Title: WEB CONTENTS TRANSMISSION SYSTEM AND METHOD THEREOF

Abstract: A web contents transmission system which can provide high speed web document services by solving bottlenecks in a web server and in the Internet through a method in which a plurality of web cache clusters are installed in geographically scattered areas and a client is connected to a neighboring web cache cluster using an intelligent domain name server (DNS) or redirector, is provided. According to the system, a plurality of web cache clusters are installed in geographically scattered locations on the Internet, and web server documents are stored in the web cache cluster which is located closest to a client, or web documents which are expected to be frequently requested are fetched periodically in advance. Then, if an arbitrary client requests a web document service, the client receives the web document service from a neighboring web cache cluster indicated by the intelligent DNS or redirector. By doing so, the bottlenecks in the web server and in the Internet can be removed and each client can receive high speed web document service.
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.
WEB CONTENTS TRANSMISSION SYSTEM AND METHOD THEREOF

Technical Field

The present invention relates to a web contents transmission system on a world wide web (WWW) system and a method thereof, and more particularly, to a web contents transmission system suitable for solving bottlenecks in a web server and on the Internet when web contents are transmitted on the WWW system.

Background Art

Recently, in line with exponential growth in the Internet-using population, huge loads are increasingly occurring in traffic routes between Internet servers, particularly web servers, and clients, that is, in Internet lines. The overloads are causing bottlenecks in servers and in the Internet and are considered to be the main factor contributing to deterioration of service quality for clients.

In a typical conventional client-server system, as shown in FIG. 5, a plurality of clients 502 access a web server 506 and receive desired information, that is, desired data. In the client-server system, the web server 506 directly processes services for all the clients 502.

That is, if a client 502 requests the web server 506 for a web document with a uniform resource locator (URL), the web server fetches the web document indicated by the URL, forms an information packet, and then provides the information packet to the client 502 through the Internet 504.

However, in the method in which the web server 506 processes all requests from all the clients 502, the quality of services is greatly deteriorated because the rapid increase in the Internet-using population causes bottlenecks in the web server 506 and in the Internet. Therefore, to solve the bottleneck problem, a high performance web server 506 or a method in which a plurality of web servers 506 form a cluster and use a borrowed wider bandwidth Internet 504 can be considered. However, in such cases, higher installation and maintenance costs are required. In addition, due to the limited bandwidth of a single Internet line, the bottleneck of the Internet cannot be basically solved.
Therefore, as a method to solve the bottleneck of the Internet, a web cache is used to support a web service, by minimizing the bottleneck.

FIG. 6 illustrates a system for transmitting web contents using a conventional web cache. Referring to FIG. 6, the conventional web contents transmission system has a plurality of clients 602, a web cache 604, and a web server 608.

Referring to FIG. 6, if a predetermined client requests a web document with a URL, the web cache 604 intercepts the request and checks whether or not the web document indicated by the URL is in the web cache 604 database, by searching the database. If the result of the search includes that the requested web document is in the database, the web cache 604 fetches the document and transmits the document to the predetermined client 602.

Otherwise, that is, if the requested document is not in the database of the web cache 604, or the document is not the latest document, the web cache 604 requests the web server 608 for the document through the Internet, receives the document, and then transmits the web document to the predetermined client 602.

Meanwhile, in performing Internet networking, it is very important for the web server 608 to equally provide high quality services to all the clients 602. However, in the conventional method using the web cache 604, it cannot be said that all the clients 602 are provided with high quality services. For only the clients that have the web caches 604 can receive relatively high quality services, while the remaining clients that do not have the web cache 604 receive relatively low quality services.

Therefore, from the viewpoint of a web server operator, the conventional method using the web cache 604 is a very passive method in which the Internet 606 of all the clients must have the web cache 604.

Also, in the conventional method using the web cache 604, a high cache hit ratio cannot be provided because the web cache must store documents of all the web servers 608. That is, from the viewpoint of the web server operator, since the operator's web server document can be replaced from the web cache 604 by another operator's web server document, it cannot be said that all web documents use the web cache 604 function. In this kind
of system, it has been known that the cache hit ratio is usually 40 to 50%.

Disclosure of the Invention

To solve the above problems, it is an objective of the present invention to provide a web contents transmission system which can provide high speed web document services by solving bottlenecks in a web server and in the Internet through a method in which a plurality of web cache clusters are installed in geographically scattered areas and a client is connected to a neighboring web cache cluster, using an intelligent domain name server (DNS) or redirector, and a method thereof.

To accomplish the above object of the present invention, there is provided a web contents transmission system in which a web document stored in a web server is provided to each of a plurality of clients, the web contents transmission system having a customer domain name server (DNS) for determining an intelligent DNS which interprets the domain name of a predetermined web server, by searching a mapping table if an arbitrary client sends a query for the interpretation of the domain name of the predetermined web server, and providing information to access the determined intelligent DNS to the service requesting client, the intelligent DNS for selecting a web cache cluster which is the closest to the service requesting client, among a plurality of web cache clusters installed in each network of the Internet, if the service requesting client sends a query for the interpretation of the domain name of the predetermined web server, and providing the Internet protocol (IP) address of the selected neighboring web cache cluster, to the service requesting client; and the plurality of web cache clusters for forming an information packet of the corresponding web document when the service requesting client requests a service for the web document, and providing the packet to the service requesting client.

It is preferable that the intelligent DNS selects the neighboring web cache cluster according to rules defined in advance.

It is preferable that the intelligent DNS selects the neighboring web cache cluster according to the current traffic state of the Internet.

It is preferable that each web cache cluster is formed of a plurality of
web cache servers.

It is preferable that each web cache cluster caches web contents through a passive method in which a client who first accesses predetermined web document information caches the web contents, an active method in which predetermined web contents are cached in advanced according to definitions and updating rules received in advance from a corresponding web server, or a mirroring method in which a part of or all the web contents of a corresponding web server is copied in advance according to the rules received from the web server.

It is preferable that each web cache cluster caches web contents through a mixed method in which at least two of the passive method, active method, and mirroring method are used.

To accomplish another object of the present invention, there is also provided a web contents transmission control method in which a web document stored in a web server is provided to a plurality of clients, the web contents transmission control method having the steps of (a) determining an intelligent DNS which interprets the domain name of a predetermined web server, by searching a mapping table if an arbitrary client sends a query for the interpretation of the domain name of the predetermined web server, and providing information to access the determined intelligent DNS to the service requesting client; (b) sending a query for the interpretation of the domain name of the predetermined web server to the determined intelligent DNS; (c) selecting a web cache cluster which is the closest to the service requesting client, among a plurality of cache clusters installed in each network of the Internet, responding to the query for the interpretation of the domain name; (d) providing the IP address of the selected web cache cluster closest to the service requesting client, to the service requesting client; and (e) receiving a web document service from the closest web cache cluster using the IP address.

It is preferable that the closest web cache cluster is selected according to a rule defined in advance.

It is preferable that the closest web cache cluster is selected referring to the current traffic state of the Internet.
It is preferable that each web cache cluster caches web contents through a passive method in which a client who first accesses predetermined web document information caches the web contents, an active method in which predetermined web contents are cached in advance according to definitions and updating rules received in advance from a corresponding web server, or a mirroring method in which a part of or all the web contents of a corresponding web server is copied in advance according to the rules received from the web server.

It is preferable that each web cache cluster caches web contents through a mixed method in which at least two of the passive method, active method, and mirroring method are used.

To accomplish another object of the present invention, there is also provided a web contents transmission system in which a web document stored in a web server is provided to each of a plurality of clients, the web contents transmission system having a customer DNS for determining a redirector which will interpret the domain name of a predetermined web server, by searching a mapping table if an arbitrary client sends a query for the interpretation of the domain name of the predetermined web server, and providing information to access the determined redirector to the service requesting client; the redirector for selecting a web cache cluster which is the closest to the service requesting client, among a plurality of web cache clusters installed in each network of the Internet, if the service requesting client sends a request for a predetermined web document, and providing the URL of the selected neighboring web cache cluster, to the service requesting client; and the plurality of web cache clusters for forming an information packet of the corresponding web document when the service requesting client requests a service for the web document, and providing the packet to the service requesting client.

It is preferable that the redirector selects the neighboring web cache cluster according to distance information provided from the web cache cluster and the current traffic state of the Internet.

It is preferable that each web cache cluster is formed of a plurality of web cache servers.
It is preferable that each web cache cluster caches web contents through a passive method in which a client who first accesses predetermined web document information caches the web contents, an active method in which predetermined web contents are cached in advance according to definitions and updating rules received in advance from a corresponding web server, or a mirroring method in which a part of or all the web contents of a corresponding web server is copied in advance according to the rules received from the web server.

It is preferable that each web cache cluster caches web contents through a mixed method in which at least two of the passive method, active method, and mirroring method are used.

To accomplish another object of the present invention, there is also provided a web contents transmission control method in which a web document stored in a web server is provided to a plurality of clients, the web contents transmission control method having the steps of (a) a customer DNS determining a redirector which interprets the URL of a web cache cluster, by searching a mapping table if an arbitrary client sends a query for the interpretation of the domain name of the predetermined web server, and providing information to access the determined redirector to the service requesting client; (b) sending a query for the interpretation of the domain name of the predetermined web server to the determined redirector; (c) requesting service selecting information to a plurality of web cache clusters installed in each network of the Internet, responding to the query for the interpretation of the domain name; (d) selecting a web cache cluster which is the closest to the service requesting client, among the plurality of cache clusters, based on the selecting information received from each web cache cluster; (e) providing the URL of the selected neighboring web cache cluster to the service requesting client; and (f) receiving a web document service from the neighboring web cache cluster, using the URL.

It is preferable that the service selecting information is information on the distance between each web cache client and the service requesting client and information on the current traffic state of the Internet.

It is preferable that each web cache cluster caches web contents
through a passive method in which a client who first accesses predetermined web document information caches the web contents, an active method in which predetermined web contents are cached in advanced according to definitions and updating rules received in advance from a corresponding web server, or a mirroring method in which a part of or all the web contents of a corresponding web server is copied in advance according to the rules received from the web server.

It is preferable that each web cache cluster caches web contents through a mixed method in which at least two of the passive method, active method, and mirroring method are used.

**Brief Description of the Drawings**

FIG. 1 illustrates a web contents transmission system according to a first embodiment of the present invention;

FIG. 2 is a flowchart for showing a process to control web contents transmission according to the first embodiment of the present invention;

FIG. 3 illustrates a web contents transmission system according to a second embodiment of the present invention;

FIG. 4 is a flowchart for showing a process to control the web contents transmission according to the second embodiment of the present invention;

FIG. 5 illustrates a system for showing an ordinary connection of clients and a web server; and

FIG. 6 illustrates a system for transmitting web contents using a conventional web cache.

**Best mode for carrying out the Invention**

Hereinafter, embodiments of the present invention will be described in detail with reference to the attached drawings. The present invention is not restricted to the following embodiments, and many variations are possible within the spirit and scope of the present invention. The embodiments of the present invention are provided in order to more completely explain the present invention to anyone skilled in the art. Identical reference numbers in the drawings represent identical elements.
First, the core of the technology of the present invention is that a plurality of web cache clusters are installed at geographically scattered areas on the Internet and web server documents are stored in a web cache cluster that is located in a location closer to a client; and when an arbitrary client requests a web document service, a web cache cluster in a closer location, the cluster which is linked to the client by an intelligent DNS or redirector, provides the web document to the requesting client. Through this technological means, the bottlenecks in the web server and in the Internet can be removed, which is the purpose of the present invention.

FIG. 1 illustrates a web contents transmission system according to a first embodiment of the present invention. Referring to FIG. 1, the web contents transmission system according to the first embodiment of the present invention has a client 102, a customer DNS 104, an intelligent DNS 106, web cache clusters 110/1 and 110/2, and a web server 112. The client 102 and web cache clusters 110/1 and 110/2, and web cache clusters 110/1 and 110/2 and the web server 112 are connected to each other through the Internet 108.

Referring to FIG. 1, when the customer DNS 104 receives a query for interpretation of a domain name with a URL from the client 102, for example, when the customer DNS 104 receives an Internet protocol (IP) address request of www.server.com, the customer DNS 104 interprets the URL. According to the result of the interpretation, the customer DNS 104 searches a mapping table and finds an intelligent DNS providing a service for the IP address requested by the client. The customer DNS 104 generates a response message to lead to access the intelligent DNS determined to provide a service, and provides the message to the client 102. For this, in the mapping table of the customer DNS 104, a DNS code to lead to access an intelligent DNS corresponding to each domain name is stored.

Next, when the intelligent DNS 106 receives a query for interpretation of a domain name, for example, when the intelligent DNS 106 receives an IP address request of www.server.com, the intelligent DNS 106 determines a web cache cluster which is regarded to be the closest to the service requesting client 102, considering rules defined in advance by the administrator and the current traffic state of the Internet 108. Then, the intelligent DNS 106
transmits the IP address of the determined web cache cluster (for example, 110/1) to the client 102.

The web cache cluster 110/1 accesses the web server 112 through the Internet 108 and stores the web documents processed in the web server 112. When a service request for a web document comes from the client 102, that is, when an information request packet is received, the web cache cluster 110/1 searches for the corresponding document and transmits the document to the service requesting client 102. By forming the web cache cluster 110/1 with a plurality of web cache servers, each client that requests a service can receive a high quality service with high speed processing, a high speed responding time, and high availability.

That is, the web cache cluster 110/1 searches for the web document indicated by the URL in the database of the web cache cluster 110/1. When the web document requested from the client 102 is stored in the database of the web cache cluster 110/1, the web cache cluster 110/1 fetches the stored web document, forms an information packet, and then transmits the packet to the service requesting client 102 through the Internet 108.

Meanwhile, when the result of the search indicates that the requested document is not in the database of the web cache cluster 110/1, or that the document is not the latest one, the web cache cluster 110/1 requests the web document to the web server 112 through the Internet 108, receives the web document, stores or updates the received web document in the database of the web cache cluster 110/1, and then transmits the web document to the service requesting client 102.

Also, unlike the passive method described above in which a client who first accesses predetermined web document information of the web server 112 caches web contents in the web cache cluster 110/1, each web cache cluster caches web contents through an active caching method or a mirroring method.

That is, the web cache cluster 110/1 provides web contents to an arbitrary client through an active caching method in which the web cache cluster 110/1 receives definitions and updating rules on what contents to be cached, from each web contents provider, that is, the web server 112, and web contents predetermined according to the definitions and updating rules are
cached in the corresponding web cache clusters in advance. Or, in the
mirroring method in which the web cache cluster 110/1 caches a part of or all
the contents of the web server 112, through in-advance copying according to
the schedule rules received from a web contents provider (web server), the
web cache cluster 110/1 updates the contents of the web cache cluster 110/1
only when a web contents provider requests it.

Therefore, in the present invention, depending on necessity or purpose,
the passive caching method, active caching method, or mirroring method can
be appropriately selected and used, and, as the case may be, a complex
caching method in which a caching method changes according to web content
can be used by modifying the methods.

Referring to FIG. 1, the web cache cluster 110/1 and web cache cluster
110/2 are installed in different networks, and in the embodiment of the present
invention, just two web cache clusters 110/1 and 110/2 are shown as
examples.

Finally, when an arbitrary web cache cluster requests information, that
is, a web document request is received, the web server 112 fetches the
document, and provides the document, or a part of or all the web contents to
the web cache cluster according to the predetermined rules or updating rules,
or web contents for updating, to the requesting web cache cluster. An
example of this web server 112 is a web server operating company having
major customers such as portal sites, electronic commerce sites, search sites,
and online newspaper sites.

Therefore, the web contents transmission system according to the first
embodiment of the present invention installs a plurality of web cache clusters
in geographically scattered locations on the Internet, and when an arbitrary
client requests a web document service, a web cache cluster which is located
in a place closer to the client and connected to the client by selection of the
intelligent DNS 106 according to the rules defined in advance or the current
Internet traffic state, is made to provide the web document (contents) to the
service requesting client 102.

Accordingly, the bottlenecks in the web server 112 and in the Internet 108 can
be clearly removed and each client can receive high speed web document
services.

Next, a process for controlling the transmission of web contents according to the rules defined in advance or the current Internet traffic state, using the web contents transmission system of the first embodiment of the present invention having the structure described above will now be explained.

FIG. 2 is a flowchart for showing the process to control the web contents transmission according to the first embodiment of the present invention.

Referring to FIG. 2, if the client 102 sends a query for interpretation of a domain name, that is, an IP address in step 202, the customer DNS 104 interprets the domain name, searches a mapping table, determines an intelligent DNS (for example, 106) which provides a service for the IP address requested by the client, generates a response message to lead to access the intelligent DNS determined to provide a service, and transmits the message to the client 102 in step 204. At this time, in the mapping table in the customer DNS 104, a DNS code to lead to access an intelligent DNS corresponding to each IP address has already been stored.

Next, when the response message from the customer DNS 104 is received, the client 102 analyzes the response message to determine to which intelligent DNS the client 102 must send the query for interpretation of a domain name, for example, the intelligent DNS 106, and sends the query for interpretation of the domain name of a desired web server in step 206.

Then, when the query for interpretation of the domain name from the client 102 is received, the intelligent DNS 106 determines which web cache cluster is the closest to the service requesting client 102, for example, the web cache cluster 110/1, referring to the rules defined in advance by the administrator, or to the current traffic state, and sends the IP address of the determined web cache cluster 110/1 to the client 102 in step 208.

Therefore, connected to the web cache cluster 110/1 with the IP address determined by the intelligent DNS 106, the client 102 requests the service of the necessary web documents (contents) in step 210.

Next, the web cache cluster 110/1 determines whether or not the requested web document is stored in the database of the web cache cluster
110/1, and if the web document is stored in the database, determines whether or not the document is the latest one in step 212. Here, if the result of the search indicates that the requested web document is stored as the latest one in the database, that is, if the cache is hit, the web cache cluster 110/1 fetches the requested web document, forms an information packet in step 214, and then transmits the packet to the client 102 through the Internet in step 220.

If the result of the search indicates that the requested web document is not stored in the database of the web cache cluster 110/1 or that the web document is not the latest one, the web cache cluster 110/1 accesses the web server 112 through the Internet 108, and requests the web document, that is, transmits an information request packet to the web server in step 216.

Therefore, the web server 112 transmits the requested web document to the web cache cluster 110/1, and the web cache cluster 110/1 stores the received web document in the database of the web cache cluster 110/1 in the step 218, and transmits the web document to the service requesting client 102 in step 220.

In the above embodiment, it is described that web contents are provided to an arbitrary client through a passive method in which a client which first accesses predetermined web document information of the web server 112 caches web contents in the web cache cluster 110/1, but the embodiment is not limited to the passive method.

That is, in the web transmission control method according to the present embodiment, each web cache cluster can provide web contents to an arbitrary client which requests web contents service through an active caching method in which each web cache cluster receives definitions and updating rules on what contents are to be cached, from each web contents provider (that is, web server), and web contents predetermined according to the definitions and updating rules are cached in advance in the corresponding web cache clusters, or through a mirroring method in which each web cache cluster caches a part or all of the contents of a web server, through in-advance copying according to the schedule rules received from the web contents provider (web server). At this time, in the mirroring method, the contents of each web cache cluster is updated only when the web contents provider
requests updating.

Therefore, in the present embodiment, depending on necessity or purpose, the passive caching method, active caching method, or mirroring method can be appropriately selected and used, and, as the case may be, a complex caching method in which a caching method changes according to web content can be used by modifying the methods.

Accordingly, in the present invention, a plurality of web cache clusters are installed in geographically scattered areas; a web cache cluster which is closer to the client processes most requests; each web cache cluster caches the web documents of subscribing customers, that is, clients; and therefore the web cache cluster can record a cache hit ratio close to 100%.

Also, in the present invention, since each web cache cluster is connected to a different Internet line, the service bandwidth can be widened by increasing the number of web cache clusters, and since an intelligent DNS designates a web cache cluster which is the closest to a service requesting client to process the request, delays occurring in the Internet lines can be minimized and high quality services can be provided.

FIG. 3 illustrates a web contents transmission system according to a second embodiment of the present invention. The web contents transmission system according to the second embodiment of the present invention has a client 302, a customer DNS 304, at least one or more redirector 306, a plurality of web cache clusters 310/1~310/4, and a web server 312. The client 302 and the web cache clusters 310/1~310/4, and the web cache clusters 310/1~310/4 and the web server 312 are connected to each other through the Internet 308.

Referring to FIG. 3, the web contents transmission system according to the second embodiment of the present invention has the major technological characteristic and difference from the first embodiment that the system according to the second embodiment adopts a redirector 306, instead of the intelligent DNS 106 adopted in the web contents transmission system according to the first embodiment described above. Except this difference, the structure and functions of the remaining elements are substantially the same as those in the first embodiment described above.

Also, though only one redirector 306 is shown in FIG. 3, the number of
redirectors is not limited to one, and a plurality of redirectors can be installed depending on the number of web cache clusters, considering the size of the Internet 308. At this time, in the mapping table of the customer DNS 304, a DNS code to lead to access a redirector corresponding to each domain name is stored.

Therefore, to avoid redundant descriptions and to provide concise explanation for better understanding, only the characteristic parts, centering around the service provided by the redirector 306, that is, the URL information service of a web cache cluster which is the closest to a client requesting a web contents service, in the second embodiment of the present invention will now be explained.

First, if the client 302 sends a query for interpretation of a domain name with a URL, for example, requests the IP address of www.server.com, the customer DNS 304 interprets the received URL, searches a mapping table according to the result of the interpretation, determines a redirector which provides a service for the URL requested by the client 302, for example, the redirector 306 of FIG. 3, generates a response message to lead to access the redirector 306 determined to provide a service, and provides the message to the client 302.

Next, when the web document request from the client 302 is received, the redirector 306 searches a mapping table according to rules defined in advance by an administrator, and sends a query to the web cache clusters 310/1~310/4 registered in the redirector 306. That is, the redirector 306 requests distance information, that is, information on the distances between the client 302 and the request-receiving web cache cluster, and information on the current traffic state of the Internet 308. Referring to distance information and information on the current traffic state of the Internet 308 received from web cache clusters 310/1~310/4 as responses to the request, the redirector 306 provides the URL of a web cache cluster which is the closest to the service requesting client 302, for example, 310/4 of FIG. 3, to the client 302.

Therefore, the client 302 requesting the contents service can receive the desired contents by accessing the web cache cluster 310/4, using the URL received from the redirector 306.
Meanwhile the web cache clusters 310/1~310/4 adopted in the web contents transmission system according to the second embodiment of the present invention can cache web contents from the corresponding web server through the passive method, active method, mirroring method, or complex method, according to necessity or purpose, as the web cache clusters 110/1 and 110/2 described above.

Therefore, like the first embodiment described above, the web contents transmission system according to the second embodiment of the present invention can clearly remove the bottlenecks in the web server and in the Internet and can provide high speed web document services to each client.

Next, a process for controlling the transmission of web contents according to the rules defined in advance or the current Internet traffic state, using the web contents transmission system of the second embodiment of the present invention having the structure described above will now be explained.

FIG. 4 is a flowchart for showing a process to control the web contents transmission according to the second embodiment of the present invention.

Referring to FIG. 4, if the client 302 sends a query for interpretation of a domain name, that is, an IP address in step 402, the customer DNS 304 interprets the domain name, searches a mapping table, determines a redirector (for example, 306) which provides a service for the IP address requested by the client 302, generates a response message to lead to access the redirector 306 determined to provide a service, and transmits the message to the client 302 in step 404. At this time, in the mapping table in the customer DNS 304, a DNS code to lead to access a redirector corresponding to each IP address has already been stored.

Next, the client sends a query for the URL of a web server which the client wishes to access, to the customer DNS 304 in step 406.

Then, if the URL query from the client 302 is received, responding to the query, the redirector 306 searches a mapping table according to the rules defined in advance, and sends a query to each web cache cluster 310/1~310/4 registered in the redirector 306. That is, the redirector 306 requests information on the distance between the query-receiving web cache cluster and the client 302, and information on the current traffic state of the Internet
308 in step 408.

Responding to this, each web cache clusters 310/1~310/4, after collecting distance information between the client 302 and the web cache cluster and information on the current traffic state of the Internet 308 transmits the information to the redirector 306 through the Internet 308, in step 410.

Next, referring to the distance information and information on the current traffic state of the Internet 308 received from the web cache clusters 310/1~310/4, the redirector 306 determines a web cache cluster, for example 310/4 of FIG. 3, which is the closest to the client 302, and provides the URL of the determined web cache cluster 310/4 to the client 302 in step 412.

Therefore, connected to the web cache cluster 310/4 with the URL determined by the redirector 306, the client 302 requests the web document (contents) service which the client 302 needs in step 414.

Next, the web cache cluster 310/4 searches its database to determine whether or not the requested web document is stored in the database, and, if the document is stored in the database, whether or not the document is the latest one in step 416. Here, if the result of searching indicates that the requested web document is stored as the latest document in the database, that is, if the cache is hit, the web cache cluster 310/4 fetches the requested web document, forms an information packet in step 418, and then transmits the packet to the client 302 through the Internet 308.

If the result of the search indicates that the requested web document is not stored in the database or that the web document is not the latest one, the web cache cluster 310/4 accesses the web server 312 through the Internet 308, and requests the requested web document, that is, sends an information request packet to the web server 312 in step 420.

Therefore, the web server 312 transmits the requested web document to the web cache cluster 310/4, and the web cache cluster 310/4 stores the web document received from the web server 312 in the database of the web cache cluster 310/4, and then transmits the web document to the service requesting client 320 in step 424.

Meanwhile, in the second embodiment, it is described that web contents are provided to an arbitrary client through a passive method in which a client
who first accesses predetermined web document information of the web server 312 caches web contents in the web cache cluster 310/4, but the present embodiment is not limited to the passive method.

That is, in the second embodiment, as in the first embodiment, the caching method can be set so that each web cache cluster can cache web contents of a web server through a passive method, active method, mirroring method, or complex method, depending on necessity or purpose.

Therefore, the web contents transmission system according to the second embodiment, as in the first embodiment described above, can clearly remove the bottlenecks in the web server and in the Internet and can provide high speed web document services to each client.

**Industrial Applicability**

In the present invention, a plurality of web cache clusters are installed at the edges of the Internet. When an arbitrary client requests a web document service, an intelligent DNS or redirector selects a web cache cluster closer to the client according to the rules defined in advance or the current traffic state of the Internet so that the client can receive the web document service from the selected web cache cluster closer to the client. By doing so, the bottlenecks in the web server and in the Internet can be clearly removed and each client can receive high speed web document services on the WWW system.

The present invention can be applied to all computer systems communicating documents through a network.
What is claimed is:

1. A web contents transmission system wherein a web document stored in a web server is provided to each of a plurality of clients, the web contents transmission system comprising:

   a customer domain name server (DNS) for determining an intelligent DNS which interprets the domain name of a predetermined web server, by searching a mapping table if an arbitrary client sends a query for the interpretation of the domain name of the predetermined web server, and providing information to access the determined intelligent DNS to the service requesting client,

   the intelligent DNS for selecting a web cache cluster which is the closest to the service requesting client, among a plurality of web cache clusters installed in each network of the Internet, if the service requesting client sends a query for the interpretation of the domain name of the predetermined web server, and providing the Internet protocol (IP) address of the selected neighboring web cache cluster, to the service requesting client; and

   the plurality of web cache clusters for forming an information packet of the corresponding web document when the service requesting client requests a service for the web document, and providing the packet to the service requesting client.

2. The web contents transmission system of claim 1, wherein the intelligent DNS selects the neighboring web cache cluster according to rules defined in advance.

3. The web contents transmission system of claim 1, wherein the intelligent DNS selects the neighboring web cache cluster according to the current traffic state of the Internet.

4. The web contents transmission system of any one of claim 1-3, wherein each web cache cluster is formed of a plurality of web cache servers.

5. The web contents transmission system of claim 4, wherein each
web cache cluster caches web contents through a passive method in which a client who first accesses predetermined web document information caches the web contents, an active method in which predetermined web contents are cached in advance according to definitions and updating rules received in advance from a corresponding web server, or a mirroring method in which a part of or all the web contents of a corresponding web server is copied in advance according to the rules received from the web server.

6. The web contents transmission system of claim 5, wherein each web cache cluster caches web contents through a mixed method in which at least two of the passive method, active method, and mirroring method are used.

7. A web contents transmission control method wherein a web document stored in a web server is provided to a plurality of clients, the web contents transmission control method comprising the steps of:

(a) determining an intelligent DNS which interprets the domain name of a predetermined web server, by searching a mapping table if an arbitrary client sends a query for the interpretation of the domain name of the predetermined web server, and providing information to access the determined intelligent DNS to the service requesting client;

(b) sending a query for the interpretation of the domain name of the predetermined web server to the determined intelligent DNS;

(c) selecting a web cache cluster which is the closest to the service requesting client, among a plurality of cache clusters installed in each network of the Internet, responding to the query for the interpretation of the domain name;

(d) providing the IP address of the selected web cache cluster closest to the service requesting client, to the service requesting client; and

(e) receiving a web document service from the closest web cache cluster using the IP address.

8. The web contents transmission control method of claim 7,
wherein the closest web cache cluster is selected according to a rule defined in advance.

9. The web contents transmission control method of claim 7, wherein the closest web cache cluster is selected referring to the current traffic state of the Internet.

10. The web contents transmission control method of any one of claims 7-9, wherein each web cache cluster caches web contents through a passive method in which a client who first accesses predetermined web document information caches the web contents, an active method in which predetermined web contents are cached in advanced according to definitions and updating rules received in advance from a corresponding web server, or a mirroring method in which a part of or all the web contents of a corresponding web server is copied in advance according to the rules received from the web server.

11. The web contents transmission control method of claim 10, wherein each web cache cluster caches web contents through a mixed method in which at least two of the passive method, active method, and mirroring method are used.

12. A web contents transmission system wherein a web document stored in a web server is provided to each of a plurality of clients, the web contents transmission system comprising:

- a customer DNS for determining a redirector which will interpret the domain name of a predetermined web server, by searching a mapping table if an arbitrary client sends a query for the interpretation of the domain name of the predetermined web server, and providing information to access the determined redirector to the service requesting client;

- the redirector for selecting a web cache cluster which is the closest to the service requesting client, among a plurality of web cache clusters installed in each network of the Internet, if the service requesting client sends a request
for a predetermined web document, and providing the URL of the selected neighboring web cache cluster, to the service requesting client; and
the plurality of web cache clusters for forming an information packet of the corresponding web document when the service requesting client requests a service for the web document, and providing the packet to the service requesting client.

13. The web contents transmission system of claim 12, wherein the redirector selects the neighboring web cache cluster according to distance information provided from the web cache cluster and the current traffic state of the Internet.

14. The web contents transmission system of claims 12 or 13, wherein each web cache cluster is formed of a plurality of web cache servers.

15. The web contents transmission system of claim 14, wherein each web cache cluster caches web contents through a passive method in which a client who first accesses predetermined web document information caches the web contents, an active method in which predetermined web contents are cached in advance according to definitions and updating rules received in advance from a corresponding web server, or a mirroring method in which a part of or all the web contents of a corresponding web server is copied in advance according to the rules received from the web server.

16. The web contents transmission system of claim 15, wherein each web cache cluster caches web contents through a mixed method in which at least two of the passive method, active method, and mirroring method are used.

17. A web contents transmission control method wherein a web document stored in a web server is provided to a plurality of clients, the web contents transmission control method comprising the steps of:
   (a) a customer DNS determining a redirector which interprets the URL
of a web cache cluster, by searching a mapping table if an arbitrary client
sends a query for the interpretation of the domain name of the predetermined
web server, and providing information to access the determined redirector to
the service requesting client;
5  (b) sending a query for the interpretation of the domain name of the
predetermined web server to the determined redirector;
   (c) requesting service selecting information to a plurality of web cache
clusters installed in each network of the Internet, responding to the query for
the interpretation of the domain name;
10  (d) selecting a web cache cluster which is the closest to the service
requesting client, among the plurality of cache clusters, based on the selecting
information received from each web cache cluster;
   (e) providing the URL of the selected neighboring web cache cluster to
the service requesting client; and
15  (f) receiving a web document service from the neighboring web cache
cluster, using the URL.

18. The web contents transmission control method of claim 17,
wherein the service selecting information is information on the distance
between each web cache client and the service requesting client and
information on the current traffic state of the Internet.

19. The web contents transmission control method of claim 17 or 18,
wherein each web cache cluster caches web contents through a passive
method in which a client who first accesses predetermined web document
information caches the web contents, an active method in which predetermined web contents are cached in advanced according to definitions
and updating rules received in advance from a corresponding web server, or
a mirroring method in which a part of or all the web contents of a
30 corresponding web server is copied in advance according to the rules received
from the web server.

20. The web contents transmission control method of claim 19,
wherein each web cache cluster caches web contents through a mixed method in which at least two of the passive method, active method, and mirroring method are used.
FIG. 2

START

SEND QUERY FOR INTERPRETATION OF DOMAIN NAME

SEND QUERY TO INTELIGENT DNS

REQUEST INTELIGENT DNS FOR IP ADDRESS

DETERMINE WEB CACHE CLUSTER AND SEND IP ADDRESS

REQUEST DETERMINED WEB CACHE CLUSTER FOR INFORMATION

CACHE HIT? Y

FETCH REQUESTED INFORMATION AND FORM INFORMATION PACKET

REQUEST WEB SERVER FOR INFORMATION

STORE RECEIVED INFORMATION

TRANSMIT INFORMATION TO CLIENT

END
FIG. 4

START

SEND QUERY FOR INTERPRETATION OF DOMAIN NAME 402

SEND QUERY TO REDIRECTOR 404

REQUEST REDIRECTOR FOR URL 406

SEND QUERY TO WEB CACHE CLUSTER 408

PROVIDE INFORMATION RESPONDING TO QUERY 410

DETERMINE WEB CACHE CLUSTER AND SEND URL 412

REQUEST WEB SERVER FOR INFORMATION DETERMINED 414

CACHE HIT? Y

FETCH REQUESTED INFORMATION AND FORM INFORMATION PACKET 418

N

REQUEST WEB SERVER FOR INFORMATION 420

STORE RECEIVED INFORMATION 422

TRANSMIT INFORMATION TO CLIENT 424

END
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 G06F 15/00
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the files searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tr>
<td>A</td>
<td>US-5983005 (Netcast Communications Corp.) November 9, 1999 * Abstract *</td>
<td>1 - 20</td>
</tr>
<tr>
<td>A</td>
<td>US-5991306 (Microsoft Corporation) November 23, 1999 * Whole document *</td>
<td>1 - 20</td>
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[ ] Further documents are listed in the continuation of Box C.   [X] See patent family annex.

* Special categories of cited documents:
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