a service, and the entire process the user wish to do by using a storage service will undesirably depend on the reliability and quality of service of the one selected provider.

[0012]

EmbodimentsA purpose of the invention seekmade in view of the above-mentioned circumstances is to provide a distributed storage technology that allows a large number of files of various sizes to be stored by using many computers and can reduce single-point-of-failure factors in the system. EmbodimentsAnother purpose of the invention also seekis to allow this distributed storage technology to achieve speedups in access to files, improve the performance of random access, or the like, or to use storage services provided by a plurality of providers to configure one storage service.

Means for solving the problems

[0013]

A storage service provision apparatus of an example according to the principle of the invention is connected with a plurality of storage apparatuses over a network and provides a service to store a file by use of the storage apparatuses. The storage service provision apparatus comprises: means for dividing a file to be written into one or more pieces of data and, handling a data component of the file as a block object, assigning object identification information to each block object; means for creating information for constructing the file using data of each block object and, handling the information as a management information object, assigning object identification information to the management information object; means for determining at least one of the plurality of storage apparatuses based on object identification information; and means for transmitting each block object and the management information object to their respective storage apparatuses determined based on their own object identification information, to make them stored there.

According to a first aspect of the present invention, there is provided a storage service provision apparatus to be connected with a plurality of storage apparatuses over a

network for providing a file storage service by use of the storage apparatuses, wherein the file in the storage service is divided to a plurality of areas and distributed to be stored in a plurality of storage apparatuses, each of the plurality of storage apparatuses comprises means for storing objects and for returning an object identified by object identification information in response to a request from the storage service provision apparatus, and a plurality of objects stored in the storage apparatuses include a block object having data composing an area of the file, and a management information object having, as management information, a set of object identification information and offset information indicating which area in the file an object identified by the object identification information corresponds to, the storage service provision apparatus comprising: means for determining a first object identification information corresponding to a file to be read, and for acquiring a management information object identified by the first object identification information by requesting an object to a storage apparatus identified by the first object identification information; means for referring to the management information contained in the management information object acquired to determine one or more second object identification information, and for acquiring at least either of a block object and a management information object which are one or more object identified by the second object identification information by requesting an object to a storage apparatus identified by the second object identification information; means for acquiring one or more block object identified by a third object identification information by recursively performing an action, the action being determining, in a case where an object acquired is a further management information object, referring to the management information contained in the further management information object to determine one or more third object identification information and requesting an object to a storage apparatus identified by the third object identification information; and means for making the file by arranging data of respective block objects in areas indicated by offset information, the offset information being determined from the management information having been referred to for acquisition of the block object.

According to a second aspect of the present invention, there is provided a system comprising a client apparatus and a plurality of storage apparatuses connected with the client apparatus over a network, the client apparatus providing a user with a file storage service, wherein the file in the storage service is divided to a plurality of areas and distributed to be stored in a plurality of storage apparatuses, each of the plurality of storage apparatuses comprises: means for storing objects; and means for returning an object identified by object identification information in response to a request from the client apparatus, and a plurality of objects stored in the storage apparatuses include a block object having data composing an area of the file, and a management information object having, as management information, a set of object identification information and offset information indicating which area in the file an object identified by the object identification information corresponds to, the client apparatus comprising: means for determining a first object identification information corresponding to a file to be read, and for acquiring a management information object identified by the first object identification information by requesting an object to a storage apparatus identified by the first object identification information; means for referring to the management information contained in the management information object acquired to determine one or more second object identification information, and for acquiring at least either of a block object and a management information object which are one or more object identified by the second object identification information by requesting an object to a storage apparatus identified by the second object identification information; means for acquiring one or more block object identified by a third object identification information by recursively performing an action, the action being determining, in a case where an object acquired is a further management information object, referring to the management information contained in the further management information object to determine one or more third object identification information and requesting an object to a storage apparatus identified by the third object identification information; and means for making the file by arranging data of respective block objects in areas indicated by offset information, the offset

information being determined from the management information having been referred to for acquisition of the block object.

According to a third aspect of the present invention, there is provided a method for providing a file storage service by a computer connected with a plurality of storage apparatuses over a network, the computer using the storage apparatuses, wherein the file in the storage service is divided to a plurality of areas and distributed to be stored in a plurality of storage apparatuses, each of the plurality of storage apparatuses stores objects and returns an object identified by object identification information in response to a request from the storage service provision apparatus, and a plurality of objects stored in the storage apparatuses include a block object having data composing an area of the file, and a management information object having, as management information, a set of object identification information and offset information indicating which area in the file an object identified by the object identification information corresponds to, the method comprising: determining a first object identification information corresponding to a file to be read, and acquiring a management information object identified by the first object identification information by requesting an object to a storage apparatus identified by the first object identification information; referring to the management information contained in the management information object acquired to determine one or more second object identification information, and acquiring at least either of a block object and a management information object which are one or more object identified by the second object identification information by requesting an object to a storage apparatus identified by the second object identification information; acquiring one or more block object identified by a third object identification information by recursively performing an action, the action being determining, in a case where an object acquired is a further management information object, referring to the management information contained in the further management information object to determine one or more third object identification information and requesting an object to a storage apparatus identified by the third object identification information; and making the file by arranging data of

respective block objects in areas indicated by offset information, the offset information being determined from the management information having been referred to for acquisition of the block object.

According to a fourth aspect of the present invention, there is provided a program for causing a computer connected with a plurality of storage apparatuses over a network to operate as an apparatus for providing a file storage service by use of the storage apparatuses, wherein the file in the storage service is divided to a plurality of areas and distributed to be stored in a plurality of storage apparatuses, each of the plurality of storage apparatuses stores objects and returns an object identified by object identification information in response to a request from the storage service provision apparatus, and a plurality of objects stored in the storage apparatuses include a block object having data composing an area of the file, and a management information object having, as management information, a set of object identification information and offset information indicating which area in the file an object identified by the object identification information corresponds to, the program comprising: a program code for determining a first object identification information corresponding to a file to be read, and for acquiring a management information object identified by the first object identification information by requesting an object to a storage apparatus identified by the first object identification information; a program code for referring to the management information contained in the management information object acquired to determine one or more second object identification information, and for acquiring at least either of a block object and a management information object which are one or more object identified by the second object identification information by requesting an object to a storage apparatus identified by the second object identification information; a program code for acquiring one or more block object identified by a third object identification information by recursively performing an action, the action being determining, in a case where an object acquired is a further management information object, referring to the management information contained in the further management information object to determine one or more third

object identification information and requesting an object to a storage apparatus identified by the third object identification information; and a program code for making the file by arranging data of respective block objects in areas indicated by offset information, the offset information being determined from the management information having been referred to for acquisition of the block object.

ADVANTAGES OF THE INVENTION

[0014]

CLAIMS

1. A storage service provision apparatus to be connected with a plurality of storage apparatuses over a network for providing a service to store a file by use of the storage apparatuses, the storage service provision apparatus comprising:

means for dividing a file to be written into one or more pieces of data and, handling a data component of the file as a block object, assigning object identification information to each block object;

means for creating information for constructing the file using data of each block object and, handling the information as a management information object, assigning object identification information to the management information object;

means for determining at least one of the plurality of storage apparatuses based on object identification information; and

means for transmitting each block object and the management information object to their respective storage apparatuses determined based on their own object identification information, to make them stored there.

2. The storage service provision apparatus according to claim 1, further comprising:

means for determining top object identification information corresponding to a file to be read, and accessing a storage apparatus determined based on the top object identification information to acquire the management information object;

means for using information for constructing the file contained in the acquired management information object to determine object identification information of a block object having a data component of the file, and accessing a storage apparatus determined based on the object identification information to acquire the block object; and

means for arranging pieces of data contained in acquired block objects in accordance with the information for constructing the file, thereby acquiring the file.

3. The storage service provision apparatus according claims 1 to 2, wherein object identification information for determining a storage apparatus is assigned such that a management information object corresponding to one file and a management information object corresponding to another file are stored on different ones of the plurality of storage apparatuses.

4. The storage service provision apparatus according to one of claims 1 to 3,

wherein the means for determining at least one of the plurality of storage apparatuses based on object identification information also determines an access method applicable to a determined storage apparatus, and

wherein usage of a storage apparatus connected over the network is performed by requesting the determined storage apparatus for storage or acquisition of the object assigned with the object identification information in accordance with the determined access method.

5. The storage service provision apparatus according to one of claims 1 to 4, wherein each of the plurality of storage apparatuses is a storage server that can operate with the storage service provision apparatus as a client over an optionally-selected access protocol.

6. The storage service provision apparatus according to one of claims 1 to 5, wherein one and another of the plurality of storage apparatuses are of storage services provided by different service providers.

7. The storage service provision apparatus according to one of claims 1 to 6, further comprising

means for receiving from a user terminal a write or read request for a file stored by use of the plurality of storage apparatuses,

wherein the write or read request is a request of a type used in general-purpose

file systems.

8. The storage service provision apparatus according to one of claims 1 to 7, wherein the management information object contains: pieces of object identification information of a plurality of block objects having pieces of data composing different parts of a file; and offset information indicating which parts of the file the pieces of data of respective block objects are to be placed in.

9. The storage service provision apparatus according to one of claims 1 to 8, wherein the management information object includes:

a first management information object containing: pieces of object identification information of a plurality of block objects having pieces of data composing different parts of one area in a file; and in-area offset information indicating which parts of the one area the pieces of data of respective block objects are to be placed in; and

a second management information object containing: object identification information of the first management information object; and in-file offset information indicating where the one area, on which the first management information object has information, is located in the file.

10. The storage service provision apparatus according to one of claims 1 to 9,

wherein the management information object can comprise a plurality of management information objects having a recursive structure, and

wherein if the number of the block objects is larger than a predetermined number, the depth of the recursive structure is increased to generate a plurality of management information objects.

11. The storage service provision apparatus according to one of claims 1 to 10,

wherein the management information object contains a plurality of pieces of object identification information, and

wherein a process to request a storage apparatus determined based on one of the plurality of pieces of object identification information for storage or acquisition of the one object and a process to request a storage apparatus determined based on another one of the plurality of pieces of object identification information for storage or acquisition of the another one object are performed in parallel.

12. The storage service provision apparatus according to one of claims 1 to 11, wherein when part of data of a stored file is updated, a block object whose data is rewritten is assigned with new object identification information, a management information object containing information for constructing the file from data of the block object is also assigned with new object identification information, and the new object identification information of the management information object is set so as to be determined as top object identification information corresponding to the file, whereby the contents of an object having an identical object identification information are managed to remain unchanged.

13. The storage service provision apparatus according to one of claims 1 to 12,

wherein the means for determining at least one of the plurality of storage apparatuses based on object identification information can determine two or more storage apparatuses, and

wherein the storage service provision apparatus further comprises means for copying each block object and the management information object, and transmitting them to their respective two or more storage apparatuses determined based on their own object identification information, to make them stored there.

14. The storage service provision apparatus according to onen of claims 1 to 13, further comprising:

means for, based on respective object identification information of a management information object and each block object corresponding to a file to be read,

determining two or more of the plurality of storage apparatuses storing a relevant object or a copy thereof; and

means for accessing one determined storage apparatus and, if there is no response therefrom, accessing another determined storage apparatus to acquire an object or a copy thereof.

15. The storage service provision apparatus according to one of claims 1 to 14, further comprising:

means for, based on respective object identification information of a management information object and each block object corresponding to a file to be read, determining two or more of the plurality of storage apparatuses storing a relevant object or a copy thereof; and

means for accessing two or more determined storage apparatuses in parallel, and acquiring an object or a copy thereof from a storage apparatus that has responded earlier.

16. The storage service provision apparatus according to one of claims 1 to 15,

wherein when data is partially written to a stored file, which part of the file the data to be written is to be placed in is specified, and

wherein objects related to the specified part are selected or new objects are generated among all block objects and management information objects belonging to the file, storage apparatuses respectively determined based on object identification information of the selected or newly generated objects are accessed, and storage apparatuses for other objects are not accessed.

17. The storage service provision apparatus according to one of claims 1 to 16,

wherein when data is partially read from a stored file, which part of the file the data to be read is placed in is specified, and

wherein objects related to the specified part are selected among all block objects

and management information objects belonging to the file, storage apparatuses respectively determined based on object identification information of the selected objects are accessed, and storage apparatuses for other objects are not accessed.

18. The storage service provision apparatus according to one of claims 1 to 17,

wherein the file to be written has been created by a user encrypting an entire original file and is divided into a plurality of pieces of data, and

wherein object identification information for determining a storage apparatus is assigned such that a block object having one piece of data and a block object having another piece of data of the plurality of pieces of data are stored on different ones of the plurality of storage apparatuses.

19. The storage service provision apparatus according to one of claims 1 to 18,

wherein the file to be written has been created by a user encrypting an entire original file and is divided into a plurality of pieces of data, and

wherein object identification information for determining a storage apparatus is assigned such that a block object having one piece of data of the plurality of pieces of data and the management information object are stored on different ones of the plurality of storage apparatuses.

20. The storage service provision apparatus according to one of claims 1 to 19,

wherein the management information object contains: object identification information of a block object having data composing part of a file; and offset information indicating which part of the file the data of the block object is to be placed in,

wherein when there is a part of the file where no data exists, no block object corresponding to the part where no data exists is generated, whereas a block object having substantial data and the management information object are made to be stored, and

wherein when a file is read and if the management information object indicates

that there is no object identification information corresponding to one part of the file, the file is acquired by placing NUL data in the one part.

21. The storage service provision apparatus according to one of claims 1 to 20,

wherein the management information object contains: object identification information of a block object having data composing part of a file; and offset information indicating which part of the file the data of the block object is to be placed in,

wherein when there is a part of the file where no data exists following a part where data exists, a block object having the substantial data and information on the length of the data and the management information object are made to be stored, and

wherein when a file is read and if the length of data to be placed in one part of the file as indicated by the management information object is longer than the length of data indicated by information on the length contained in a block object corresponding to the one part, the file is acquired by placing NUL data for the shortage of length.

22. The storage service provision apparatus according to one of claims 1 to 21,

wherein a management information object assigned with top object identification information determined corresponding to a file to be read contains: information on the entire length of the file; and information indicating which part of the file having the length an object assigned with which object identification information is placed in,

wherein if the object assigned with object identification information is also a management information object, the management information object contains: information on the length of an area where the object is placed in the file; and information indicating which part of the area having the length an object assigned with which object identification information is placed in, and

wherein if the object assigned with object identification information is a block object, the block object has: a data component of the file; and information on the length of the data.

23. The storage service provision apparatus according to one of claims 1 to 22, wherein when part of data of a stored file is updated, a block object whose data is to be rewritten and a management information object containing object identification information of the block object, among block objects and management information objects belonging to the file, are acquired from storage apparatuses storing respective objects and, among the contents of each acquired object, a part not to be changed by the data rewrite is left intact whereas data is written to a part to be changed, whereby each new object is generated and made to be stored on a storage apparatus determined based on object identification information of the each new object.

24. The storage service provision apparatus according to one of claims 1 to 23, wherein the means for assigning object identification information uniquely assigns new object identification information to all block objects and management information objects stored on the plurality of storage apparatuses.

25. The storage service provision apparatus according to one of claims 1 to 24, wherein the means for determining at least one of the plurality of storage apparatuses based on object identification information comprises determining one of the plurality of storage apparatuses in accordance with the value of the remainder left when the result of a predetermined calculation made on the value of the object identification information is divided by the number of the plurality of storage apparatuses.

26. The storage service provision apparatus according to one of claims 1 to 24, wherein the means for determining at least one of the plurality of storage apparatuses based on object identification information comprises having each of the plurality of storage apparatuses assigned with a range of value to be covered by the each storage apparatus, comparing the result of a predetermined calculation made on the value of the object identification information and a range of value to be covered by each storage apparatus, and thereby determining one of the plurality of storage apparatuses.

27. The storage service provision apparatus according to claim 26, wherein when a storage apparatus connected over the network is added or removed, the means for determining at least one of the plurality of storage apparatuses based on object identification information changes the determination method such that the added storage apparatus is to be determined for some of a plurality of pieces of object identification information or that the removed storage apparatus is to be determined for no object identification information.

28. The storage service provision apparatus according to one of claims 1 to 27, further comprising means for storing top object identification information corresponding to a file to be read,

wherein a storage apparatus to be accessed first for the file is determined based on the stored top object identification information.

29. The storage service provision apparatus according to one of claims 1 to 27, further comprising means for determining at least one of the plurality of storage apparatuses based on identification information of a file to be read,

wherein a thus determined storage apparatus stores top object identification information corresponding to the file to be read as a kind of a management information object.

30. The storage service provision apparatus according to one of claims 1 to 27, further comprising means for connecting over a network with an attribute management apparatus that stores top object identification information corresponding to each file along with file attribute information,

wherein top object identification information corresponding to a file to be read is acquired from the attribute management apparatus, and a storage apparatus to be accessed first for the file is determined based on the acquired top object identification

information.

31. A system comprising a client apparatus and a plurality of storage apparatuses connected with the client apparatus over a network, the client apparatus providing a user with a file storage service,

wherein the plurality of storage apparatuses comprise means for storing for each file a plurality of block objects and one or more management information objects individually assigned with object identification information, each of the plurality of block objects having a respective data component of the file divided into a plurality of pieces of data, the management information objects having information for constructing the file using data of each block object, and

wherein the client apparatus comprises:

means for determining top object identification information corresponding to a file to be read, and accessing a storage apparatus determined based on the top object identification information to acquire the management information object;

means for using information for constructing the file contained in the acquired management information object to determine object identification information of a block object having a data component of the file, and accessing a storage apparatus determined based on the object identification information to acquire the block object; and

means for arranging pieces of data contained in acquired block objects in accordance with the information for constructing the file, thereby acquiring the file.

32. The system according to claim 31,

wherein the system has a plurality of client apparatuses,

wherein the management information object contains a plurality of pieces of object identification information, and

wherein each of the plurality of client apparatuses is set to be able to determine the top object identification information corresponding to the file to be read and, independently of the other client apparatuses, performs a process of requesting

acquisition of the management information object based on the top object identification information and a process of requesting acquisition of each object based on the plurality of pieces of object identification information.

33. A method for using a computer connected with a plurality of storage apparatuses over a network to provide a service to store a file by use of the storage apparatuses, the service provision method comprising:

dividing a file to be written into one or more pieces of data and, handling a data component of the file as a block object, assigning object identification information to each block object;

creating information for constructing the file using data of each block object and, handling the information as a management information object, assigning object identification information to the management information object; and

transmitting each block object and the management information object to their respective storage apparatuses of the plurality of storage apparatuses determined based on their own object identification information, to make them stored there.

34. A method for using a computer connected to a plurality of storage apparatuses over a network to provide a service to acquire a file stored by use of the storage apparatuses,

a plurality of block objects and one or more management information objects individually assigned with object identification information being stored for each file,

each of the plurality of block objects having a respective data component of the file divided into a plurality of pieces of data, the management information objects having information for constructing the file using data of each block object,

the service provision method comprising:

determining top object identification information corresponding to a file to be read, and accessing a storage apparatus determined based on the top object identification information to acquire the management information object;

using information for constructing the file contained in the acquired management information object to determine object identification information of a block object having a data component of the file, and accessing a storage apparatus determined based on the object identification information to acquire the block object; and

arranging pieces of data contained in acquired block objects in accordance with the information for constructing the file, thereby acquiring the file.

35. A program for causing a computer connected with a plurality of storage apparatuses over a network to operate as an apparatus for providing a service to store a file by use of the storage apparatuses, the service provision program comprising:

a program code for dividing a file to be written into one or more pieces of data and, handling a data component of the file as a block object, assigning object identification information to each block object;

a program code for creating information for constructing the file using data of each block object and, handling the information as a management information object, assigning object identification information to the management information object; and

a program code for transmitting each block object and the management information object to their respective storage apparatuses of the plurality of storage apparatuses determined based on their own object identification information, to make them stored there.

36. A program for causing a computer connected with a plurality of storage apparatuses over a network to operate as an apparatus for providing a service to acquire a file stored by use of the storage apparatuses,

a plurality of block objects and one or more management information objects individually assigned with object identification information being stored for each file,

each of the plurality of block objects having a respective data component of the file divided into a plurality of pieces of data, the management information objects having information for constructing the file using data of each block object,

the service provision program comprising:

a program code for determining top object identification information corresponding to a file to be read, and accessing a storage apparatus determined based on the top object identification information to acquire the management information object;

a program code for using information for constructing the file contained in the acquired management information object to determine object identification information of a block object having a data component of the file, and accessing a storage apparatus determined based on the object identification information to acquire the block object; and

a program code for arranging pieces of data contained in acquired block objects in accordance with the information for constructing the file, thereby acquiring the file.

Claims:

1. A storage service provision apparatus to be connected with a plurality of storage apparatuses over a network for providing a file storage service by use of the storage apparatuses, wherein

the file in the storage service is divided to a plurality of areas and distributed to be stored in a plurality of storage apparatuses,

each of the plurality of storage apparatuses comprises means for storing objects and for returning an object identified by object identification information in response to a request from the storage service provision apparatus, and

a plurality of objects stored in the storage apparatuses include a block object having data composing an area of the file, and a management information object having, as management information, a set of object identification information and offset information indicating which area in the file an object identified by the object identification information corresponds to,

the storage service provision apparatus comprising:

means for determining a first object identification information corresponding to a file to be read, and for acquiring a management information object identified by the first object identification information by requesting an object to a storage apparatus identified by the first object identification information;

means for referring to the management information contained in the management information object acquired to determine one or more second object identification information, and for acquiring at least either of a block object and a management information object which are one or more object identified by the second object identification information by requesting an object to a storage apparatus identified by the second object identification information;

means for acquiring one or more block object identified by a third object identification information by recursively performing an action, the action being determining, in a case where an object acquired is a further management information object, referring to the management information contained in the further management information object to determine one or more third object identification information and requesting an object to a storage apparatus identified by the third object identification information; and

means for making the file by arranging data of respective block objects in areas indicated by offset information, the offset information being determined from the management information having been referred to for acquisition of the block object.

2. The storage service provision apparatus according to claim 1,

wherein at least two management information objects including at least one further management information object belong to one file, and a plurality of management information objects belonging to one file are distributed to be stored in a plurality of storage apparatuses.

3. The storage service provision apparatus according to claim 1 or 2,

wherein at least two block objects belong to one further management information object, and a plurality of block objects belonging to one further management information object are distributed to be stored in a plurality of storage apparatuses.

4. The storage service provision apparatus according to one of claims 1 to 3,

wherein the management information object identified by the first object identification information contains two or more pieces of second object identification information, and

wherein a process to request a storage apparatus determined based on one of the two or more pieces of second object identification information for return of one further management information object identified by the piece object identification information and a process to request a storage apparatus determined based on another of the two or more pieces of second object identification information for return of another further management information object identified by the piece of object identification information are performed in parallel.

5. The storage service provision apparatus according to one of claims 1 to 4, further comprising:

means for dividing a file to be written to a plurality of pieces of data to generate a plurality of block objects, and for assigning object identification information to respective block objects;

means for creating information for constructing the file from data of the respective block objects to generate a plurality of management information objects in a hierarchical structure, and for assigning object identification information to respective management information objects;

means for determining at least one of the plurality of storage apparatuses based on object identification information, and

means for transmitting the respective block objects and the respective management information objects to respective storage apparatuses determined based on their object

identification information to make them stored there.

6. The storage service provision apparatus according to claim 5,

wherein object identification information for determining a storage apparatus is assigned such that one management information object and another management information object among the plurality of management information objects belonging to the file are stored in different ones of the plurality of storage apparatuses.

7. The storage service provision apparatus according to one of claims 1 to 6,

wherein the object identification information is information capable of uniquely identifying an object among all management information objects and block objects stored in the plurality of storage apparatuses.

8. The storage service provision apparatus according to one of claims 1 to 7,

wherein one part of the plurality of storage apparatuses and another part of the plurality of storage apparatuses are of storage services provided by different service providers, and

wherein a request for an object to a storage apparatus by the storage service provision apparatus is done by regarding the storage apparatus as a server and the storage service provision apparatus as a client, via an access protocol selected by a service provider of the storage apparatus.

9. The storage service provision apparatus according to one of claims 1 to 8,

wherein determination of a storage apparatus based on the object identification information is done by determining a value of the remainder left when a result of a predetermined calculation made on a value of the object identification information is divided by the number of the plurality of storage apparatuses.

10. The storage service provision apparatus according to one of claims 1 to 8,

wherein determination of a storage apparatus based on the object identification information is done by having each of the plurality of storage apparatuses assigned with a range of value to be covered by the storage apparatus and comparing a result of a predetermined calculation made on a value of the object identification information with the range of value to be covered by each storage apparatus.

11. A system comprising a client apparatus and a plurality of storage apparatuses connected with the client apparatus over a network, the client apparatus providing a user with a file storage service, wherein

the file in the storage service is divided to a plurality of areas and distributed to be stored in a plurality of storage apparatuses,

each of the plurality of storage apparatuses comprises:

means for storing objects; and

means for returning an object identified by object identification information in response to a request from the client apparatus, and

a plurality of objects stored in the storage apparatuses include a block object having data composing an area of the file, and a management information object having, as management information, a set of object identification information and offset information indicating which area in the file an object identified by the object identification information corresponds to,

the client apparatus comprising:

means for determining a first object identification information corresponding to a file to be read, and for acquiring a management information object identified by the first object identification information by requesting an object to a storage apparatus identified by the first object identification information;

means for referring to the management information contained in the management information object acquired to determine one or more second object identification information, and for acquiring at least either of a block object and a management information object which are one or more object identified by the second object identification information by requesting an object to a storage apparatus identified by the second object identification information;

means for acquiring one or more block object identified by a third object identification information by recursively performing an action, the action being determining, in a case where an object acquired is a further management information object, referring to the management information contained in the further management information object to determine one or more third object identification information and requesting an object to a storage apparatus identified by the third object identification information; and

means for making the file by arranging data of respective block objects in areas indicated by offset information, the offset information being determined from the management information having been referred to for acquisition of the block object.

12. The system according to claim 11,

wherein at least two management information objects including at least one further management information object belong to one file, and a plurality of management information objects belonging to one file are distributed to be stored in a plurality of storage apparatuses,

wherein the system has a plurality of client apparatuses, and

wherein, when a first client apparatus and a second client apparatus are to acquire an identical file for respective users, a process for requesting return of one of the plurality of management information objects by the first client apparatus and a process for requesting return of another of the plurality of management information objects by the second client apparatus are performed in parallel.

13. A method for providing a file storage service by a computer connected with a plurality of storage apparatuses over a network, the computer using the storage apparatuses, wherein

the file in the storage service is divided to a plurality of areas and distributed to be stored in a plurality of storage apparatuses,

each of the plurality of storage apparatuses stores objects and returns an object identified by object identification information in response to a request from the storage service provision apparatus, and

a plurality of objects stored in the storage apparatuses include a block object having data composing an area of the file, and a management information object having, as management information, a set of object identification information and offset information indicating which area in the file an object identified by the object identification information corresponds to,

the method comprising:

determining a first object identification information corresponding to a file to be read, and acquiring a management information object identified by the first object identification information by requesting an object to a storage apparatus identified by the first object identification information;

referring to the management information contained in the management information object acquired to determine one or more second object identification information, and acquiring at least either of a block object and a management information object which are one or more object identified by the second object identification information by requesting an object to a storage apparatus identified by the second object identification information;

acquiring one or more block object identified by a third object identification information

by recursively performing an action, the action being determining, in a case where an object acquired is a further management information object, referring to the management information contained in the further management information object to determine one or more third object identification information and requesting an object to a storage apparatus identified by the third object identification information; and

making the file by arranging data of respective block objects in areas indicated by offset information, the offset information being determined from the management information having been referred to for acquisition of the block object.

14. A program for causing a computer connected with a plurality of storage apparatuses over a network to operate as an apparatus for providing a file storage service by use of the storage apparatuses, wherein

the file in the storage service is divided to a plurality of areas and distributed to be stored in a plurality of storage apparatuses,

each of the plurality of storage apparatuses stores objects and returns an object identified by object identification information in response to a request from the storage service provision apparatus, and

a plurality of objects stored in the storage apparatuses include a block object having data composing an area of the file, and a management information object having, as management information, a set of object identification information and offset information indicating which area in the file an object identified by the object identification information corresponds to,

the program comprising:

a program code for determining a first object identification information corresponding to a file to be read, and for acquiring a management information object identified by the first object identification information by requesting an object to a storage apparatus identified by the first object identification information;

a program code for referring to the management information contained in the management information object acquired to determine one or more second object identification information, and for acquiring at least either of a block object and a management information object which are one or more object identified by the second object identification information by requesting an object to a storage apparatus identified by the second object identification information;

a program code for acquiring one or more block object identified by a third object

identification information by recursively performing an action, the action being determining, in a case where an object acquired is a further management information object, referring to the management information contained in the further management information object to determine one or more third object identification information and requesting an object to a storage apparatus identified by the third object identification information; and

a program code for making the file by arranging data of respective block objects in areas indicated by offset information, the offset information being determined from the management information having been referred to for acquisition of the block object.