



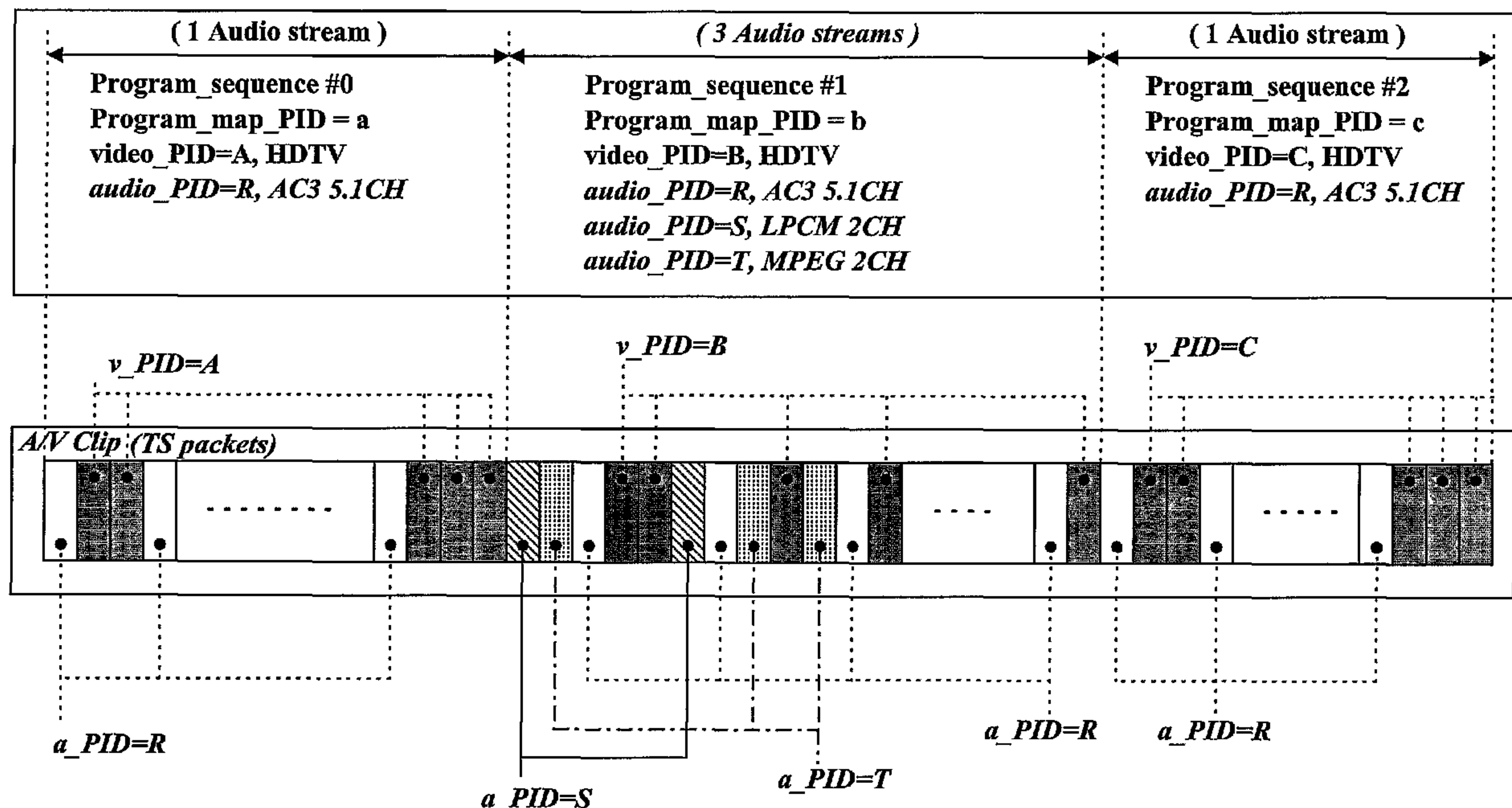
(86) Date de dépôt PCT/PCT Filing Date: 2003/10/11
(87) Date publication PCT/PCT Publication Date: 2004/04/29
(45) Date de délivrance/Issue Date: 2010/09/14
(85) Entrée phase nationale/National Entry: 2004/06/02
(86) N° demande PCT/PCT Application No.: KR 2003/002097
(87) N° publication PCT/PCT Publication No.: 2004/036577
(30) Priorité/Priority: 2002/10/14 (KR10-2002-0062523)

(51) Cl.Int./Int.Cl. *G11B 20/12* (2006.01),
H04N 5/781 (2006.01)
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(54) Titre : SUPPORT D'ENREGISTREMENT PRESENTANT UNE STRUCTURE DE DONNEES POUR GERER LA REPRODUCTION DE FLUX AUDIO MULTIPLES ENREGISTRES SUR CELUI-CI ET PROCEDES ET APPAREILS D'ENREGISTREMENT ET DE REPRODUCTION
(54) Title: RECORDING MEDIUM HAVING DATA STRUCTURE FOR MANAGING REPRODUCTION OF MULTIPLE AUDIO STREAMS RECORDED THEREON AND RECORDING AND REPRODUCING METHODS AND APPARATUSES

BD-ROM

ClipInfo



(57) Abrégé/Abstract:

The recording medium includes a data area storing at least multiple audio streams in at least one portion thereof. The multiple audio streams are multiplexed, and each audio stream is a transport stream stored as one or more packets. Each packet has a packet identifier, and the packets of the same audio stream have the same packet identifier.



(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



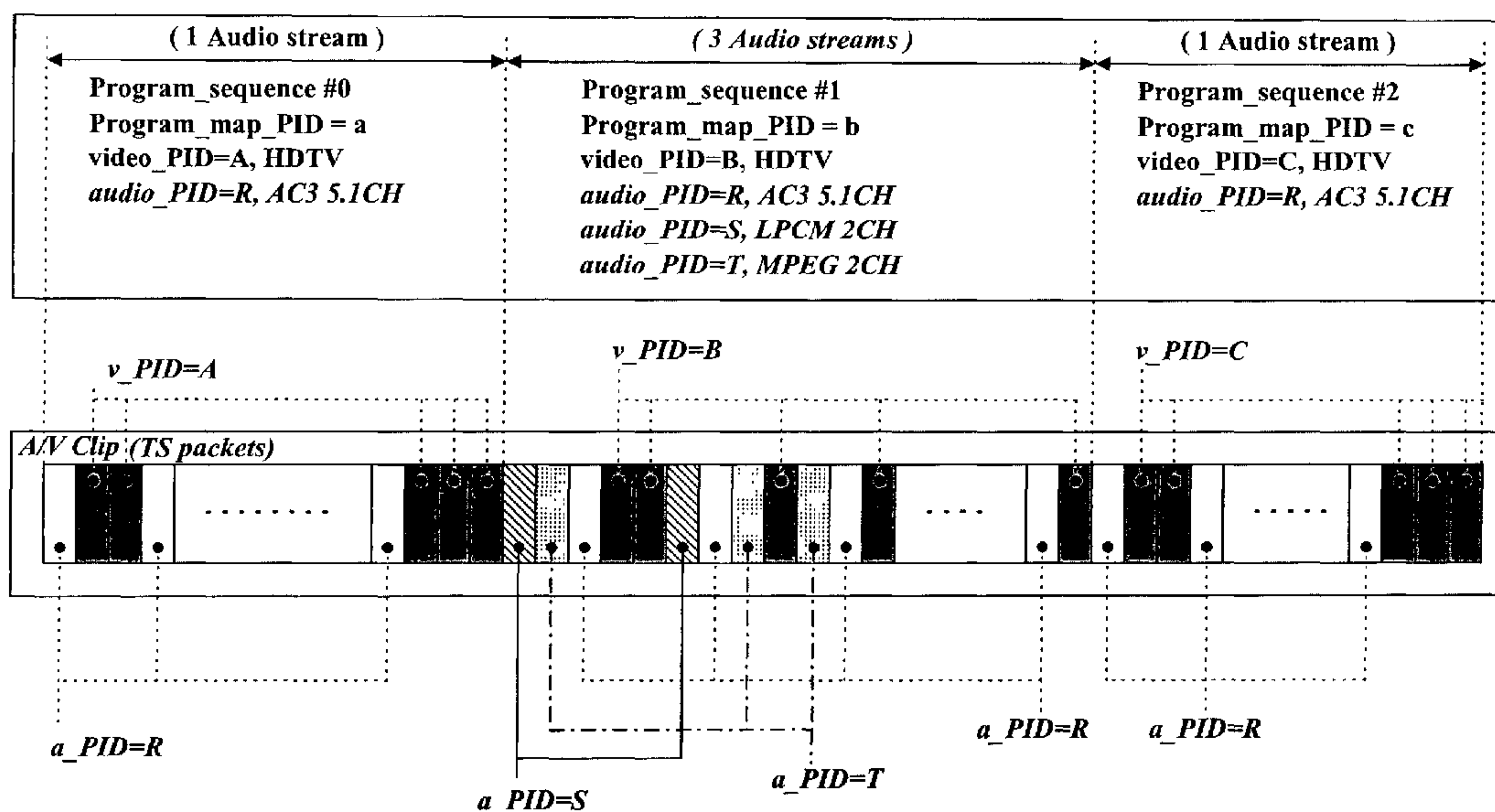
(43) International Publication Date
29 April 2004 (29.04.2004)

PCT

(10) International Publication Number
WO 2004/036577 A1

- (51) International Patent Classification⁷: **G11B 20/12** (74) Agent: **PARK, Lae Bong**; 1Fl., Dongun Bldg., 413-4, Dogok 2-dong, Kangnam-gu, Seoul 135-272 (KR).
- (21) International Application Number: PCT/KR2003/002097 (81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW.
- (22) International Filing Date: 11 October 2003 (11.10.2003)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
10-2002-0062523 14 October 2002 (14.10.2002) KR
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- (84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- Published:**
— with international search report
- 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.

(54) Title: RECORDING MEDIUM HAVING DATA STRUCTURE FOR MANAGING REPRODUCTION OF MULTIPLE AUDIO STREAMS RECORDED THEREON AND RECORDING AND REPRODUCING METHODS AND APPARATUSES

BD-ROM**ClipInfo**

(57) Abstract: The recording medium includes a data area storing at least multiple audio streams in at least one portion thereof. The multiple audio streams are multiplexed, and each audio stream is a transport stream stored as one or more packets. Each packet has a packet identifier, and the packets of the same audio stream have the same packet identifier.

WO 2004/036577 A1

DESCRIPTION

RECORDING MEDIUM HAVING DATA STRUCTURE FOR MANAGING REPRODUCTION OF MULTIPLE AUDIO STREAMS RECORDED THEREON AND RECORDING AND REPRODUCING METHODS AND APPARATUSES

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1. TECHNICAL FIELD

The present invention relates to a recording medium having a data structure for managing reproduction of at least multiple audio streams recorded thereon as well as methods and apparatuses
10 for reproduction and recording.

2. BACKGROUND ART

An optical disc such as a DVD (Digital Versatile Disc), capable of recording high quality video and audio data for many hours, is being developed and released to consumer markets. Various
15 types of DVD exist including DVD-ROM and DVD-RW (DVD-Rewritable).

Video and audio streams in a DVD-ROM are recorded in units of a program stream packet defined by the MPEG standard. As shown in FIG. 1, one pack corresponds to a single physical sector with the record size of 2048 bytes.

20 A single pack is composed of a pack header and includes packets of video, audio, and sub-pictures. The pack header includes pack start code (Pack_start_code), SCR, program mux rate (program_mux_rate), and stuffing length (Stuffing_length).

In a DVD-ROM where a single physical sector corresponds to
25 a single pack in the above-described manner, multiple audio streams may be recorded in a number of respective coding formats in a data area of the DVD-ROM.

For example, as shown in FIG. 2, an audio pack where audio data are recorded according to LPCM (Linear Pulse Code Modulation)

format comprises a pack header (Pack_header) of 14 bytes, a packet header (Packet_header) of more than one byte, sub-stream ID (sub_stream_id) of one byte, audio frame information (Audio_frame_information), audio data information (Audio_data_information), and PCM audio data ranging from one byte to 2013 bytes.

As shown in FIG. 3, in case of an audio pack where audio data are recorded according to Dolby AC-3 format, the audio pack comprises a pack header (Pack_header) of 14 bytes, a packet header (Packet_header) of more than one byte, audio frame information (Audio_frame_information), sub-stream ID (sub_stream_id) of one byte, audio frame information (Audio_frame_information), and Dolby AC-3 audio data ranging from one byte to 2016 bytes.

As described above, an audio pack which includes audio data recorded according to a particular coding format is recorded with a characteristic sub-stream ID (sub_stream_ID) so as to determine the coding format. At the same time, attribute information corresponding to the sub-stream ID is recorded and managed in the DVD-ROM as navigation information.

For example, as shown in FIG. 4, among navigation information recorded and managed in the DVD-ROM, VTS_AST_ATR (Video Title Set Audio Stream Attribute) information is included and recorded in a VTSI (Video Title Set Information) area. The VTS_AST_ATR includes eight VTS_AST_ATRs, namely, VTS_AST_ATRs of audio streams #0 ~ #7, corresponding to the respective sub-stream IDs.

The attribute information, as shown in FIG. 5, includes audio coding mode information, and the audio coding mode information includes information to identify the coding format of the audio data recorded in the corresponding audio pack.

For example, when the audio coding information corresponds to '000b', it indicates that the corresponding audio data have been encoded according to Dolby AC-3 format. Audio coding information of '010b' denotes encoding according to the MPEG-1 or MPEG-2 format

without an extension bitstream, while '011b' denotes that the corresponding audio data have been encoded according to the MPEG-1 or MPEG-2 format with an extension bitstream. In addition, audio coding mode information of '100b' indicates that the corresponding audio data have been encoded according to LPCM format. An optical disc apparatus such as a DVD-player, when reading out audio data recorded in the DVD-ROM, refers to a characteristic sub-stream ID included in an audio pack and on this basis selects the audio stream requested for playback by the user.

Subsequently, the optical disc apparatus checks the audio
10 coding mode information corresponding to the sub-stream ID of the selected audio stream and decodes the selected audio stream according to the coding format designated by the audio coding mode information. Therefore, the optical disc apparatus can normally perform selective play of an arbitrary audio stream requested by the user.

Recently, standardization of high-density optical discs such as a read-only Blu-ray disc (BD-ROM), which has a higher recording capacity than a DVD, is underway. However, an appropriate method for managing multiple audio streams for the high-density optical
20 disc has not been established.

3. DISCLOSURE OF INVENTION

The recording medium according to the present invention includes a data structure for managing reproduction of at least multiple audio streams recorded on the recording medium.

In one exemplary embodiment, there is provided a recording medium having a data structure for managing reproduction of multiple audio streams, comprising:

a data area for storing the multiple audio streams, the multiple audio streams being multiplexed, each audio stream being a transport stream and
30 stored as one or more packets, each packet having a packet identifier, and the packets of a same audio stream having a same packet identifier; and

a management area for storing management information for managing reproduction of the multiple audio streams, wherein the management information includes the packet identifier for each of the multiple audio streams.

According to another exemplary embodiment of the present invention, there is provided a method of reproducing a data structure for managing reproduction of multiple audio streams from a recording medium, comprising:

10 reproducing the multiple audio streams from a data area of the recording medium in which the multiple audio streams are multiplexed, each audio stream being a transport stream and stored as one or more packets, each packet having a packet identifier, and the packets of a same audio stream having a same packet identifier; and

reproducing management information for managing reproduction of the multiple audio streams from a management area of the recording medium, wherein the management information includes the packet identifier for each of the multiple audio streams.

According to another exemplary embodiment of the present invention, there is provided an apparatus for reproducing a data structure for managing reproduction of multiple audio streams from a recording medium, comprising:

20 a reproducing device configured to reproduce data recorded on the recording medium;

a controller, operably coupled to the reproducing device, configured to control the reproducing device to reproduce the multiple audio streams from a data area of the recording medium in which the multiple audio streams are multiplexed, each audio stream being a transport stream and stored as one or more packets, each packet having a packet identifier, and the packets of a same audio stream having a same packet identifier,

wherein the controller is further configured to control the reproducing device to reproduce management information for managing reproduction of the multiple audio streams from a management area of the recording medium, and

30

the management information includes the packet identifier for each of the multiple audio streams.

In accordance with another aspect of the invention, there is provided a method of recording a data structure for managing reproduction of multiple audio streams on a recording medium, comprising:

recording the multiple audio streams in a data area of the recording medium such that the multiple audio streams are multiplexed, each audio stream being a transport stream and recorded as one or more packets, each packet having a packet identifier, and the packets of a same audio stream
10 having a same packet identifier; and

recording management information for managing reproduction of the multiple audio streams in a management area of the recording medium,

wherein the management information includes the packet identifier for each of the multiple audio streams.

Yet another aspect of the invention provides an apparatus for recording a data structure for managing reproduction of multiple audio streams on a recording medium, comprising:

a recording device configured to record data on the recording medium;
an encoder configured to encode the multiple audio streams; and
20 a controller, operably coupled to the recording device, configured to control the recording device to record at least multiple audio streams in a data area of the recording medium such that the multiple audio streams are multiplexed, each audio stream being a transport stream and recorded as one or more packets, each packet having a packet identifier, and the packets of a same audio stream having a same packet identifier,

wherein the controller is further configured to control the recording device to record management information for managing reproduction of the multiple audio streams in a management area of the recording medium such that the management information includes the packet identifier for each of the multiple
30 audio stream.

4. BRIEF DESCRIPTION OF DRAWINGS

The above features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

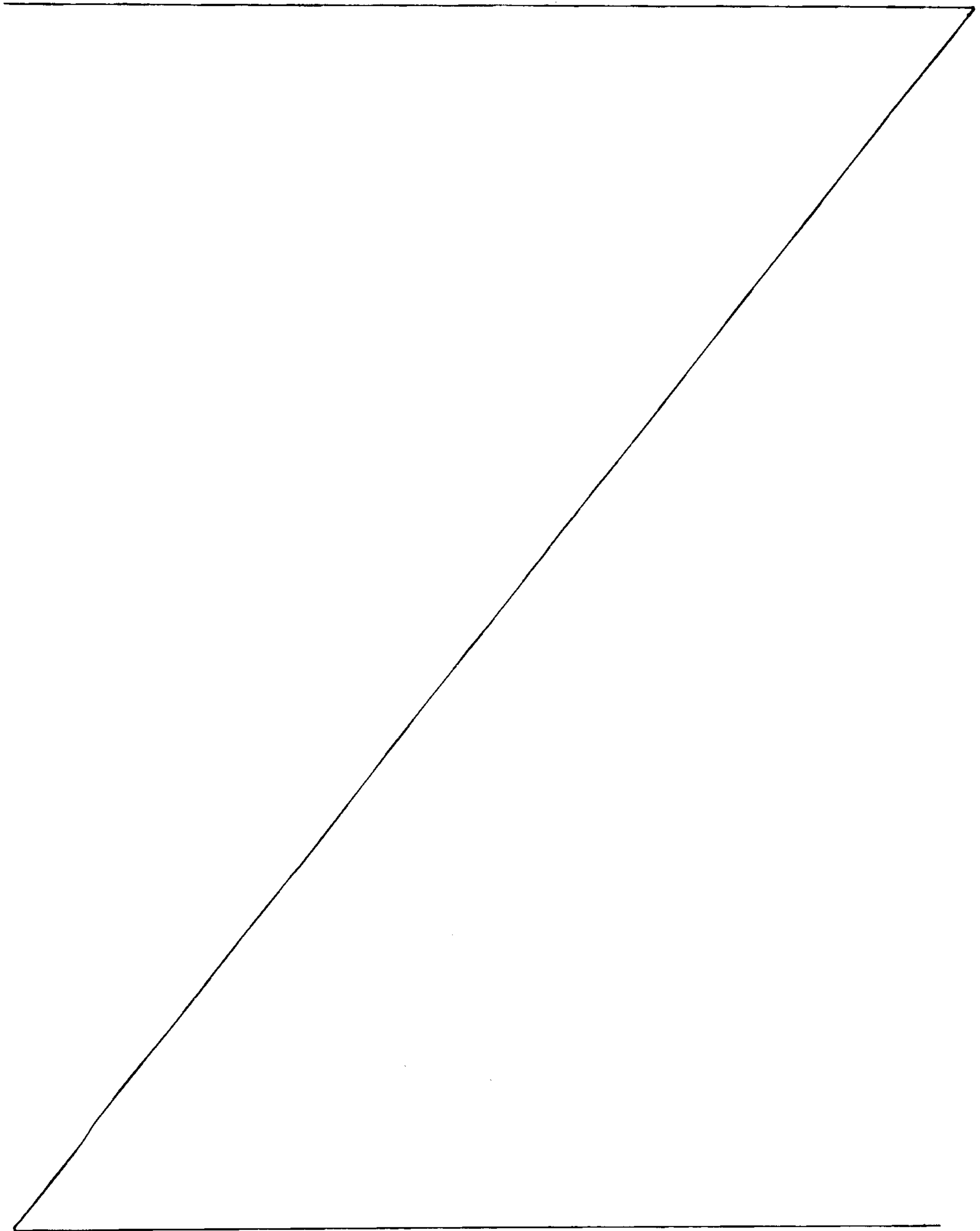


FIG. 1 is a diagram illustrating the data pack structure of DVD-ROM;

FIG. 2 is a diagram illustrating the LPCM audio pack of DVD-ROM;

5 FIG. 3 is a diagram illustrating the Dolby AC-3 audio pack of DVD-ROM;

FIG. 4 is a diagram illustrating the structure of VTSI (Video Title Set Information) of DVD-ROM;

FIG. 5 is a diagram illustrating the structure of VTS_AST_ATR
10 (Video Title Set Audio Stream Attribute) information of DVD-ROM;

Fig. 6 illustrates an exemplary embodiment of a recording medium file or data structure according to the present invention;

Fig. 7 illustrates an example of a recording medium having the data structure of Fig. 6 stored thereon;

15 Fig. 8 illustrates portions of the structure of a program information field recorded on an optical disc according to an embodiment of the present invention;

Figs. 9 and 10 each graphically illustrates a program information field of a clip information file and an associated A/V
20 clip recorded in a BD-ROM according to an embodiment of the present invention; and

FIG. 11 is a diagram illustrating the structure of an optical disc apparatus where the present invention is applied.

5. MODES FOR CARRYING OUT THE INVENTION

25 A high-density optical disk, for example, a Blu-Ray ROM (BD-ROM), BD-RE, etc. in accordance with the invention may have a file or data structure for managing reproduction of video and audio data as shown in Fig. 6.

As shown in Fig. 6, the root directory contains at least one
30 BD directory. The BD directory includes general files (not shown), a PLAYLIST directory in which playlist files (e.g., *.mpls) are stored, a CLIPINF directory in which clip information files

(*clpi) are stored, and a STREAM directory in which MPEG2-formatted A/V stream clip files (*.m2ts), corresponding to the clip information files, are stored.

The STREAM directory includes MPEG2-formatted A/V stream files called clips or clip files. The A/V stream includes source packets of video and audio data. For example, a source packet of video data includes a header and a transport packet. A source packet includes a source packet number, which is generally a sequentially assigned number that serves as an address for accessing the source packet. Transport packets include a packet identifier (PID).

The CLIPINF directory includes a clip information file associated with each A/V stream file. The clip information file indicates, among other things, the type of A/V stream associated therewith, sequence information, program information and timing information. The sequence information describes the arrival time basis (ATC) and system time basis (STC) sequences. For example, the sequence information indicates, among other things, the number of sequences, the beginning and ending time information for each sequence, the address of the first source packet in each sequence and the PID of the transport packets in each sequence. A sequence of source packets in which the contents of a program is constant is called a program sequence. The program information indicates, among other things, the number of program sequences, the starting address for each program sequence, and the PID(s) of transport packets in a program sequence.

The timing information is referred to as characteristic point information (CPI). One form of CPI is the entry point (EP) map. The EP map maps a presentation time stamp (e.g., on an arrival time basis (ATC) and/or a system time basis (STC)) to a source packet address (i.e., source packet number). The presentation time stamp (PTS) and the source packet number (SPN) are related to an entry point in the A/V stream; namely, the PTS and its related SPN point to an entry point on the A/V stream. The packet pointed to is often

referred to as the entry point packet.

The PLAYLIST directory includes one or more playlist files. The concept of a playlist has been introduced to promote ease of editing/assembling clips for playback. A playlist file is a
5 collection of playing intervals in the clips. Each playing interval is referred to as a playitem. The playlist file, among other things, identifies each playitem forming the playlist, and each playitem, among other things, is a pair of IN-point and OUT-point that point to positions on a time axis of the clip (e.g., presentation time
10 stamps on an ATC or STC basis). Expressed another way, the playlist file identifies playitems, each playitem points to a clip or portion thereof and identifies the clip information file associated with the clip. The clip information file is used, among other things, to map the playitems to the clip of source packets.

15 The general information files (not shown) provide general information for managing the reproduction of the A/V streams recorded on the optical disk.

In addition to illustrating the data structure of the recording medium according to an embodiment of the present
20 invention, Fig. 6 represents the areas of the recording medium. For example, the general information files are recorded in one or more general information areas, the playlist directory is recorded in one or more playlist directory areas, each playlist in a playlist directory is recorded in one or more playlist areas of the recording
25 medium, etc. Fig. 7 illustrates an example of a recording medium having the data structure of Fig. 6 stored thereon. As shown, the recording medium includes a file system information area, a data base area and an A/V stream area. The data base area includes a general information file and playlist information area and a clip
30 information area. The general information file and playlist information area have the general information files recorded in a general information file area thereof, and the PLAYLIST directory and playlist files recorded in a playlist information area thereof.

The clip information area has the CLIPINFO directory and associated clip information files recorded therein. The A/V stream area has the A/V streams for the various titles recorded therein.

Video and audio data are typically organized as individual
5 titles; for example, different movies represented by the video and audio data are organized as different titles. Furthermore, a title may be organized into individual chapters in much the same way a book is often organized into chapters.

Because of the large storage capacity of the newer,
10 high-density recording media such as BD-ROM and BD-RE optical disks, different titles, various versions of a title or portions of a title may be recorded, and therefore, reproduced from the recording media. For example, video data representing different camera angles may be recorded on the recording medium. As another example, versions
15 of title or portions thereof associated with different languages may be recorded on the recording medium. As a still further example, a director's version and a theatrical version of a title may be recorded on the recording medium. Or, an adult version, young adult version and young child version (i.e., different parental control
20 versions) of a title or portions of a title may be recorded on the recording medium. Each version, camera angle, etc. represents a different reproduction path, and the video data in these instances is referred to as multiple reproduction path video data. Similarly, the different audio data available (e.g., different languages,
25 director's commentary, audio coding formats, etc.) provide different audio streams for reproduction.

The data structure for managing reproduction of multiple audio streams for a high-density optical disk in accordance with embodiments of the present invention will be described along with
30 methods and apparatuses according to embodiments of the present invention for recording and reproducing multiple audio streams.

As discussed above, the CLIPINF directory includes a clip information file associated with each A/V stream file, and a clip

information file includes a program information field. Fig. 8 illustrates portions of the structure of a program information field recorded on an optical disc according to an embodiment of the present invention. As shown, a length field indicates a length of the program information field, and a reserved_for_word_align field is reserved for future use. Next, a number of program sequences is indicated by the number_of_program_sequences field. For each program sequence i , the program information field provides at least the fields of: SPN_program_sequence_start[i],
10 program_map_PID[i], audio_PID[i][stream_index] and audioCodingInfo(i ,stream_index). The SPN_program_sequence_start[i] field indicates a source packet number of a source packet where the i th program sequence starts in the A/V stream file. The program_map_PID[i] field indicates the
15 value of the PID of the transport packets that shall contain the program map section applicable for the i th program sequence. The audio_PID[i][stream_index] field provides the value of the PID for each audio stream in the i th program sequence, and the audioCodingInfo(i ,stream_index) provides the coding information
20 (e.g., AC3 5.1CH, LPCM 2CH, MPEG 2CH) for each audio stream in the i th program sequence. While not shown, the program information field may also provide the PID of the video streams in each program sequence.

The audio_PID field may be used in several different ways.
25 For example, in one embodiment detailed in Fig. 9 described below, each audio stream coded in a different manner may be assigned a different audio_PID. However, the present invention is not limited to using the audio_PID field in this manner. As a further example, described in detail below with respect to Fig. 10, the audio_PID
30 field may designate different language audio streams. As a further example, the audio_PID field could be used to differentiate an audio stream of director's commentary from one of the other above-described exemplary uses of the audio_PID field.

As shown in Figs. 9 and 10, unlike the DVD-ROM standard described above, the multiple audio streams of a high-density optical disc according the present invention are divided into transport stream packets compliant with the MPEG standard, and may
5 be recorded with video stream transport packets or recorded independently. Fig. 9 graphically illustrates a program information field of a clip information file and an associated A/V clip recorded in a BD-ROM according to an embodiment of the present invention. As shown, the program information field includes three
10 program sequences #0, #1 and #2. The first program sequence #1 indicates the program_map_PID is 'a', the video_PID is A, HDTV and the audio_PID is 'R'. As discussed above, in this embodiment, each audio_PID indicates a particular coding format of the audio stream. Here, the audio stream having an audio_PID of 'R' indicates the
15 audio stream is coded according to the AC3 5.1CH format. This coding information is also supplied via the audioCodingInfo field.

The second program sequence #1 indicates the program_map_PID is 'b', the video_PID is B, HDTV and that there are three audio_PIDs. This indicates that the second program sequence #1 includes three
20 audio streams. The three audio_PID values of the three audio streams are indicated as 'R', 'S' and 'T', which respectively indicate the coding formats of AC3 5.1CH, LPCM 2CH and MPEG 2CH. This coding information is also supplied via the audioCodingInfo field.

25 The third program sequence #2 indicates the program_map_PID is 'c', the video_PID is C, HDTV and provides a single audio_PID of 'R'. This indicates that the third program sequence #2 includes a single audio stream. The coding information indicated by the audio_PID value is also supplied via the audioCodingInfo field.

30 As shown in Fig. 9 by the portion of the A/V clip file associated with the second program sequence #1, when a program sequence includes multiple audio streams, the transport packets of the multiple audio streams are multiplexed together in the A/V

clip file. As further shown by this portion of the A/V clip file, the audio transport packets may also be multiplexed with the video transport packets.

As discussed above, the audio_PID of the transport packets
5 in each audio stream of a program sequence are not limited to indicating the coding format of the audio stream, particularly, since this information is provided in the audioCodingInfo field. Instead, for example, as illustrated in Fig. 10, each audio_PID may correspond to a different language. Here, an audio stream of
10 a particular language has its transport packets assigned the audio_PID value associated with that language. In the example of Fig 10, the audio_PID values of 'R', 'S', and 'T' correspond to the languages English, Korean and Japanese, respectively. In addition, the audio_PID values may convey the coding format as
15 well as the language type. And, as will be appreciated, the present invention is not limited to the audio_PID value associated with an audio stream indicating language and/or format. For example, a particular audio_PID value may indicate that the associated audio stream is director's commentary for a movie represented by
20 an associated video stream, etc.

Fig. 11 illustrates a schematic diagram of an embodiment of an optical disk recording and reproducing apparatus according to the present invention. As shown, an AV encoder 9 receives and encodes data (e.g., movie video and audio data, only audio data,
25 and/or still image data). The AV encoder 9 outputs the encoded data along with coding information and stream attribute information. A multiplexer 8 multiplexes the encoded data based on the coding information and stream attribute information to create, for example, an MPEG-2 transport stream. A source packetizer 7
30 packetizes the transport packets from the multiplexer 8 into source packets in accordance with the audio/video format of the optical disk. As shown in Fig. 11, the operations of the AV encoder 9, the multiplexer 8 and the source packetizer 7 are controlled by a

controller 10. The controller 10 receives user input on the recording operation, and provides control information to AV encoder 9, multiplexer 8 and the source packetizer 7. For example, the controller 10 instructs the AV encoder 9 on the type of encoding to perform, instructs the multiplexer 8 on the transport stream to create, and instructs the source packetizer 7 on the source packet format. The controller 10 further controls a drive 3 to record the output from the source packetizer 7 on the optical disk.

The controller 10 also creates the navigation and management information for managing reproduction of the data being recorded on the optical disk. For example, based on information received via the user interface (e.g., instruction set saved on disk, provided over an intranet or internet by a computer system, etc.) the controller 10 controls the drive 3 to record one or more of the data structures of Figs. 6-10 on the optical disk.

During reproduction, the controller 10 controls the drive 3 to reproduce this data structure. Based on the information contained therein, as well as user input received over the user interface (e.g., control buttons on the recording and reproducing apparatus or a remote associated with the apparatus), the controller 10 controls the drive 3 to reproduce the data from the optical disk.

The reproduced source packets are received by a source depacketizer 4 and converted into a data stream (e.g., an MPEG-2 transport packet stream). A demultiplexer 5 demultiplexes the data stream into encoded data. An AV decoder 6 decodes the encoded data to produce the original data that was feed to the AV encoder 9. During reproduction, the controller 10 controls the operation of the source depacketizer 4, demultiplexer 5 and AV decoder 6. The controller 10 receives user input on the reproducing operation, and provides control information to AV decoder 6, demultiplexer 5 and the source packetizer 4. For example, the controller 10 instructs the AV decoder 9 on the type of decoding to perform,

instructs the demultiplexer 5 on the transport stream to demultiplex, and instructs the source depacketizer 4 on the source packet format. When multiple audio streams are recorded in a data area of the BD-ROM, the controller 10 checks the characteristic 5 audio packet ID (audio_PID) recorded in each audio packet.

Next, audio packets having audio packet IDs corresponding to the audio stream selected by a user via the user interface (e.g., a particular coding system, a particular language, etc.) are routed to the AV decoder 6 by the demultiplexer 5 under the control of 10 the controller 10.

The controller 10 also searches for and checks the corresponding audio coding information (audioCodingInfo) in the program information field and instructs the decoder 6 to perform decoding operations according to the coding format designated by 15 the audio coding information.

While Fig. 11 has been described as a recording and reproducing apparatus, it will be understood that only a recording or only a reproducing apparatus may be provided using those portions of Fig. 11 providing the recording or reproducing 20 function.

As will be appreciated from the forgoing disclosure, the present invention provides a recording medium having a data structure for managing multiple audio streams recorded on a high-density recording medium (e.g., a high-density optical disk 25 such as a BD-ROM).

As apparent from the above description, the present invention provides methods and apparatuses for recording a data structure on a high density recording medium for managing multiple audio streams recorded on the recording medium.

30 The above description further provides methods and apparatus for reproducing multiple audio streams recorded on a high density recording medium based on a data structure, also recorded on the high density recording medium, for managing the reproduction of

the multiple audio streams.

While the invention has been disclosed with respect to a limited number of embodiments, those skilled in the art, having the benefit of this disclosure, will appreciate numerous
5 modifications and variations there from. For example, while described with respect to a Blu-ray ROM optical disk in several instances, the present invention is not limited to this standard of optical disk or to optical disks. It is intended that all such modifications and variations fall within the spirit and scope of
10 the invention.

WHAT IS CLAIMED IS:

1. A recording medium having a data structure for managing reproduction of multiple audio streams, comprising:

a data area for storing the multiple audio streams, the multiple audio streams being multiplexed, each audio stream being a transport stream and stored as one or more packets, each packet having a packet identifier, and the packets of a same audio stream having a same packet identifier; and

10 a management area for storing management information for managing reproduction of the multiple audio streams,

wherein the management information includes the packet identifier for each of the multiple audio streams.

2. The recording medium of claim 1, wherein the multiple audio streams are associated with languages.

3. The recording medium of claim 2, wherein at least two of the multiple audio streams are each associated with a language, and each associated language is different from another associated language.

4. The recording medium of claim 1, wherein the management information includes coding format information for the multiple audio streams.

20 5. A method of reproducing a data structure for managing reproduction of multiple audio streams from a recording medium, comprising:

reproducing the multiple audio streams from a data area of the recording medium in which the multiple audio streams are multiplexed, each audio stream being a transport stream and stored as one or more packets, each packet having a packet identifier, and the packets of a same audio stream having a same packet identifier; and

reproducing management information for managing reproduction of the multiple audio streams from a management area of the recording medium,

wherein the management information includes the packet identifier for each of the multiple audio streams.

6. The method of claim 5, further comprising associating the multiple audio streams with languages.

7. The method of claim 6, further comprising associating at least two of the multiple audio streams with a language, wherein the associated language is different from another associated language.

8. The method of claim 5, further comprising reproducing coding format information for each of the multiple audio streams included in the management information.

9. An apparatus for reproducing a data structure for managing reproduction of multiple audio streams from a recording medium, comprising:

a reproducing device configured to reproduce data recorded on the recording medium;

a controller, operably coupled to the reproducing device, configured to control the reproducing device to reproduce the multiple audio streams from a data area of the recording medium in which the multiple audio streams are multiplexed, each audio stream being a transport stream and stored as one or more packets, each packet having a packet identifier, and the packets of a same audio stream having a same packet identifier,

wherein the controller is further configured to control the reproducing device to reproduce management information for managing reproduction of the multiple audio streams from a management area of the recording medium, and the management information includes the packet identifier for each of the multiple audio streams.

10. The apparatus of claim 9, wherein the controller associates the multiple audio streams with languages.

11. The apparatus of claim 10, wherein the controller associates each at least two of the multiple audio streams with a language, wherein each associated language is different from another associated language.

12. The apparatus of claim 9, wherein the reproducing device reproduces coding format information for each of the multiple audio streams included in the management information.

13. A method of recording a data structure for managing reproduction of multiple audio streams on a recording medium, comprising:

10 recording the multiple audio streams in a data area of the recording medium such that the multiple audio streams are multiplexed, each audio stream being a transport stream and recorded as one or more packets, each packet having a packet identifier, and the packets of a same audio stream having a same packet identifier; and

recording management information for managing reproduction of the multiple audio streams in a management area of the recording medium,

wherein the management information includes the packet identifier for each of the multiple audio streams.

14. The method of claim 13, further comprising associating at least one of the multiple audio streams with a language.

20 15. The method of claim 14, further comprising associating each at least two of the multiple audio streams with a language, wherein the associated language is different from another associated language.

16. The method of claim 13, further comprising recording coding format information for each of the multiple audio streams in the management information.

17. An apparatus for recording a data structure for managing reproduction of multiple audio streams on a recording medium, comprising:

a recording device configured to record data on the recording medium;

an encoder configured to encode the multiple audio streams; and

a controller, operably coupled to the recording device, configured to control the recording device to record at least multiple audio streams in a data area of the recording medium such that the multiple audio streams are multiplexed, each audio stream being a transport stream and recorded as one or more packets, each packet having a packet identifier, and the packets of a same
10 audio stream having a same packet identifier,

wherein the controller is further configured to control the recording device to record management information for managing reproduction of the multiple audio streams in a management area of the recording medium such that the management information includes the packet identifier for each of the multiple audio stream.

18. The apparatus of claim 17, wherein the controller associates the multiple audio streams with languages.

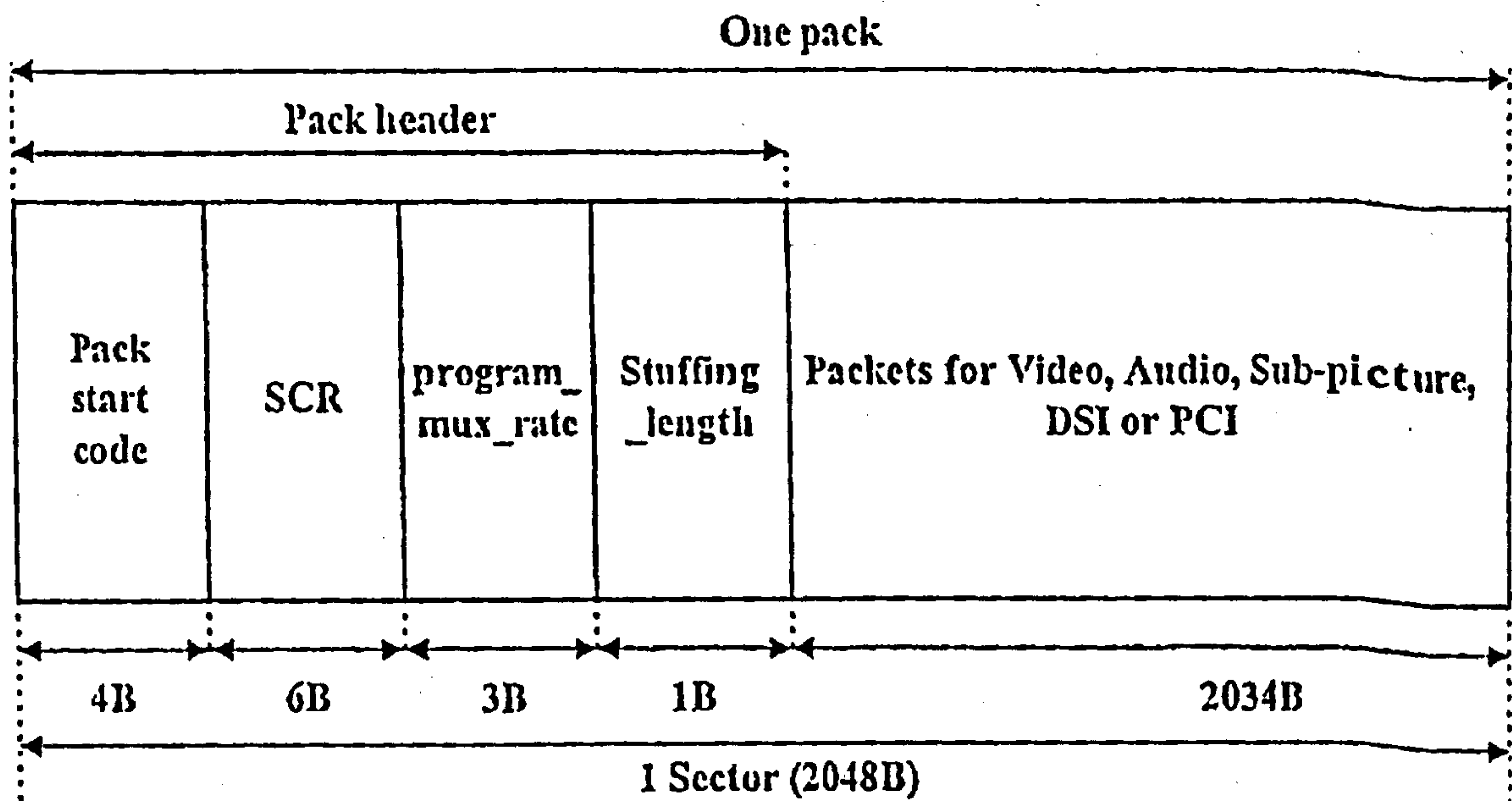
19. The apparatus of claim 18, wherein the controller associates each at least two of the multiple audio streams with a language, and each associated
20 language is different from another associated language.

20. The apparatus of claim 17, wherein the recording device records coding format information for each of the multiple audio streams in the management information.

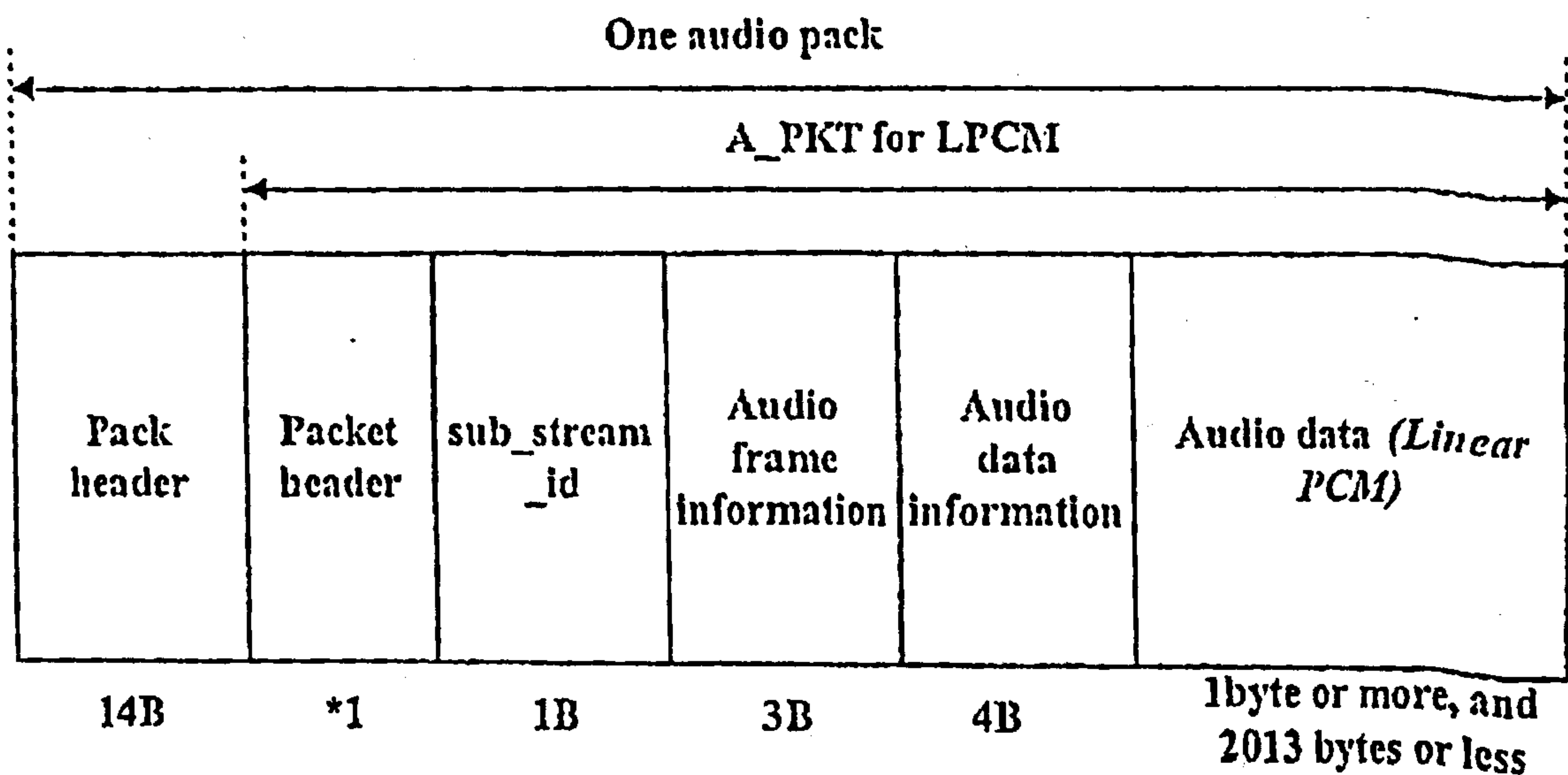
1/9

FIG. 1

(PRIOR ART)

DVD-ROM**FIG. 2**

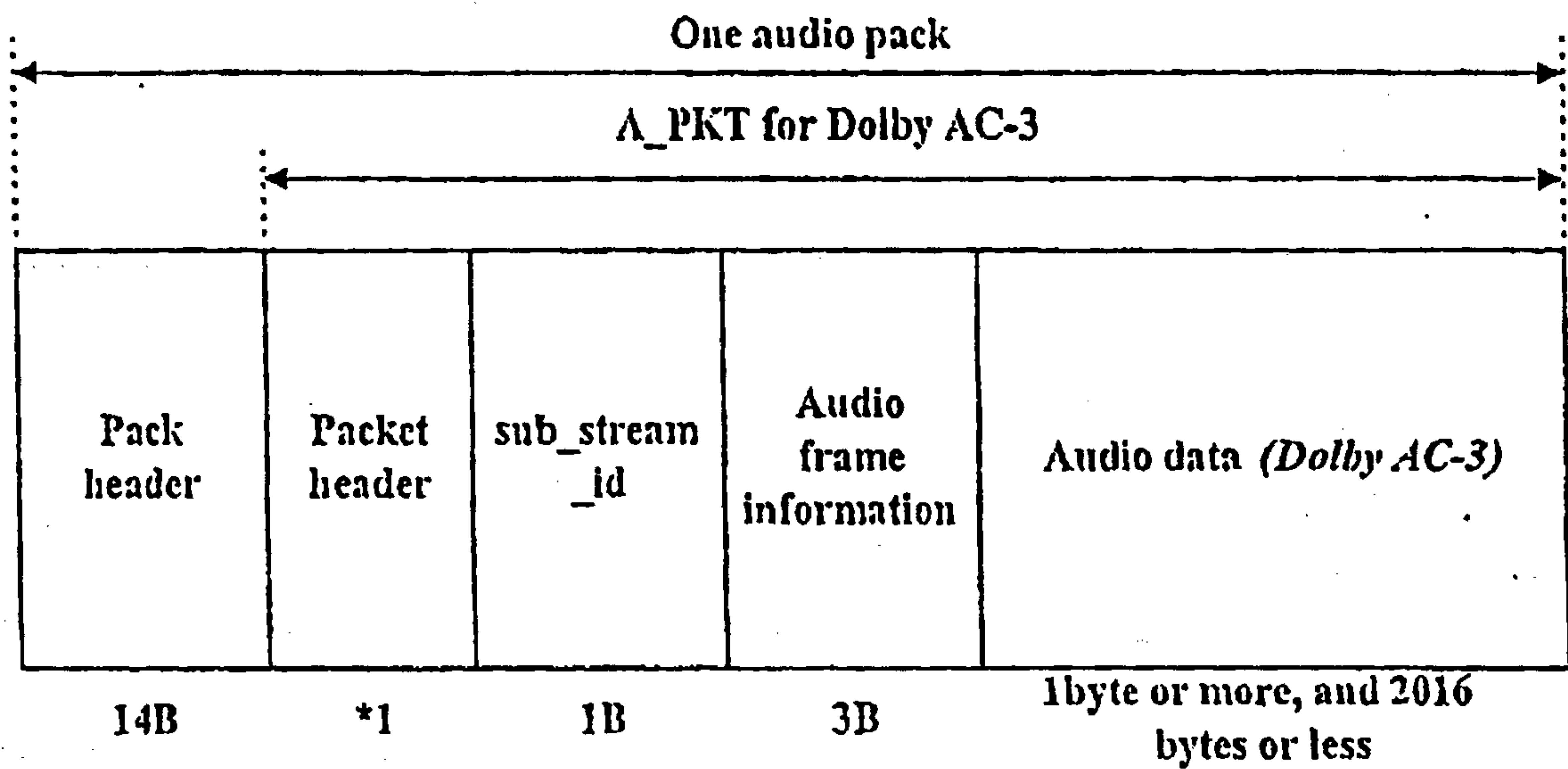
(PRIOR ART)

Structure of Audio pack

2/9

FIG. 3

(PRIOR ART)

Structure of Audio pack**FIG. 4**

(PRIOR ART)

Video Title Set Information (VTSI)

⋮	
VTS AST ATR	VTS_AST_ATR of Audio stream #0
	VTS_AST_ATR of Audio stream #1
	VTS_AST_ATR of Audio stream #2
	VTS_AST_ATR of Audio stream #3
	VTS_AST_ATR of Audio stream #4
	VTS_AST_ATR of Audio stream #5
	VTS_AST_ATR of Audio stream #6
	VTS_AST_ATR of Audio stream #7
⋮	

3/9

FIG. 5

(PRIOR ART)

Video Title Set Audio Stream Attribute (VTS_AST_ATR)

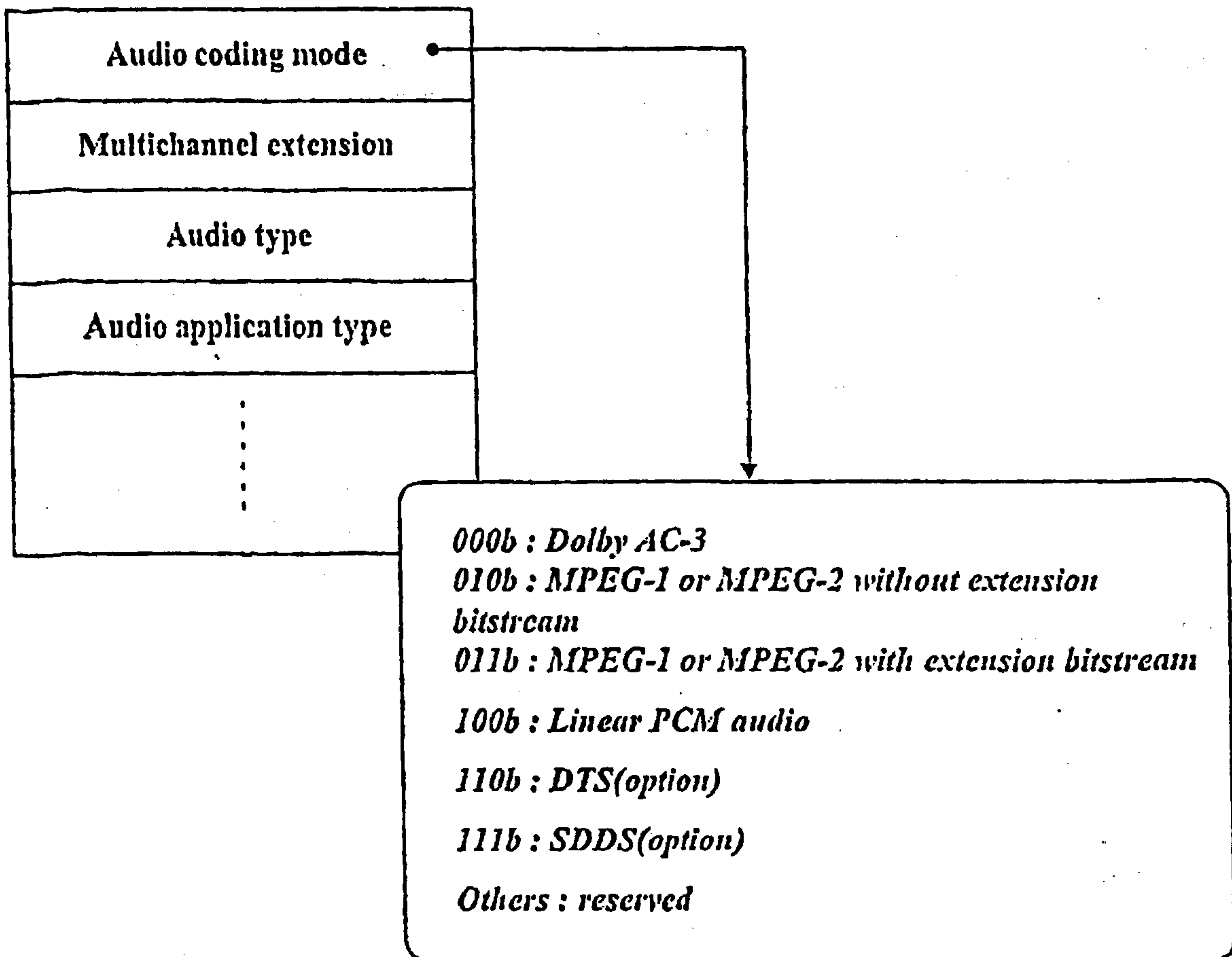


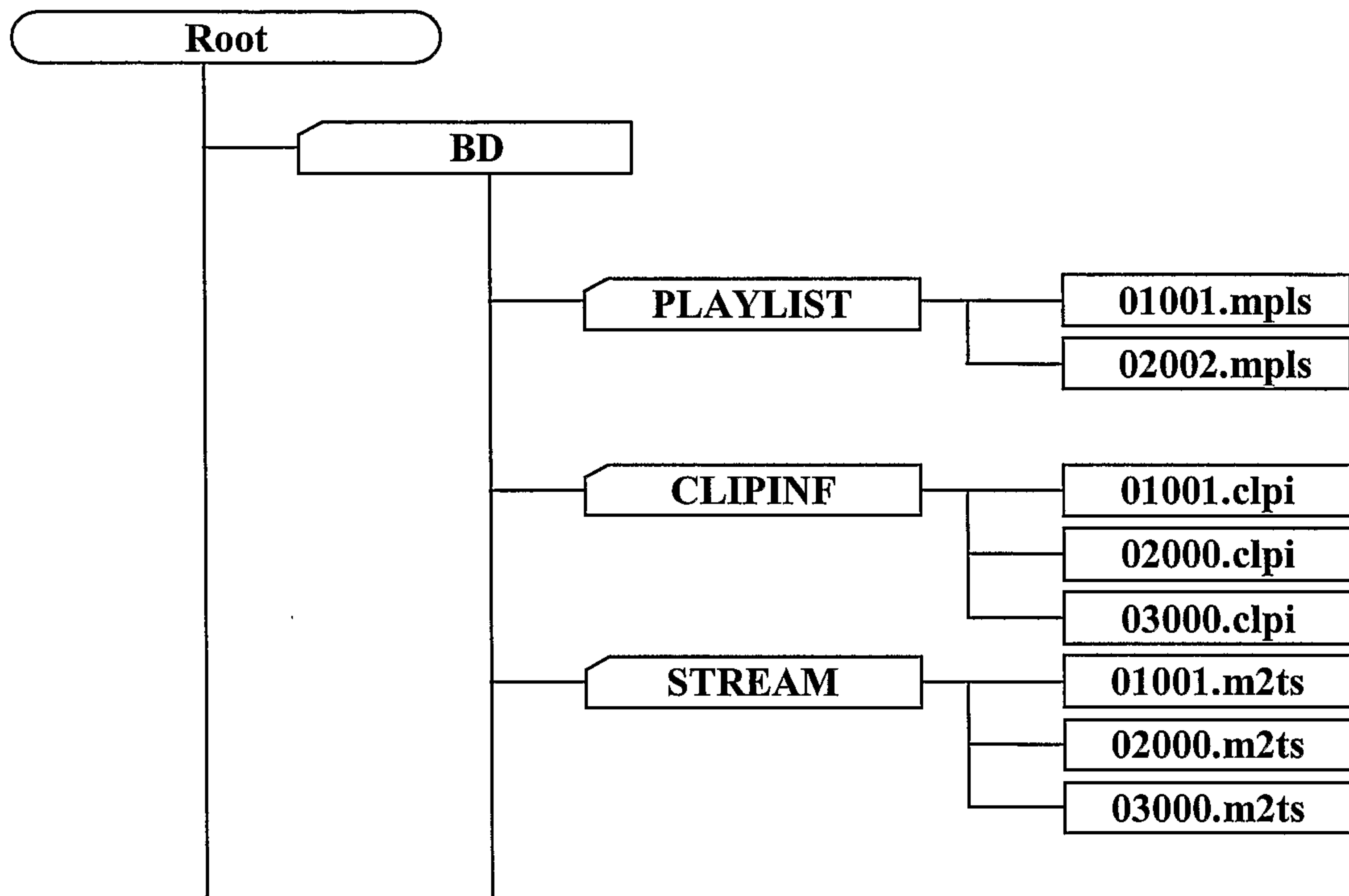
FIG. 6

FIG. 7

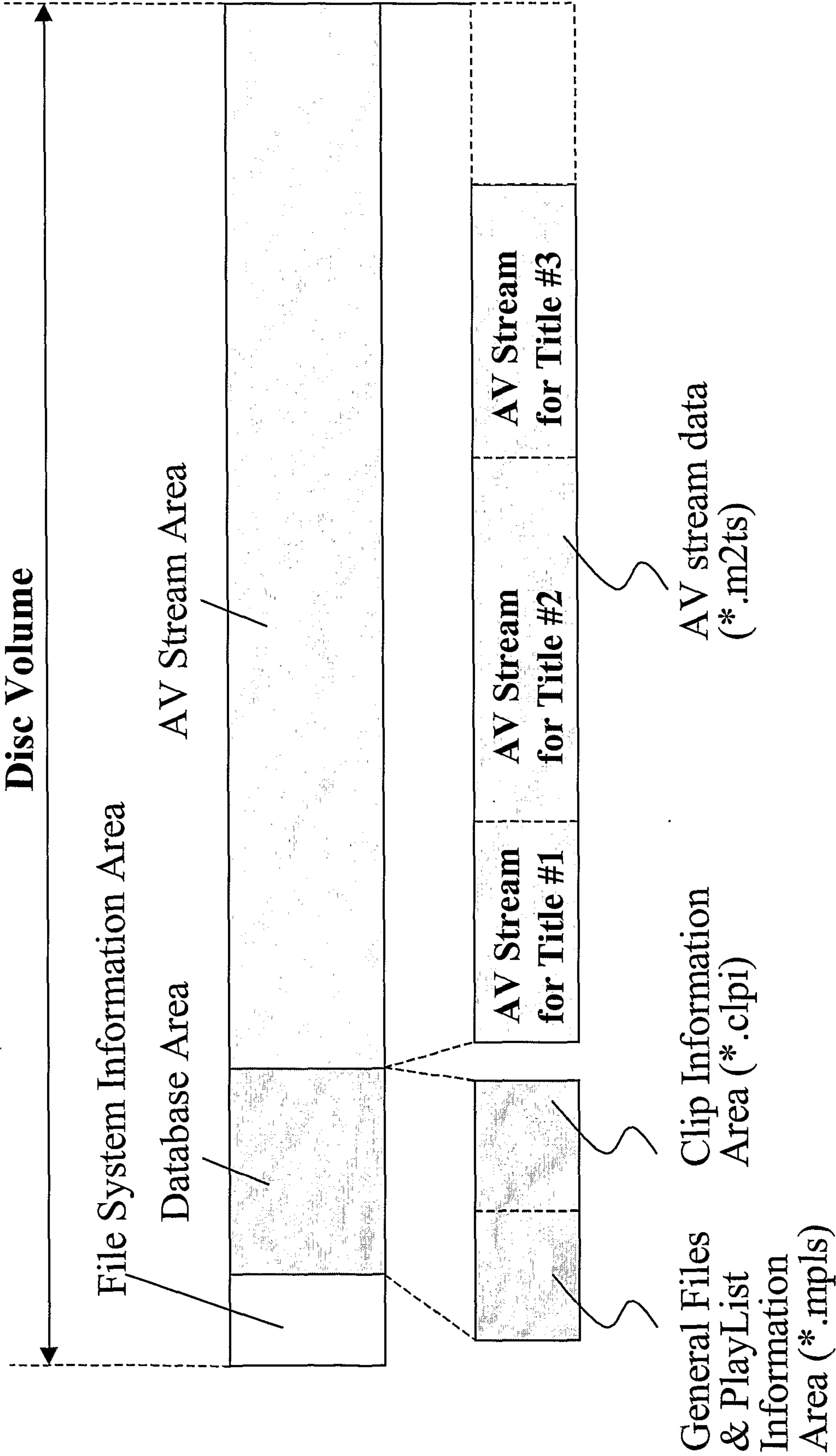


FIG. 8

ProgramInfo-Syntax

```
ProgramInfo(){  
    length  
    reserved_for_word_align  
    number_of_program_sequences  
    for(i=0; i<number_of_program_sequence;i++){  
        SPN_program_sequence_start[i]  
        program_map_PID[i]  
        -----  
        audio_PID[i][stream_index]  
        audioCodingInfo(i, stream_index)  
    }  
    -----
```

FIG. 9

BD-ROM

ClipInfo

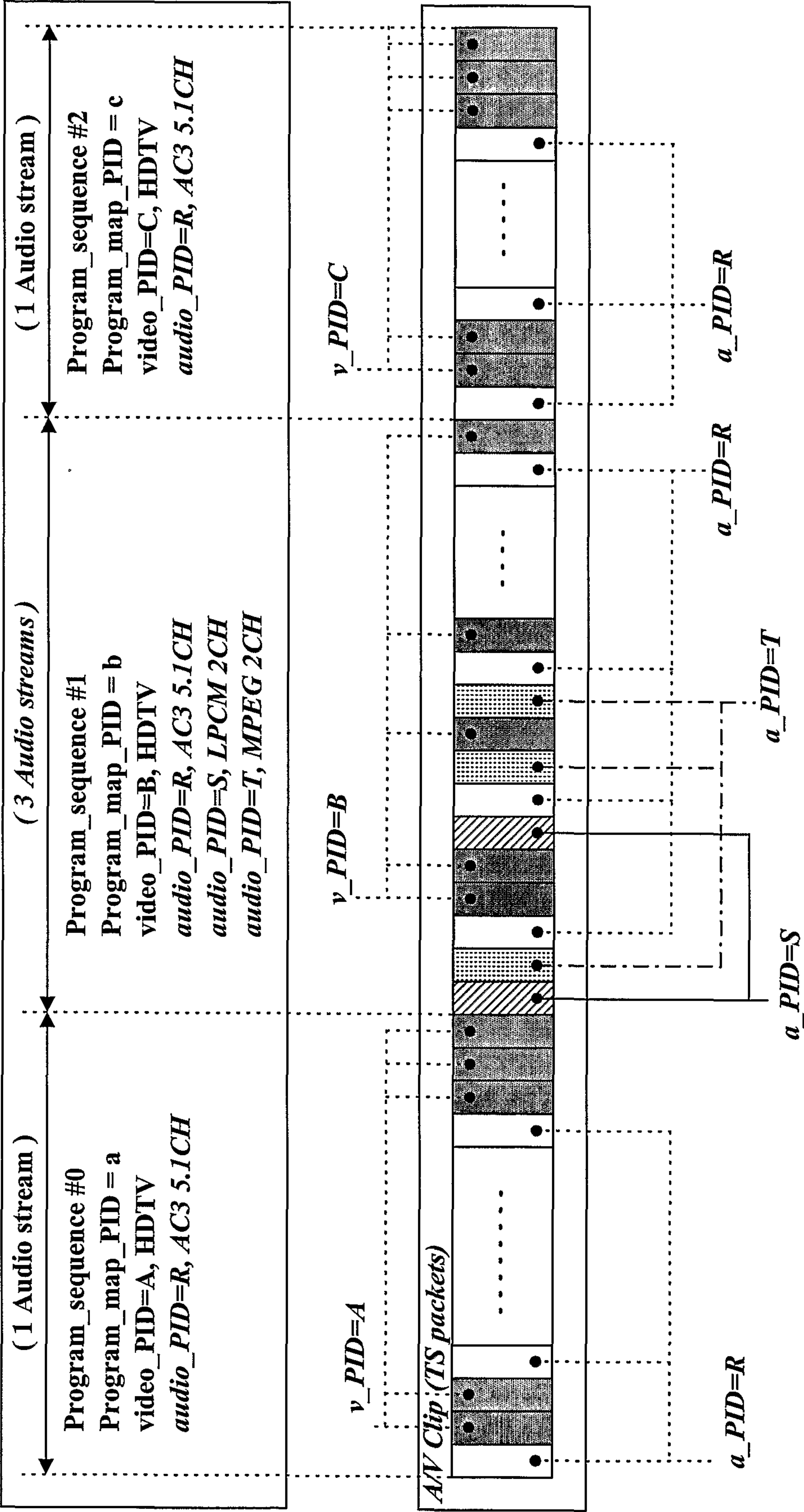


FIG. 10

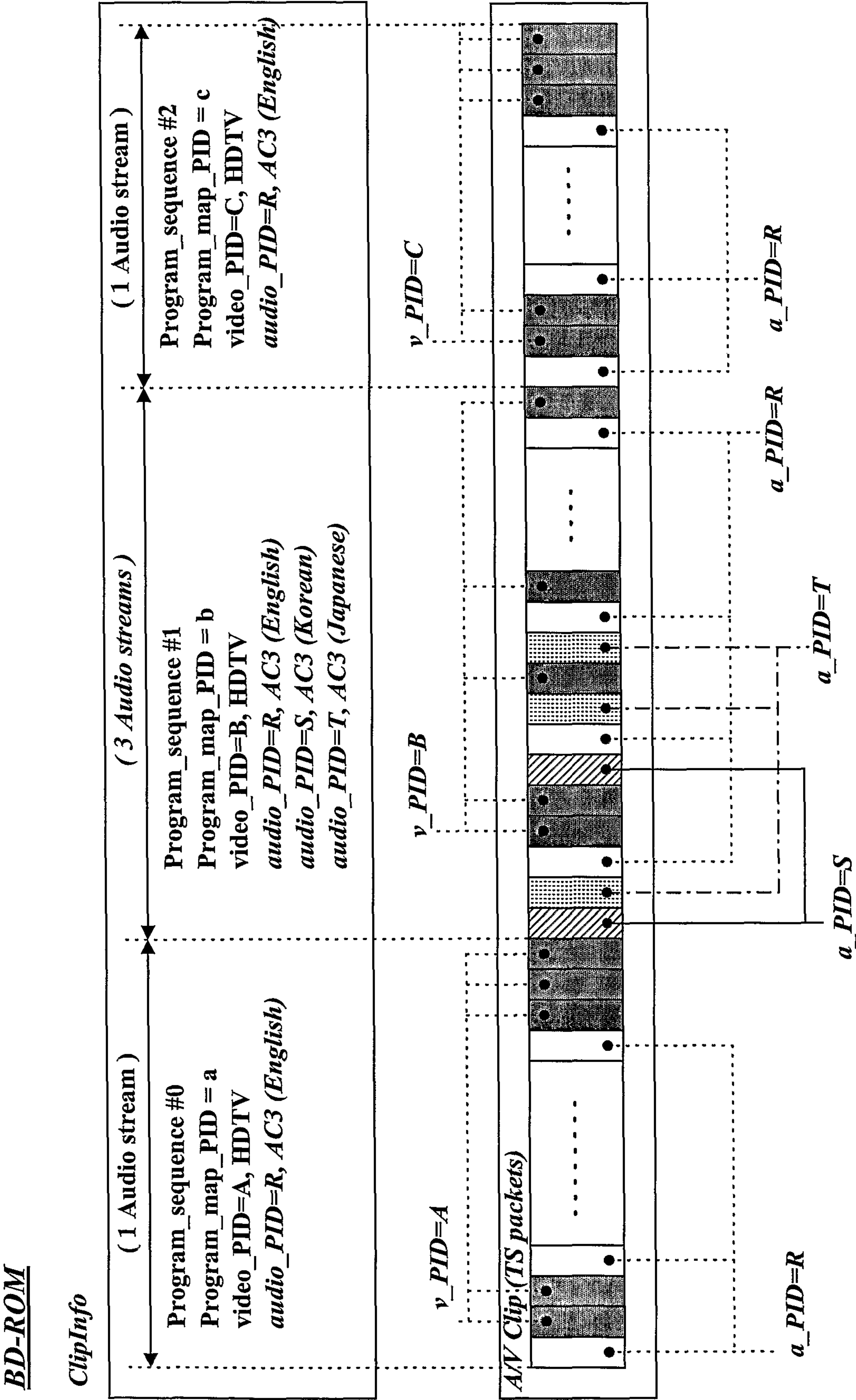
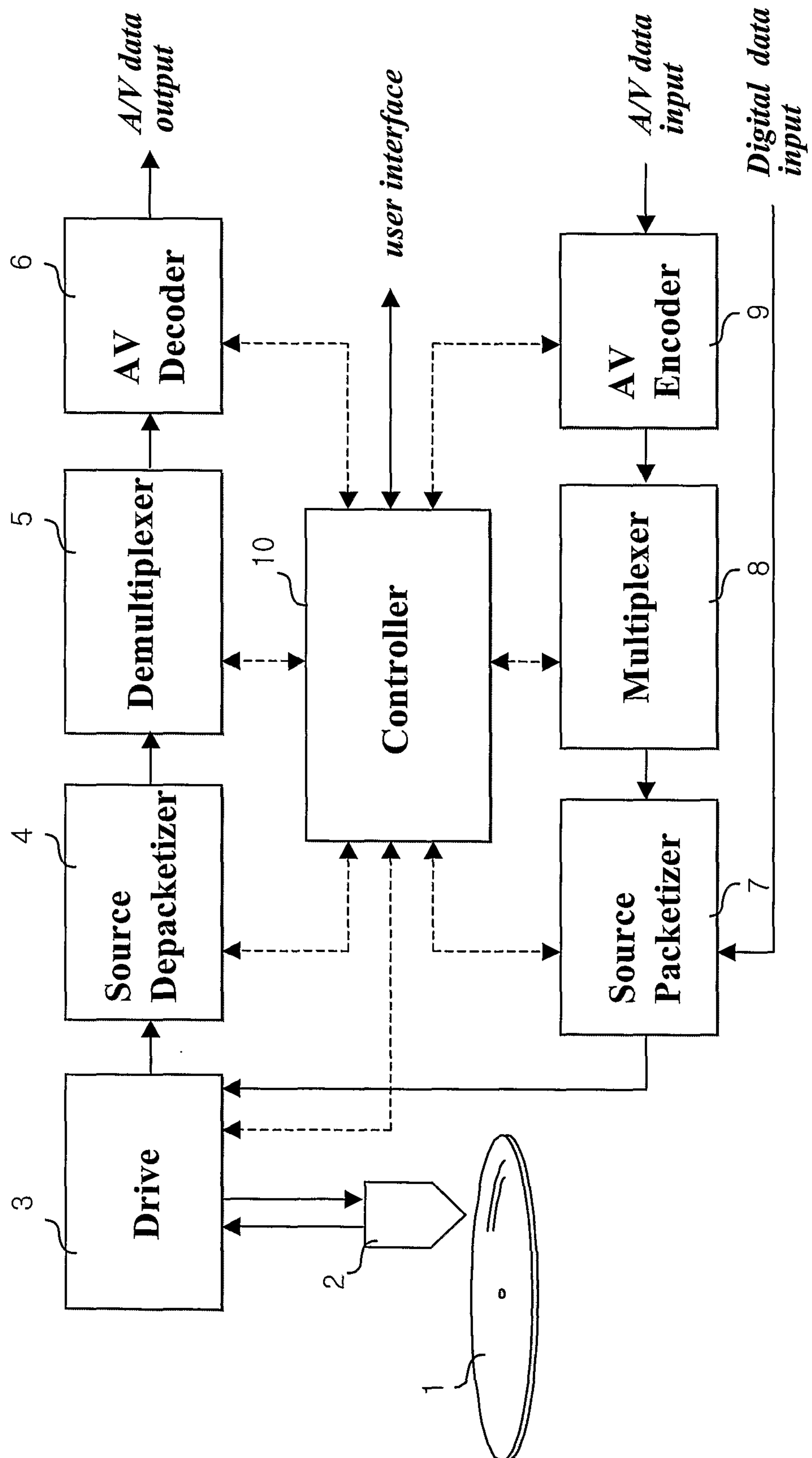


FIG. 11

BD-ROM

ClipInfo

