions stored in the memory **20** for the methods illustrated and described with reference to the examples, although the processor(s) can execute other types and numbers of instructions and perform other types and numbers of operations. The processor(s) **18** may comprise one or more central processing units (CPUs) or general purpose processors with one or more processing cores, such as AMD® processor(s), although other types of processor(s) could be used (e.g., Intel®).

Memory **20** may comprise one or more tangible storage media and/or devices, such as RAM, ROM, flash memory, CD-ROM, floppy disk, hard disk drive(s), solid state memory, DVD, or any other memory storage types or devices, including combinations thereof, which are known to those of ordinary skill in the art. The various storage devices of the memory **20** may be arranged in a tiered storage system to allow for less expensive and larger capacity storage devices, for example, to store less frequently accessed, compressed and/or archived data.

Memory **20** may store one or more non-transitory computer-readable instructions of this technology as illustrated and described with reference to the examples herein that may be executed by the one or more processor(s) **18**. The flow charts shown in FIGS. **2** and **3** are representative of example steps or actions of this technology that may be embodied or expressed as one or more non-transitory computer or machine readable instructions stored in memory **20** that may be executed by the processor(s) **18** and/or may be implemented by configured logic in optional configurable logic device **21**.

The optional configurable logic device **21** may comprise specialized hardware configured to implement one or more steps of this technology as illustrated and described with reference to the examples herein. By way of example only, the optional configurable logic device **21** may comprise one or more of field programmable gate arrays (FPGAs), field programmable logic devices (FPLDs), application specific integrated circuits (ASICs) and/or programmable logic units (PLUs).

Input and display devices **22** enable a user, such as an administrator, to interact with the network traffic management apparatus **14**, such as to input and/or view data and/or to configure, program and/or operate it by way of example only. Input devices may include a keyboard and/or a computer mouse and display devices may include a computer monitor, although other types and numbers of input devices and display devices could be used.

The interface device **24** in the network traffic management apparatus **14** is used to operatively couple and communicate between the network traffic management apparatus **14** and the client computing devices **12** and the servers **16**, which are all coupled together by one or more local area networks (LAN) **28** and wide area networks (WAN) **30**, although other types and numbers of communication networks or systems with other types and numbers of connections and configurations to other devices and elements. By way of example only, the local area networks (LAN) **28** and wide area networks (WAN) **30** can use TCP/IP over Ethernet and industry-standard protocols, including NFS, CIFS, SOAP, XML, LDAP, and SNMP, although other types and numbers of communication networks, can be used. In this example, the bus **26** is a hyper-transport bus in this example, although other bus types and links may be used, such as PCI.

Each of the client computing devices **12** and the servers **16** include a central processing unit (CPU) or processor, a memory, an interface device, and an I/O system, which are coupled together by a bus or other link, although other numbers and types of network devices could be used. The client computing devices **12**, in this example, may run interface applications, such as Web browsers, that may provide an interface to make requests for and send content and/or data to different server-based applications via the LANs **28** and/or WANs **30**.

Generally, servers **16** process requests received from client computing devices **12** via LANs **28** and/or WANs **30** according to the HTTP-based application RFC protocol or the CIFS or NFS protocol in this example, but the principles discussed herein are not limited to this example and can include other application protocols. A series of applications may run on the servers **16** that allow the transmission of data, such as object data, files, and/or metadata, requested by the client computing devices **12**. The servers **16** may provide data or receive data in response to requests directed toward the respective applications on the servers **16** from the client computing devices **12**. In some example, the servers **16** may further include various storage devices including a tiered file storage system and/or may be one or more tiers of a tiered file storage system including one or more other network devices. Accordingly the servers **16** can provide backup, archived, and/or compressed data storage services for other networked devices. It is to be understood that the servers **16** may be hardware or software or may represent a system with multiple servers **16** in a server pool, which may include internal or external networks. In this example the servers **16** may be any version of Microsoft® IIS servers or Apache® servers, although other types of servers may be used. Further, additional servers may be coupled to the LAN **28** and many different types of applications may be available on servers coupled to the LAN **28**.

Although an exemplary network environment **10** with client computing devices **12**, network traffic management apparatus **14**, servers **16**, LANs **28** and WANs **30** are described and illustrated herein, other types and numbers of systems, devices, blades, components, and elements in other topologies can be used. It is to be understood that the systems of the examples described herein are for exemplary purposes, as many variations of the specific hardware and software used to implement the examples are possible, as will be appreciated by those skilled in the relevant art(s).

Furthermore, each of the systems of the examples may be conveniently implemented using one or more general purpose computer systems, microprocessors, digital signal processors, and micro-controllers, programmed according to the teachings of the examples, as described and illustrated herein, and as will be appreciated by those of ordinary skill in the art.

In addition, two or more computing systems or devices can be substituted for any one of the systems or devices in any example. Accordingly, principles and advantages of distributed processing, such as redundancy and replication also can be implemented, as desired, to increase the robustness and performance of the devices and systems of the examples. The examples may also be implemented on computer system(s) that extend across any suitable network using any suitable interface mechanisms and traffic technologies, including by way of example only teletraffic in any suitable form (e.g., voice and modem), wireless traffic media, wireless traffic networks, cellular traffic networks, G3 traffic networks, Public Switched Telephone Network (PSTNs), Packet Data Networks (PDNs), the Internet, intranets, and combinations thereof.

The examples may also be embodied as a non-transitory computer readable medium having instructions stored thereon for one or more aspects of the technology as described and illustrated by way of the examples herein, which when executed by a processor (or configurable hardware), cause the processor to carry out the steps necessary to implement the methods of the examples, as described and illustrated herein.

An exemplary method for servicing read data access requests in a compressed file system will now be described with reference to FIGS. **1**-**2**. In this particular example, in step **200**, the network traffic management apparatus **14** obtains at least one original write request including at least the object data to be stored, although in other examples the data may already compressed and stored as described here with reference to steps **200**, **202**, **204**, and **206**.

In step **202**, the network traffic management apparatus **14** compresses the object data into at least one compressed block. In some examples, each compressed block has a fixed size or length, such as 64 kilobytes, for example, although the compressed blocks may be any other fixed size or of variable size.

In step **204**, the network traffic management apparatus **14** stores the compressed blocks in the memory **20**, although the compressed blocks can be stored in other data storage devices and at other locations. For example, the compressed blocks could be stored in one or more file server devices **16**, a tiered storage system including the memory **20** and/or one or more file server devices **16**, and/or any other data storage device(s).

In step **206**, the network traffic management apparatus **14** maintains and stores a mapping of the original object data to the compressed blocks of object data, which the network traffic management apparatus **14** in the memory **20**, although the mapping could be stored in other locations. One exemplary mapping is a table including object identifier, start offset, and length values for the object data included in the original write request associated with a unique identifier of the compressed block storing the compressed object data for the portion of the object data indicated by the associated start offset and length values, although other mappings of the original object data to the compressed object data can be used.

In one example, the unique identifier for each compressed block includes a file handle or other identifier shared by a plurality of compressed blocks storing compressed data for the same object as well as a start offset and a length value that together uniquely identify each compressed block. In the latter example, and in the exemplary operation in which the compressed blocks are of a fixed size, the length values will all be the same and the start offsets will all be intervals determined by the length value. In order to locate the compressed blocks at a later time, the network traffic management apparatus **14** can store a mapping of the unique identifier for each compressed block to a location of the compressed block in the data storage device or utilize any other method of maintaining the location of the compressed blocks.

In step **208**, the network traffic management apparatus **14** obtains a read data access request from a client computing device **12** for object data previously stored as described and illustrated earlier with respect to steps **200**, **202**, **204**, and **206**. The read request can be based on any protocol requiring at least object identifier or file handle, start offset, and length parameters, the length parameter indicating a number of bytes, for example, including a common Internet file system (CIFS) protocol, a network file system (NFS) protocol, or a file transfer protocol (FTP), for example.

In step **210**, the network traffic management apparatus **14** identifies at least one compressed block storing compressed object data required to service the read request by querying the table based on the read request parameter values. Accordingly, in one example, a read request is obtained by the network traffic management apparatus **14** from a client computing device **12** including at least parameter values F_0

for the object identifier, 50 for the start offset, and 100 for the length. In this example, the mapping stored in step **206** for object F_0 indicates that the compressed block having a unique identifier of C_0 is storing start offset 0 and length 100, the compressed block having a unique identifier of C_1 is storing start offset 100 and length 100, and the compressed block having a unique identifier of C_2 is storing start offset 200 and length 75. Accordingly, in step **210**, the network traffic management apparatus **14** identifies compressed blocks C_0 and C_1 based on the mapping of the object data byte range 50-150, as identified by the read request parameter values of 50 for the start offset and 100 for the length.

In step **212**, the network traffic management apparatus **14** retrieves the identified compressed blocks from the data storage device. Accordingly, in this example, the network traffic management apparatus **14** retrieves compressed blocks C_0 and C_1 from a data storage device, such as one of server devices **16**.

In step **214**, the network traffic management apparatus **14** obtains the requested object data by decompressing the retrieved compressed blocks. Accordingly, in this example, blocks C_0 and C_1 are decompressed by the network traffic management apparatus **14** and the object data responsive to the received read request in step **208** is obtained based on the read request parameter values.

In step **216**, the obtained object data is sent by the network traffic management apparatus **14** to the requesting one of the client computing devices **12**. Because the read request included parameter values of 50 for the start offset and 100 for the length, in this example, only the second 50 bytes of object data included in compressed block C_0 and only the first 50 bytes of object data included in compressed block C_1 are obtained by the network traffic management apparatus **14**, in step **214**, and sent by the network traffic management apparatus **14**, in step **216**, to the requesting one of the client computing devices **12**.

Accordingly, in this example, the read request received from the client computing device **12** is serviced by the network traffic management apparatus **14** without retrieving compressed block C_2 from the data storage device and without decompressing compressed block C_2. The ability of the network traffic management apparatus **14** to retrieve and decompress only those compressed blocks necessary to service a read request from a client computing device **12** is made possible by the mapping, stored in step **206**, which allows the network traffic management apparatus **14** to identify only a subset of compressed blocks. As compressed files and objects are often archived in relatively slow data storage devices due to their relatively infrequent access by users of client computing devices **12**, retrieving and decompressing only those necessary compressed blocks, instead of all compressed blocks storing object data for the object identified in the read request, can reduce resource utilization and response time, particularly when the number of compressed blocks not required to service the read request is substantial.

Referring to FIGS. **1** and **3**, an exemplary method for servicing write data access requests in a compressed file system will now be described. In this particular example, the write request is a request to modify object data previously stored in the compressed file system as described with reference to steps **300**, **302**, **304**, and **306**.

In step **300**, the network traffic management apparatus **14** obtains an original write request including at least the object data to be stored.

In step **302**, the network traffic management apparatus **14** compresses the object data into at least one compressed block. In this example, each of the compressed blocks includes compressed object data and at least one empty portion. In some examples, the compressed blocks each have a fixed size, such as 64 kilobytes, 4 kilobytes of which is empty and does not include compressed object data, although any size of compressed block, compressed object data, and empty storage space can be used.

In step **304**, the network traffic management apparatus **14** stores the compressed blocks in a data storage device such as the memory **20** of the network traffic management apparatus **14**, one or more file server devices **16**, a tiered storage system including the memory **20** and/or one or more file server devices **16**, and/or any other data storage device(s).

In step **306**, the network traffic management apparatus **14** maintains and stores a mapping of the original object data to the compressed blocks of object data.

In step **308**, the network traffic management apparatus **14** obtains a write request from a client computing device **12** including a plurality of parameter values and object data to be used to modify object data previously stored as described and illustrated earlier with respect to steps **300**, **302**, **304**, and **306**. The write request can be based on any protocol requiring at least an object identifier or parameter value identifying the object to be modified, a start offset parameter value indicating the beginning location in the object to be modified, and a length parameter value indicating the portion of the object data to be modified. Accordingly, the protocol can include CIFS, NFS, or FTP, for example.

In step **310**, the network traffic management apparatus **14** identifies at least one compressed block storing compressed object data required to service the write request by referencing the mapping, such as by querying a table storing the mapping, based on the write request parameter values. In step **312**, the network traffic management apparatus **14** retrieves the identified compressed blocks.

In step **314**, the network traffic management apparatus **14** obtains the object data to be modified by decompressing the retrieved compressed blocks. As at least a subset of the parameters are the same for a read request as for a write request, the identification of step **310**, retrieval of step **312**, and obtaining of step **314** can be performed by the network traffic management apparatus **14** as described and illustrated earlier with respect to steps **210**, **212**, and **214**, respectively.

In step **316**, the network traffic management apparatus **14** modifies the object data obtained in step **314** to include at least a portion of the object data included in the write request. In step **318**, the network traffic management apparatus **14** generates modified compressed blocks by compressing the modified object data. Accordingly, the modified compressed blocks include compressed write request object data along with compressed object data that was previously stored and not currently modified.

The modified compressed blocks may be smaller, the same size, or larger than the corresponding compressed blocks retrieved, in step **312**, by the network traffic management apparatus **14**, depending on the size of the write request object data, the size of any previously stored object data that is replaced by the write request object data, and/or the compressibility of the object data as modified, for example. If a modified compressed block is not greater than the corresponding retrieved compressed block, the network traffic management apparatus **14** completes service of the write request by replacing, in step **320**, the retrieved compressed block with the modified compressed block.

If the size of any compressed block is greater than the corresponding retrieved compressed block, the network traffic management apparatus **14** can retrieve every compressed block storing object data for the object identified by the write request object identifier parameter value, as identified based on the mapping. The network traffic management apparatus **14** can then decompress all of the retrieved compressed blocks, recompress the object data, and update the mapping. Because such an operation is relatively expensive, particularly with respect to compressed and archived data stored on relatively slow data storage device(s), including the empty portion in each compressed block when compressing the object data, in step **302**, can provide for expansion of the compressed data upon servicing the write request, thereby reducing the number of instances in which a modified compressed block is greater in size than a corresponding retrieved compressed block.

Accordingly, in this example, in order to service a write data access request received from a client computing device **12**, only those compressed blocks storing compressed object data required to service the write request are retrieved and decompressed by the network traffic management apparatus **14**. Additionally, in examples in which a space for expansion is included by the network traffic management apparatus **14** in the form of an empty portion in the compressed blocks, the number of instances in which compressed blocks other than those necessary to service the write request will need to be retrieved, decompressed, recompressed, and stored can be reduced, thereby reducing resource utilization and response time.

The examples described herein have particular advantages for applications in which only portions of an archived object or file are read by a client computing device **12**. Additionally, the examples described herein have particular advantages for applications in which only portions of an object or file are written such as databases and document and source control systems, for example, although these examples also provide advantages for other applications.

With this technology a mapping of object data to compressed blocks, each including compressed object data, is maintained and stored by the network traffic management apparatus **14** upon receiving an original write request. Subsequent read and write requests requiring access to the object data can be serviced by the network traffic management apparatus **14** based on the mapping and by only retrieving and decompressing, and in the case of some write requests, modifying and recompressing, only the compressed blocks required to service the requests. By accessing fewer compressed blocks in order to service data access requests, resource utilization is reduced and response time for servicing the data access request is reduced for the user of the requesting one of the client computing devices **12**.

Having thus described the basic concept of the invention, it will be rather apparent to those skilled in the art that the foregoing detailed disclosure is intended to be presented by way of example only, and is not limiting. Various alterations, improvements, and modifications will occur and are intended to those skilled in the art, though not expressly stated herein. These alterations, improvements, and modifications are intended to be suggested hereby, and are within the spirit and scope of the invention. Additionally, the recited order of processing elements or sequences, or the use of numbers, letters, or other designations therefore, is not intended to limit the claimed processes to any order except as may be specified in the claims. Accordingly, the invention is limited only by the following claims and equivalents thereto.

What is claimed is:

1. A method for accessing data in a compressed file system, comprising:

[obtaining, by a network traffic management apparatus, at least one original write request from a client computing device comprising object data;]

compressing, by [the] *a* network traffic management apparatus, [the] object data *included in an original write request from a client computing device* into a plurality of compressed blocks*, wherein the object data is associated with a file system object*;

generating, by the network traffic management apparatus, a mapping of each of the plurality of compressed blocks to a corresponding portion of the object data, wherein every corresponding portion of the object data is represented in the mapping by [a corresponding unique] *an* object identifier *for the object*, a start offset, and a length *that corresponds to a size of the portion of the object data*; and

servicing, by the network traffic management apparatus, at least one subsequent data access request for [at least a portion] *one of the portions* of the object data, the servicing comprising obtaining at least the requested portion of the object data from the mapped one of the plurality of compressed blocks based on the [unique] object identifier, the start offset and the length.

2. The method as set forth in claim **1** wherein the servicing further comprises:

obtaining, by the network traffic management apparatus, the data access request from the client computing device, wherein the data access request comprises a value for a plurality of parameters comprising the object identifier, the start offset, and the length;

identifying, by the network traffic management apparatus, the mapped [at least] one *of the plurality of* compressed [block] *blocks* based at least in part on the mapping and one or more of the data access request parameter values;

retrieving, by the network traffic management apparatus, the identified compressed block;

obtaining, by the network traffic management apparatus, at least a portion of the object data identified by the data access request parameter values; and

decompressing, by the network traffic management apparatus, the retrieved compressed block.

3. The method as set forth in claim **2** wherein the data access request is a read request, the method further comprising:

sending, by the network traffic management apparatus, the obtained object data to the requesting client computing device.

4. The method as set forth in claim **2** wherein the data access request is a write request, the write request further comprises *additional* object data, *each of the plurality of compressed blocks includes compressed object data and an empty portion,* and [wherein the compressing, with the network traffic management apparatus, the object data into a plurality of compressed blocks] *the method* further comprises[:

compressing, by the network traffic management apparatus, the object data into a plurality of compressed blocks each including compressed object data and an empty portion, the method further comprising] replacing, by the network traffic management apparatus, the retrieved compressed block with a modified compressed block comprising[,] *a* compressed [write request] *at least a portion of the additional* object data when a size of the modified compressed block is not greater than a size of the retrieved compressed block.

5. The method as set forth in claim **4** further comprising:

modifying, by the network traffic management apparatus, the object data to include *the* at least a portion of the *additional* object data included in the write request;

generating, by the network traffic management apparatus, the modified compressed block; and

compressing, by the network traffic management apparatus, the modified object data.

6. The method as set forth in claim **2** wherein the data access request is based on a protocol comprising a common Internet file system (CIFS) protocol, a network file system (NFS) protocol, or a file transfer protocol (FTP).

7. The method as set forth in claim **1** further comprising;

storing, by the network traffic management apparatus, the compressed blocks and the mapping in at least one data storage device.

8. The method as set forth in claim **7**, wherein the at least one data storage device comprises tiered storage, a memory of a network traffic management apparatus, or a file server device.

9. A non-transitory computer readable medium having stored thereon instructions for accessing data in a compressed file system comprising machine executable code which when executed by at least one processor, causes the processor to perform steps comprising:

[obtaining at least one original write request from a client computing device comprising object data;]

compressing [the] object data *included in an original write request from a client computing device* into a plurality of compressed blocks*, wherein the object data is associated with a file system object*;

generating a mapping of each of the plurality of compressed blocks to a portion of the object data, wherein every corresponding portion of the object data is represented in the mapping by [a corresponding unique] *an* object identifier *for the object*, a start offset, and a length *that corresponds to a size of the portion of the object data*; and

servicing at least one subsequent data access request for one of the portions of the object data, wherein the servicing comprises obtaining at least the requested portion of the object data from the mapped one of the plurality of compressed blocks based on the [unique] object identifier, the start offset and the length.

10. The medium as set forth in claim **9** wherein the servicing further comprises:

obtaining the data access request from the client computing device, wherein the data access request comprises a value for a plurality of parameters comprising the object identifier, the start offset, and the length;

identifying the mapped [at least] one *of the plurality of* compressed block *blocks* based at least in part on the mapping and one or more of the data access request parameter values;

retrieving the identified compressed block[;]

obtaining at least a portion of the object data identified by the data access request parameter values; and

decompressing the retrieved compressed block.

11. The medium as set forth in claim **10** wherein the data access request is a read request, the medium further having stored thereon instructions that when executed by the at least one processor cause the processor to perform steps further comprising:

sending the obtained object data to the requesting client computing device.

12. The medium as set forth in claim **10** wherein the data access request is a write request, the write request further comprises *additional* object data, *each of the plurality of compressed blocks includes compressed object data and an empty portion,* and [the compressing the object data into a plurality of compressed blocks further comprises] *the medium further having stored thereon instructions that when executed by the processor further cause the processor to perform one or more steps further comprising*:

[compressing the object data into a plurality of compressed blocks each comprising compressed object data and an empty portion, the medium further comprising] replacing the retrieved compressed block with a modified compressed block comprising *a* compressed [write request] *at least a portion of the additional* object data when a size of the modified compressed block is not greater than a size of the retrieved compressed block.

13. The medium as set forth in claim **12** further having stored thereon instructions that when executed by the processor cause the processor to perform steps further comprising:

modifying the object data to include *the* at least a portion of the *additional* object data included in the write request; [and]

generating the modified compressed block; and

compressing the modified object data.

14. The medium as set forth in claim **10** wherein the data access request is based on a protocol comprising a common Internet file system (CIFS) protocol, a network file system (NFS) protocol, or a file transfer protocol (FTP).

15. The medium as set forth in claim **9** further having stored thereon instructions that when executed by the processor cause the processor to perform steps further comprising:

storing, the compressed blocks and the mapping in at least one data storage device.

16. The medium as set forth in claim **15**, wherein the at least one data storage device comprises tiered storage, a memory of a network traffic management apparatus, or a file server device.

17. A network traffic management apparatus comprising:

a memory;

configurable logic; and

a processor coupled to the memory and the configurable logic, at least one of the configurable logic configured to implement or the processor configured to execute programmed instructions stored in the memory comprising:

[obtaining at least one original write request from a client computing device comprising object data;]

compressing [the] object data *included in an original write request from a client computing device* into a plurality of compressed blocks*, wherein the object data is associated with a file system object*;

generating a mapping of each of the plurality of compressed blocks to a portion of the object data, wherein every corresponding portion of the object data is represented in the mapping by [a corresponding unique] *an* object identifier *for the object*, a start offset, and a length *that corresponds to a size of the portion of the object data*; and

servicing at least one subsequent data access request for one of the portions of the object data, wherein the servicing comprises *obtaining* at least the requested portion of the object data from the mapped one of the plurality of compressed blocks based on the [unique] object identifier, the start offset and the length.

18. The apparatus as set forth in claim **17** wherein the servicing further comprises:

obtaining**[**,**]** the data access request from the client computing device, wherein the data access request comprises a value for a plurality of parameters comprising the object identifier, the start offset, and the length;

identifying**[**,**]** the mapped at least one *of the plurality of* compressed **[**block**]** *blocks* based at least in part on the mapping and one or more of the data access request parameter values;

retrieving**[**,**]** the identified compressed block**[**:**]**

obtaining**[**,**]** at least a portion of the object data identified by the data access request parameter values: and

decompressing the retrieved compressed block.

19. The apparatus as set forth in claim **18** wherein the data access request is a read request and wherein at least one of the configurable logic is configured to implement or the processor is further configured to execute, programmed instructions stored in the memory further comprising:

sending the obtained object data to the requesting client computing device.

20. The apparatus as set forth in claim **18** wherein the data access request is a write request, the write request further includes *additional* object data, **[**wherein the compressing the object data into a plurality of compressed blocks further comprises:

compressing the object data into a plurality of compressed blocks each including compressed object data and an empty portion, and wherein**]** *each of the plurality of compressed blocks includes compressed object data and an empty portion, and* at least one of the configurable logic *is further* configured to implement or the processor **[**are**]** *is* further configured to execute programmed instructions stored in the memory further comprising**[**:**]**

replacing the retrieved compressed block with a modified compressed block **[**including**]** *comprising a* compressed **[**write request**]** *at least a portion of the additional* object data when a size of the modified compressed block is not greater than a size of the retrieved compressed block.

21. The apparatus as set forth in claim **20** wherein at least one of the configurable logic is *further* configured to implement or the processor is further configured to execute**[**,**]** programmed instructions stored in the memory further comprising:

modifying the object data to include *the* at least a portion of the *additional* object data included in the write request; **[**and**]**

generating the modified compressed block; and

compressing the modified object data.

22. The apparatus as set forth in claim **18** wherein the data access request is based on a protocol comprising a common Internet file system (CIFS) protocol, a network file system (NFS) protocol, or a file transfer protocol (FTP).

23. The apparatus as set forth in claim **17** wherein the processor is further configured to execute programmed instructions stored in the memory further comprising:

storing, the compressed blocks and the mapping in at least one data storage device.

24. The apparatus as set forth in claim **23**, wherein the at least one data storage device comprises tiered storage, a memory of a network traffic management apparatus, or a file server device.

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