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Description

CONTENT PROVIDING APPARATUS AND CONTENT PROVIDING METHOD

5 Background of the Invention
Technical Field

The present invention relates to a content providing apparatus and a content providing method, and can be applied, for example, to distribution of music and videos via the Internet. In the present invention, single stream content is divided into a plurality of parts in a time-series manner, and a first part is transmitted via stream distribution, whereas remaining parts are transmitted via buffering distribution such that decoding of a receiver's side can be started upon end of decoding an immediately preceding part, whereby the stream content is distributed with a high reliability and latency can be reduced remarkably as compared to that in the conventional art.

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Background Art

Conventionally, to distribute information such as music, films, etc. whose content changes with time (hereinafter called stream content), it is designed to use a method of providing stream content while its data is being received (hereinafter called stream distribution), and a method of providing a user with stream content after its data is temporarily buffered (hereinafter called buffering distribution).

That is, in the stream distribution, as shown in FIG. 1, a transmitter's side transmits stream content to a client at a transfer rate that is substantially the same as a



reproduction speed (FIG. 1 (A)), and a receiver's side buffers the received data in an amount large enough to decode the stream content (FIG. 1 (B)) for sequential decoding (this process on the receiver's side is called stream reception as
5 corresponding to the stream distribution). In the case of this method, the stream content transmitted by the transmitter can be reproduced only to a very small delay time required for data transmission and decoding (FIG. 1 (C)), whereby a latency between the start of receiving the stream content and
10 the start of actually reproducing it can be reduced, thereby allowing the stream content to be provided smoothly.

By contrast, in the buffering distribution, as shown in FIG. 2, a transmitter's side transmits stream content at a rate irrelevant to a reproduction speed (FIG. 2 (A)). A
15 recipient receives the stream content, buffers all the received stream content (FIG. 2 (B)), and thereafter decodes the buffered stream content to provide a user with the decoded stream content (FIG. 2 (C)) (this process on the receiver's side is hereinafter called buffering reception as
20 corresponding to the buffering distribution). In the case of this method, there is a shortcoming that a relatively long time interval is required between the start of receiving the content and the start of actually reproducing it. However, in the case of this method, all the stream content is received
25 and buffered in advance prior to its reproduction, and this allows an error recovery technique, such as error correction or retransmission request processing in TCP/IP, to be applied, whereby the stream content can be distributed with a correspondingly higher reliability.

30 In the buffering distribution, it is so designed that single stream content is decomposed into a plurality of parts

to be transmitted sequentially, whereby to reduce the latency between the start of receiving the stream content and the start of actually reproducing it.

That is, in the case of this method, as shown in FIG. 3, a transmitter's side divides single stream content into, for example, four parts A to D in a time-series manner, and transmits these parts A to D sequentially (FIG. 3 (A)). In response thereto, a receiver's side receives and buffers these parts A to D, and, upon completion of receiving one part, starts reproducing this part. Thus, it is so designed that after having buffered the first part A, the receiver's side starts decoding a part whose reception is completed while buffering another part, whereby to reduce the latency (FIGS. 3 (B) and (C)).

Thus, the buffering distribution has a merit that stream content can be distributed with a high reliability, but does involve a problem of generating the latency. For this reason, a user, who has requested stream content, cannot listen to a demonstration of the content during the latency period. Incidentally, as explained with reference to FIG. 3, even when single stream content is divided and distributed as a plurality of parts, the latency does exist before reception of the first part is completed.

Disclosure of the Invention

The present invention has been made in consideration of the above points, and attempts to propose a content providing apparatus and a content providing method by which stream content is distributed with a high reliability and latency can be reduced remarkably as compared to that in the conventional art.

In order to solve the above problem, the present invention is applied to a content providing apparatus for transmitting predetermined stream content to a client. Among a plurality of parts formed by time-series division of single stream content, a first part is transmitted via stream distribution, and remaining parts are transmitted via buffering distribution such that decoding of a receiver's side can be started upon end of decoding an immediately preceding part.

The stream distribution exhibits an extremely low latency but has a demerit of low reliability, whereas the buffering distribution exhibits a high latency but has a merit of high reliability. Thus, according to the configuration of the present invention, the first part is transmitted via the stream distribution, and the remaining parts are transmitted via the buffering distribution such that decoding of the receiver's side can be started upon end of decoding an immediately preceding part, whereby while reproducing the first part after an extremely low latency, buffering of the succeeding parts can be completed, thereby allowing the parts subsequent to the first part to be reproduced without interruption. Thus, stream content can be provided, ensuring a high reliability.

Further, the present invention is applied to a content providing apparatus for receiving stream content transmitted by a predetermined server to provide a user with the received stream content. The stream content is divided into a plurality of parts in a time-series manner to be transmitted by the server, and the content providing apparatus receives a first one of the parts via stream reception to be provided to the user, and buffer-receives a rest of the parts in a manner decodable upon completion of decoding an immediately preceding part.

Thus, according to the configuration of the present invention, the process performed by the receiver's side permits the stream content to be provided at a low latency and ensuring a high reliability.

5 Still further, the present invention is applied to a content providing method of transmitting predetermined stream content to a client. Among a plurality of parts formed by time-series division of single stream content, a first part is transmitted via the stream distribution, and remaining parts
10 are transmitted via the buffering distribution such that decoding of a receiver's side can be started upon end of decoding an immediately preceding part.

 According to the configuration of the present invention, a content providing method can be provided, by which stream
15 content is distributed with a high reliability and latency can be reduced remarkably as compared to that in the conventional art.

 Still further, the present invention provides a content providing method of receiving stream content transmitted by
20 a predetermined server to provide a user with the received stream content. The stream content is divided into a plurality of parts in a time-series manner to be transmitted by the server, and the content providing method includes receiving a first one of the parts via stream reception to be provided to the
25 user, and buffer-receiving a rest of the parts in a manner decodable upon completion of an immediately preceding part.

 According to the configuration of the present invention, a content providing method can be provided, by which stream content is distributed with a high reliability and latency
30 can be reduced remarkably as compared to that in the conventional art.

Brief Description of Drawings

FIG. 1 is a characteristic curve diagram for explaining conventional stream distribution;

5 FIG. 2 is a characteristic curve diagram for explaining conventional buffering distribution;

FIG. 3 is a characteristic curve diagram for explaining buffering distribution in which single stream content is divided into a plurality of parts;

10 FIG. 4 is a block diagram showing a distribution system according to an embodiment of the present invention; and

FIG. 5 is a characteristic curve diagram for explaining the distribution of stream content in FIG. 4.

15 Best Modes for Carrying Out the Invention

Embodiments of the present invention are described below in detail with reference to the drawings whenever appropriate.

(1) Configuration of an Embodiment

FIG. 4 is a block diagram showing a distribution system
20 according to an embodiment of the present invention. In this distribution system 1, a client 2 is a computer connected to a network such as the Internet, and is a receiving unit of content. A service server 3 functions as an HTTP server and renders services such as presentation of providable content
25 by access from the client 2. A content server 4 provides stream content by similar access from the client 2.

Here, the content server 4 divides single stream content for distribution into a plurality of parts in a time-series direction, and distributes a first part via the stream
30 distribution and remaining parts are transmitted via the buffering distribution such that a receiver's side can perform

reproduction upon completion of reproducing an immediately preceding part; i.e., the receiver's side can complete buffering upon completion of decoding an immediately preceding part.

5 That is, in this embodiment, as shown in FIG. 5, single stream content is arranged in time-series manner and divided into four parts A to D. Here, the parts A to D are formed such that they are related to each other to have their reproduction time doubled sequentially in the time-series
10 direction. Among these parts A to D, the content server 4 transmits the first part A via the stream distribution. The parts B to D subsequent to the first part A are sequentially transmitted via the buffering distribution. Further, when transmitting the first part A, the content server transmits
15 the subsequent part B concurrently (FIG. 5 (A)).

 Thus, it is so designed in this embodiment that while receiving and decoding the first part A, the receiver's side receives and buffers the subsequent part B so that the subsequent part B can be reproduced upon completion of
20 reproducing the part A. Further, it is so designed that while reproducing the part B in this way, the subsequent part C is received and buffered so that the subsequent part C can be reproduced upon completion of reproducing the part B. By enabling the receiver's side to perform these processes, the
25 content server 4 is designed such that a reproducer's side can reproduce the successive parts A to D without interruption whereby to reduce the latency remarkably after a request is made.

 In order to do so, thus the client 2 requests the content
30 server 4 to distribute stream content based on a menu offered by access to the service server 3. Then the client 2

concurrently receives the first and second parts A and B transmitted in this way, and decodes the first part A to provide a user with the decoded part A, and buffers the second part B. Further, upon completion of decoding the first part A, the client 2 starts decoding the second part B, and also receives and buffers the subsequently transmitted third part C. Further, upon completion of decoding the second part B, the client 2 starts decoding the third part, and also starts receiving and buffering the fourth part, and upon completion of decoding the third part C, it starts decoding the fourth part D.

(2) Operation of the Embodiment

In the above configuration, this distribution system 1 operates such that the client 2 is provided with a list or the like of content for distribution by access to the service server 3, and stream content is provided from the content server 4 by access following this list.

In this way of providing the content, among four parts A to D formed by dividing single stream content in a time-series manner, the content server 4 provides the first part A and subsequent part B via the stream distribution and the buffering distribution, respectively, and the subsequent parts C and D via the buffering distribution. Further, the parts B to D other than the first part are distributed such that upon end of decoding an immediately preceding part, a receiver's side can decode a succeeding part for reproduction.

Thus, the receiver's side can stream-receive the first part A, whereby the stream content can be provided to the user with extremely low latency period. Further, while providing the user with the first part A in this way, the receiver's side buffer-receives the subsequent part B, i.e., receives

and buffers the part B, and starts decoding the part B upon completion of decoding the part A, whereby the successive parts A and B can be provided to the user without interruption.

Further, while providing the user with the part B in this way, the receiver's side receives and buffers the subsequent part C, and upon completion of decoding the part B, it starts decoding the part C. Further, while providing the user with the part C, the receiver's side receives and buffers the subsequent part D, and upon end of decoding the part C, it starts decoding the part D. Thus, this embodiment ensures a low latency and allows the successive parts A to D to be provided to the user without interruption. At this time, the parts B to D other than the first part are provided via the buffering distribution, whereby recovery processing for transmission error can be performed whenever necessary, to ensure a high reliability.

(3) Advantages of the Embodiment

According to the above configuration, single stream content is divided into a plurality of parts in a time-series manner, and a first part is transmitted via the stream distribution, and remaining parts are transmitted via the buffering distribution such that decoding of a receiver's side can be started upon end of decoding an immediately preceding part, whereby the stream content is distributed with a high reliability and latency can be reduced remarkably as compared to that in the conventional art.

(4) Second Embodiment

In this embodiment, the first part A according to the above-described first embodiment is distributed via unicast

and the remaining parts B to D via multicast.

Here, unicast means a process of distributing one item of stream content to one client exclusively, whereas multicast means a process of distributing one item of stream content to a plurality of clients in common. In a distribution via the multicast, the content server 4 transmits the plurality of parts C and D sequentially and cyclically, and each client buffer-receives these parts C and D sequentially and selectively.

Thus, it is so designed in this embodiment that stream the distribution of the first part is performed via unicast to allow the latency to be reduced accordingly.

Further, it is so designed that the buffering distribution of the remaining parts is performed via multicast to prevent a bandwidth required for transmission from increasing.

Further, the plurality of parts are each transmitted sequentially and cyclically to implement a distribution via the multicast, whereby it is designed to prevent the bandwidth required for transmission from increasing even if the number of clients is increased.

(5) Other Embodiments

Note that while the cases where single stream content is distributed by division into four parts have been described in the above-described embodiments, the present invention is not limited thereto. By dividing single stream content into such various parts as necessary, advantages similar to those of the above-described embodiments can be obtained.

Further, while the cases where parts to be buffer-distributed are sequentially received and buffered

have been described in the above-described embodiments, the present invention is not limited thereto. What matters is that it is arranged that upon end of decoding an immediately preceding part, buffering is completed so that decoding can
5 be started. As long as it is so arranged, even when a first part and subsequent second and third parts may be received concurrently, advantages similar to those of the above-described embodiments can be obtained.

10 As described above, according to the present invention, single stream content is divided into a plurality of parts in a time-series manner, and a first part is transmitted via the stream distribution, and remaining parts are transmitted via the buffering distribution such that decoding of a
15 receiver's side can be started upon completion of decoding an immediately preceding part, whereby the stream content is distributed with a high reliability and latency can be reduced remarkably as compared to that in the conventional art.

20 Industrial Applicability

The present invention relates to a content providing apparatus and a content providing method, and can be applied, for example, to distribution of music and videos via the Internet.

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Claims

1. A content providing apparatus for transmitting predetermined stream content to a client, characterized in that:

5 among a plurality of parts formed by time-series division of single stream content,

a first part is transmitted via stream distribution; and

10 remaining parts are transmitted via buffering distribution such that decoding of a receiver's side can be started upon end of decoding an immediately preceding part.

2. The content providing apparatus as claimed in claim 1, wherein said stream distribution is a distribution via unicast.

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3. The content providing apparatus as claimed in claim 1, wherein said buffering distribution is a distribution via multicast.

20 4. A content providing apparatus for receiving stream content transmitted by a predetermined server to provide a user with the received stream content, characterized in that:

said stream content is divided into a plurality of parts in a time-series manner to be transmitted by said server; and

25 said content providing apparatus receives a first one of said parts via stream reception to be provided to the user, and

buffer-receives a rest of said parts in a manner decodable upon completion of decoding an immediately preceding part.

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5. A content providing method of transmitting

predetermined stream content to a client, characterized by comprising:

among a plurality of parts formed by time-series division of single stream content,

5 transmitting a first part via stream distribution; and
transmitting remaining parts via buffering distribution such that decoding of a receiver's side can be started upon end of decoding an immediately preceding part.

10 6. A content providing method of receiving stream content transmitted by a predetermined server to provide a user with the received stream content, characterized in that:

said stream content is divided into a plurality of parts in a time-series manner to be transmitted by said server; and

15 said content providing method comprises:

receiving a first one of said parts via stream reception to be provided to the user; and

buffer-receiving a rest of said parts in a manner decodable upon completion of decoding an immediately preceding
20 part.