

METHOD AND APPARATUS FOR PLAYBACKING OPTICAL DISC

TECHNICAL BACKGROUND

5 The present invention relates to optical disc playing techniques, in particular to the method and apparatus for playing those optical discs which contents are enhanced by network or in other ways.

 With the development of optical storage techniques, a optical disc not only can store a mass of information, but also can be a path and window to get more information, e.g. optical discs with eDVD (Enhanced Digital Versatile Disc, eDVD) format and Blue-Ray optical disc format, etc. These optical disc formats can break the limit that earlier optical disc formats only support the playing of the contents stored in optical discs, and can further support the contents that are related to the optical discs but are not stored therein (e.g. in networks), i.e. enhanced contents. For example, when a optical disc player is playing a optical disc, besides the contents in the optical disc are played, the information related to the optical disc contents or a certain scenario can be acquired from networks through the network link information provided in the optical disc and be played, furthermore, the contents stored in other local storage mediums (e.g. U disk, hard disk, storage card, etc) which are related to the optical disc contents can also be played based on the link information provided in the optical disc. These optical disc formats with the functionality of enhanced contents can bring users unheardof audiovisual experience.

25 In these optical disc formats with enhanced optical disc contents, the playing engine of a optical disc player is required to not only play the contents stored in the optical disc, but also access and play respectively the contents from other information sources (in particular, networks) related to the optical disc contents. Fig. 1 shows a block diagram of a optical disc playing apparatus 100 in prior art. The playing apparatus 100 can not only

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play the contents stored in optical discs and other local storage mediums, but also access network servers to get the contents related to the optical disc contents for playing.

When the playing apparatus 100 is playing a optical disc, the contents stored in the optical disc can be played directly by the playing engine 110 according to corresponding application programs interfaces (APIs). As for the contents related to the optical disc contents which are stored in network servers or other local storage mediums, the playing engine 110 issues, based on these different contents storage address and storing manners, corresponding instructions and API commands (e.g. with the socket basic commands based on TCP/IP) to access relevant addresses so as to play these contents. A buffering manager 130 can control the buffer 120 to play enhanced contents.

Traditional optical disc playing apparatus and optical disc playing methods need to access and play with different commands and in different ways the contents of various storage mediums. The playing engine 110 has to identify the storage information of these contents, and in the meanwhile it needs to select different methods to handle according to various content formats. It goes further and says that the contents stored in optical discs and the enhanced contents stored in other storage mediums which are related to the optical disc contents can only be processed individually by the optical disc playing apparatus, it is very difficult for them to be used as a whole, which results in particular complexity of designing/manufacturing the playing engine.

If the enhanced contents, in particular the enhanced contents in networks, comprise a new media format or relate to a new network protocol, the playing engine 110 also has to add a new application program interface or upgrade the existing technique version, then the contents of corresponding formats can be played.

Therefore, it needs to provide a optical disc playing method and apparatus to simplify the playing of optical disc contents and enhanced contents.

5 SUMMARY OF THE INVENTION

The object of the invention is to provide a optical disc playing method and apparatus to overcome the disadvantages of techniques in prior art.

The optical disc playing method provided by the present invention comprises the steps of: retrieving the description information of the contents to be played; generating a playing file system based on said description
10 information, the playing file system is generated based on the directory file system in storage mediums of the contents to be played; next, playing the contents to be played according to the playing file system. Of which, said contents to be played comprise the contents stored in optical discs, and
15 optical disc enhanced contents stored in other storage mediums (e.g. networks). Of which, said description information comprises the storage information of said contents to be played. The method further comprises the steps of retrieving the information of the playing software resources that play said contents to be played, and generating said playing file system based on
20 the information of the playing software resources and the description information of the resources to be played. The said contents to be played are accessed and played by a single application program interface according to said playing file system.

The optical disc playing apparatus provided by the present invention
25 comprises: a retrieving device for retrieving the description information of the contents to be played, wherein the description information comprises the storage information of said contents to be played. The optical disc playing apparatus further comprises a generating device for generating a playing file system based on said description information, the playing file system
30 corresponds to the directory file system in storage mediums of said contents

to be played. The optical disc playing apparatus further comprises a playing engine for playing said contents to be played according to said playing file system. The said retrieving device is also used for retrieving the information of the playing software resources required for playing said contents to be played, including storage information, e.g. buffering storage information. The said generating device is also used for generating said playing file system based on said description information and said information of playing software resources. The said playing engine accesses and plays the contents to be played with a single application program interface according to said playing file system.

According to the present optical disc playing method and apparatus, the playing process of the contents to be played performed by the optical disc engine is simplified, the contents in various storage mediums can be accessed and played with a single application program interface. When the contents of a new optical disc format need to be played or other new storage mediums appear, there is no need to upgrade the optical disc playing engine, it only needs to simply extend some functional modules of the playing engine according to the present invention, upgrade of the whole optical disc playing apparatus can be achieved, thus the complexity of designing and implementing the playing engine is simplified significantly.

Other purposes and achievements of the present invention will be apparent by way of the following description and claims, with reference to accompanying drawings, and more thorough understanding of the present invention can be achieved.

DESCRIPTION OF ACCOMPANYING DRAWINGS

The present invention will be illustrated in details with reference to the accompanying drawings.

Fig. 1 is a block diagram of a optical disc playing apparatus 100 in prior art;

Fig. 2 is a block diagram of a optical disc playing apparatus 200 according to an embodiment of the present invention;

Fig. 3 is a flow chart of a optical disc playing method according to an embodiment of the present invention;

5 Fig. 4 is a directory structure configuration diagram of a playing file system according to an embodiment of the present invention.

Fig. 5 is a schematic diagram of links of a playing file system according to an embodiment of the present invention.

10 The same signs represent identical, similar or corresponding features and functions in all the accompanying drawings.

SPECIFIC EMBODIMENTS

15 Fig. 2 is a block diagram of a optical disc playing apparatus 200 according to an embodiment of the present invention. The apparatus 200 comprises a retrieving device 210, a generating device 220, and a playing engine 230.

20 The retrieving device 210 is used for retrieving the description information of the contents to be played. The contents to be played comprise contents to be played stored in optical discs and enhanced contents related to the contents to be played in optical discs. The enhanced contents comprise the contents stored in networks for which link addresses are provided in optical discs, also can comprise contents stored in other local storage mediums (e.g. hard disk, U disk, etc) for which links are provided in optical discs, such as some texts, still pictures, motion pictures, 25 audio and video segments, etc. The description information retrieved by the retrieving device 210 comprises the storage information of the above contents to be played, e.g. the storage address of the contents to be played in optical discs or other local storage mediums, or the buffering storage address of the contents to be played in buffer that are downloaded from 30 networks. As for network enhanced contents, they should be first

downloaded to the buffer of the optical disc playing apparatus to realize seamless playing, the network contents obtain a buffering address in the buffer.

5 If the contents to be played comprise network contents, some application program resources supporting the playing of network contents are required to be downloaded into buffer storage of the optical disc playing apparatus and get corresponding buffering storage addresses to ensure smooth playing of the network contents. In such cases, therefore, the retrieving device 210 is also used for retrieving the information of the playing
10 software resources supporting the playing of the contents to be played, e.g. storage information of the application program, including the storage address in networks or the buffering storage address in the buffer of the optical disc playing apparatus.

The generating device 220 is used for generating a playing file system
15 with the description information of the contents to be played retrieved by the retrieving device 210. Since the directory file system in a storage medium comprise the description information of the contents to be played, the generating device 220 can generate, based on the directory file system in a storage medium of the contents to be played, for example, the directory file
20 system in a optical disc of the optical disc contents, etc. Commonly an initial playing file system is established through a method of mapping or converting based on the directory file system of the contents to be played stored in a optical disc, next the description information of enhanced contents or corresponding directory file system are added to the established
25 playing file system, and thus a unified playing file system of the contents to be played is established in the optical disc playing apparatus, said file system comprises the description information (e.g. storage information, etc) of the contents to be played in various storage mediums.

30 If the contents to be played comprise network link contents, the generating device 220 should also add the playing resources information

(e.g. application programs, etc.) required for playing the corresponding network contents to be played into the playing file system, that is, to map the storage information of application programs to the playing file system so that the relevant directories of the playing file system also comprise the storage/buffering address links of these application programs. By establishing such a playing file system, it allows the contents to be played in optical discs and enhanced contents and the resources required for playing to be accessed and played in a single way.

As for the contents which have to be buffered by the buffer, if said contents are available in the buffer and have buffering storage addresses, the generating device 220 will add this information to the established playing file system. If the contents just have a buffering storage address only when they are downloaded during playing, the generating device 220 will continuously update the established playing file system during playing a optical disc. Therefore, the apparatus 200 can also comprise a buffer (not shown in figures) for buffering the contents that need to be buffered and corresponding playing application programs.

The playing engine 230 is used for playing the contents to be played of a optical disc according to the playing file system discussed above, and it does not need to access the directory file system in the optical disc. The playing engine 230 can, only with a single application program interface program, access and play smoothly the playing contents of a optical disc and the enhanced contents of the optical disc based on the information provided by said playing file system .

Fig. 3 is a flow chart of the optical disc playing method according to an embodiment of the present invention. After a optical disc is inserted into a playing apparatus, the optical disc playing apparatus firstly reads the directory file stored in the optical disc, the directory file comprises some description information of the contents to be played, and the information of corresponding playing software resources such as storage information, etc

(step S305). The purpose of step S305 is to retrieve the description information of the contents to be played, since the directory file system in a storage medium of the contents to be played comprises the description information of the contents to be played, the present embodiment can expediently get the description information of the contents to be played according to the directory file system in a storage medium of the contents to be played. Of course, other traditional methods for retrieving the description information of the contents to be played are also feasible.

Next, an initial playing file system is generated based on the directory file system of playing contents of the inserted optical disc (step S310). Based on the directory file of the optical disc, an initial playing file system is generated by mapping. For the detailed description of the process of generating the playing file system, refer to the following explanation in Fig. 4.

The initial playing file system comprises a directory file system generated by mapping, which has a directory file structure corresponding to the contents to be played stored in the optical disc. For example, the directory file system of a optical disc comprises a “video transfer sub-directory (VIDEO_TS)” and an “enhanced contents sub-directory of the optical disc (DVD_ENAV)”, correspondingly the playing file system also comprises these two sub-directories. The link information of the enhanced contents to be played, which are the storage path pointing to the enhanced contents to be played, are also included in the sub-directories of the initial playing file system. If playing the enhanced contents to be played needs the support of application programs stored in the optical disc, the storage information of these application programs will also be mapped into relevant directories of the playing file system.

Next, the description information of enhanced contents in other local storage mediums are retrieved and added to the playing file system (step S320). Since some description information such as caption, subject, some

key words, etc, of the contents stored in the optical disc has been defined and stored in the optical disc during manufacturing the optical disc, the corresponding contents to be played can be found easily in other local storage mediums based on only these information. The description information (e.g. storage address) of enhanced contents in other local storage mediums are mapped into the established playing file system, so that the playing file system comprises the link information pointing to the enhanced playing contents in other local storage mediums (e.g. storage addresses in other local storage mediums).

Afterward, the playing file system is updated based on the description information of enhanced contents in networks (step S330). Normally, the enhanced contents in networks and corresponding playing resources (e.g. playing application programs for audio and video and other application programs required for network playing) should be downloaded in advance into buffer storage of the optical disc playing apparatus and then is played to ensure seamless playing, for a certain scenario, for example, the optical disc provides the network server addresses through which some network enhanced contents can be gotten in the form of URL link (e.g., www.dvd_2.com.cn/video.exe); the network enhanced contents and corresponding playing resources can be accessed and downloaded for buffering according to said URL link information, thus the network enhanced contents and playing resources have, in addition to the network storage address information, corresponding buffering storage addresses after being downloaded.

Updating the playing file system based on the description information of the downloaded network enhanced contents and playing resources is to add these corresponding information, including buffering storage information, to the established playing file system according to the directory structure. The playing file system comprises the link information pointing to the buffering address in buffering storage device of the downloaded contents,

e.g. file://buffer:/Offset=offset&Length=length, wherein *buffer* indicates that the contents are present in the buffering storage device, the start address is *offset*, and the length is *length*. Similarly, the playing file system may also comprise the description information pointing directly to the application program resources in buffering storage device. Step S330 can also be executed during playing.

Last, the optical disc is played according to the established playing file system (step S340). According to the playing file system, the contents to be played are played with a single application program interface. By accessing a link address in the playing file system `dvd://dvdrom:/VIDEO_TS/VIDEO_TS.IFO`, for example, the playing apparatus can get the path of file `VIDEO_TS.IFO` (stored in directory `VIDEO_TS` of optical disc DVD), the player can access and play the file according to this path. Establishment of the playing file system separates the playing engine from specific storage mediums, the playing engine does not need to solely employ different access ways for playing contents in various storage mediums, the operation of the playing system is simplified.

It needs to be explained that the network enhanced contents stored in network servers can not only be downloaded before playing, but also be downloaded into buffer or other local storage mediums during playing. After the downloading is completed, the player maps buffer addresses of these downloaded network playing contents into the playing file system so that the player can access these enhanced contents with buffer addresses links provided in the playing file system.

After the optical disc playing is completed, the player can discard the playing file system. Since the playing file system is generated dynamically while a optical disc is being inserted, the player can discard the playing file system automatically upon the completion of the playing. Considering that the same optical disc may be played again and again, however, the playing file system can be stored in other local storage mediums during playing or

upon the completion of the playing, and thus it will not need to establish a playing file system while playing the same optical disc next time, the optical disc can be played by just invoking the existing playing file system.

Fig. 4 is a directory structure configuration diagram of the playing file system according to an embodiment of present invention. The player establishes an initial playing file system based on the directory file system of contents in the optical disc. It is assumed that the directory structure of playing contents in a optical disc comprises a root directory, under which there are two sub-directories "optical disc enhanced contents sub-directory" and "video transfer sub-directory", the "optical disc enhanced contents sub-directory" further has second level sub-directories, namely a "font sub-directory" and a "page number sub-directory", all the files are stored in respective directories. For example, there are startup files in "optical disc enhanced contents sub-directory" of the optical disc, and video transfer files in "video transfer sub-directory".

Since the directory structure of the playing file system corresponds to that of the optical disc, mapping the whole directory structure of a optical disc into a playing file system can make the directory structure of the playing system identical to that of the optical disc. From Fig. 4 it can be seen that the directory structure of the playing file system also comprises a root directory, under which there are a "optical disc enhanced contents sub-directory" and a "video transfer sub-directory", under the "optical disc enhanced contents sub-directory" there are also a "font sub-directory" and a "page number sub-directory". The description information of the optical disc is stored in these relevant sub-directories, for example, the description information of the startup file, i.e. the storage information of this startup file, is stored in "optical disc enhanced contents sub-directory" of the playing file system.

The playing file system comprises, besides the directories corresponding to the directory structure of the optical disc, the directories

corresponding to the directory structure of other local storage mediums. When the relevant contents of the optical disc are searched in other local storage mediums by the player, it needs to map the directory structures of other local storage mediums into the playing file system. It can be seen from Fig. 4 that the directories that are not in the directory structure of initial playing file system, e.g. "audio sub-directory", need to be added to the directory structure of the playing file system, the description information of audio files is stored in the "audio sub-directory". For existing directories such as "optical disc enhanced contents sub-directory", "font sub-directory" and "page number sub-directory", it only needs to map paths of the files (e.g. Chinese font file, index file, segment file, page number file, etc.) under these directories in other local storage mediums into relevant directories of the playing file system. The storage paths of these files are stored in relevant sub-directories of the playing file system. If there is a same file in the same sub-directory, for example, there exists already the description information of the "Chinese font file" under the "font sub-directory", the original information should be replaced with the description information of new file "Chinese font file" in other local storage mediums. Thus, the directory system files of the playing file system have been established completely.

Fig. 5 is a schematic diagram of links of a playing file system according to an embodiment of present invention, it further explains the link forms stored in the playing file system which can be played by links. The playing file system can be linked based on URI configuration, for example, a "file://" URI configuration indicates that this content is some files can be extracted from local storage space; a "http://" URI indicates that this content is located in a network server, and thus these contents can be extracted with a HTTP protocol; a "dvd://" indicates that this content is located in a optical disc, thus the optical disc specific application program interfaces can be used to extract these contents. For device identifiers (e.g. buffer:/buffer, hd:/hard disk, flash:/flash memory) of a "file://" URI, it can be identified

physically that which kind of storage medium the playing contents are stored in.

As shown in Fig. 5, it does not need to first download the contents from a optical disc into buffer, it just needs to map them under a “video transfer sub-directory” and a “optical disc enhanced contents sub-directory” based on URI configuration (specifying the representation method of information location). For example, the description information of the video transfer file is stored in the form of “dvd://dvdrom:/VIDEO_TS/VIDEO_TS.IFO”, indicating that the video file of the optical disc is stored under the video transfer sub-directory of optical disc *dvdrom* and the file name is VIDEO_TS.IFO. Another example, the description information of the startup file is stored in the “compact enhanced contents sub-directory” in a form of “dvd://dvdrom:/VIDEO_TS/STARTUP.MLS”, indicating that the startup file is stored under the video transfer sub-directory of optical disc *dvdrom* and the file name is STARTUP.MLS.

Although it is not necessary to download the playing contents of a optical disc, the playing contents in some optical discs can be downloaded in advance into the buffer, this part of contents may be some pictures, texts or segments of audio and video, etc, this is to avoid frequent jumps of the player when it is playing these contents. This part of downloaded contents need to be mapped under the “optical disc enhanced contents sub-directory”, it may be represented in the following form: file://buffer:/Offset=offset&Length=length, indicating that this file is stored in the buffer, the buffering start address is *offset*, the length is *length*.

The playing contents from other local storage mediums do not need to be downloaded, the description information of the playing contents can be mapped directly under the “optical disc enhanced contents sub-directory” according to the file form of URI configuration. There is a picture file related to the optical disc contents stored in other local storage mediums, for

example, this picture exists in a form of file://hd:/disc_a/file.jpg in the playing file system. This indicates that this picture is stored under directory *disc_a* of the hard disk, the file name is “file.jpg”.

For the contents from a network server, the playing contents or application program resources need to be firstly downloaded into the buffer, the description information of downloaded contents can be mapped under the “optical disc enhanced contents sub-directory” according to the file form of URI configuration, for example, the description information of a downloaded text file is stored in the form of file://buffer:/Offset=0x3000&Length=0x1200. This indicates that this text file is stored in the buffer, the start address is 0x3000, and the length is 0x1200. Another example, the description information of a downloaded Chinese font file is under the “font sub-directory” and is stored in the form of file://buffer:/Offset=0x0000&Length=0x1000. This indicates that this Chinese font file is stored in the buffer, the start address is 0x0000, and the length is 0x1000. The Chinese font file can also be represented not in the file form of URI configuration, it can directly point to buffering address and content length of the downloaded contents in the buffer in the form of pointers.

The present invention maps integrally the contents in and outside a optical disc into a playing file system in the form of links, the playing engine can operate on the playing file system and does not need to manage various content sources directly. In this way, it is not necessary to do much change on structure of the playing engine, and complexity of designing and manufacturing the playing engine is reduced significantly. More important, when new protocols and media formats are introduced, it is not necessary to change the optical disc playing engine, it will be enough to just upgrade and extend corresponding software resources of the retrieving device and generating device to handle the new protocols and media, which improves generality and expansibility of the whole playing apparatus.

The apparatus and method set forth by the present embodiment are suitable for various optical disc formats, such as eDVD format and Blue-ray optical disc format, etc.

Although the present invention has been described with particular
5 embodiments, various alternatives, modifications and changes made according to the above description will be apparent to those skilled in the art. Therefore, such alternatives, modifications and changes falling within the concept and scope of appended claims should be comprised in the present invention.

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What is claimed is:

1. A method for playing an optical disc, comprising the steps:

- 5 (a) obtaining the description information of the content to be played;
(b) creating a playing file system according to said description information; and
(c) accessing and playing said content to be played with a single interface of application program according to said playing file system.

10 2. The method of claim 1, wherein said content to be played comprises:
the content to be played in a network in the manner of the linkage provided by said optical disc.

3. The method of claim 1, further comprising the step: buffer-storing said content to be played.

15 4. The method of claim 1 or 3, wherein said description information of the content to be played comprises the storage information of said content to be played.

5. The method of claim 4, wherein said description information of the content to be played comprises the buffer-storage addresses of said content to be played.

20 6. The method of claim 1, wherein step (a) comprises the step of obtaining said description information according to the directory file system of said content to be played in the storage medium.

25 7. The method of claim 1, wherein step (a) further comprises the step of obtaining the information of the resource of the playing software for playing said content to be played, step (b) further comprises the step of creating said playing file system according to said description information and said information of the resource of the playing software.

30 8. The method of claim 7, wherein said information of the resource of the playing software comprises the storage information of the resource of the playing software.

9. The method of claim 1, wherein said playing file system is created according to the directory file system of said content to be played in the storage medium.

10. An apparatus for playing an optical disc, comprising:

5 obtaining means for obtaining the description information of the content to be played;
 creating means for creating a playing file system according to said description information; and
 a playing engine for accessing and playing said content to be played
10 with a single interface of application program according to said playing file system.

11. The apparatus of claim 10, further comprising: a buffer-storage device for buffer-storing said content to be played.

12. The apparatus of claim 10, wherein said content to be played
15 comprises the content to be played stored in a network.

13. The apparatus of claim 11, wherein said description information comprises the storage information of the content to be played.

14. The apparatus of claim 13, wherein said storage information comprises the buffer-storage information.

20 15. The apparatus of claim 10, wherein said obtaining means is also used to obtain the information of the resource of the playing software for playing said content to be played, and said creating means creates said playing file system according to the obtained information of the resource of the playing software and said description information of the content to be played.

25 16. The apparatus of claim 15, wherein the information of the resource of the playing software comprises the buffer-storage information of the playing resource.