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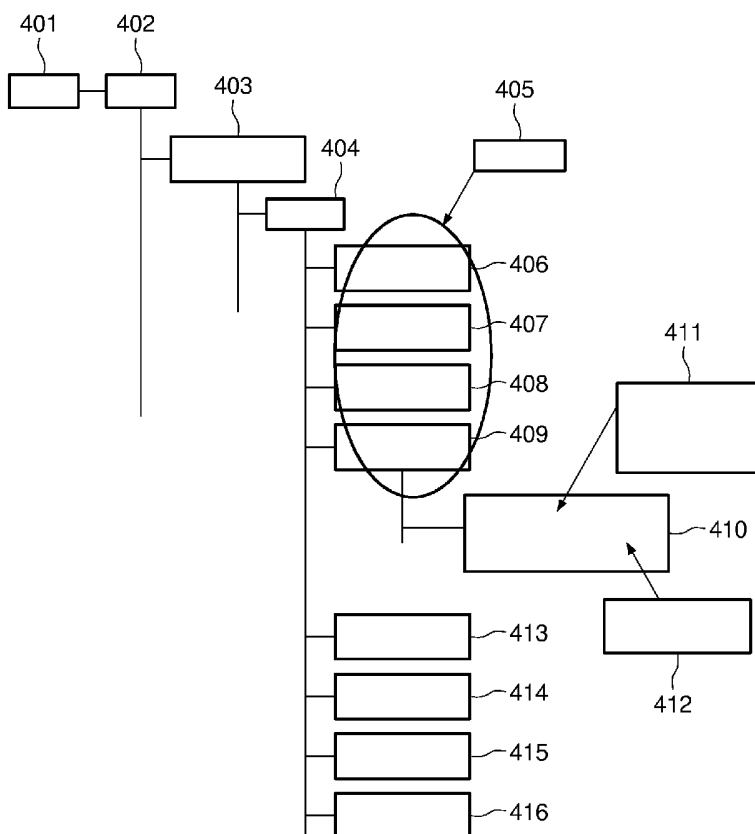
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[Continued on next page]

(54) Title: SYSTEM AND METHOD FOR UPGRADING AND EXTENDING THE FUNCTIONALITY OF PUBLISHED BLU-RAY DISC TITLES



(57) Abstract: An apparatus and method for upgrading and extending the functionality of published Blu-Ray disc titles using a player is disclosed. A disc is first read. A directory structure for the disc is then created in local storage on the player. The directory structure is updated using a first Java application. This invention is implemented, for example, in an improved system for upgrading a movie mode disc with Java full mode interactivity. Additionally, the method may be used to update Java applications on full mode titles with new versions of these applications, which may be made available over the Internet.



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System and method for upgrading and extending the functionality of published Blu-Ray disc titles

FIELD OF THE INVENTION

This invention pertains in general to the field of optical storage media. More particularly, the invention relates to a method and system for upgrading and extending the functionality of published Blu-Ray disc titles.

BACKGROUND OF THE INVENTION

The state of the art high-capacity storage standard is Blu-Ray, soon to appear on the market in consumer products. Blu-Ray Disc (BD) is a radically new optical storage medium offering higher storage capacities than legacy optical storage media. BD-Rom is the next generation Read Only optical disc standard, which utilizes a blue laser such that it is possible to obtain a capacity of 25 GB on one layer. Currently, work is being done to standardize the logical and physical format of the disc. The logical format defines the application layer on the disc, so basically what the disc can be used for.

The primary application for BD-ROM will be High Definition TV (HDTV). However, web-connectivity and interactivity such as games will also be part of the standard. In Fig. 1, a conceptual model of the logical format for BD-ROM is illustrated by:

Game	10
HD Movie	12
Enhanced Interactive View And Browser View	14
HD Movie View	16
Java Virtual Machine Supporting Internet Access and View	18
Digital AV Data	20
Disc	22

As shown in Fig. 1, Java will be the enabling technology for the interactive functionality. The BD-player will contain a Java Virtual machine with additional APIs for

controlling the A/V playback of the disc. The content author may include Java applications on the disc that allow a user to play games, access the Internet, but also to show a menu or to control the basic playback of a movie on the disc.

The BD specification will also contain a legacy system, which can provide menus and graphics, which are similar to, but better than those found on DVDs. This system is referred to as the Movie mode 26, while the Java system is referred to as the enhanced mode or full mode 24. The overlap between the two systems is indicated in Figure 2. The Movie mode 26 is designed for movie playback, simple animation, and menu graphics. The reason for having these two systems has to do with time to market. The first BD-ROM players will only support the Movie mode 26 part of the standard. These are expected to appear on the market first, approximately during 2005. The Full mode 24 players, which will be Java and Movie mode based, are expected to be on the market in 2007.

Since Blu-Ray disc titles will be published that have different capabilities, there is a need for a new system and method for providing extended capabilities that are not supported by the Blu-Ray Disc.

Hence, an improved system for upgrading a movie mode disc with Java full mode interactivity is envisaged. Additionally, the same mechanism may be used to update Java applications on full mode titles with new versions of these applications, which can be made available over the Internet.

SUMMARY OF THE INVENTION

Accordingly, the present invention preferably seeks to mitigate, alleviate or eliminate one or more of the above-identified deficiencies in the art and disadvantages singly or in any combination and to solve at least the above mentioned problems by providing a device/apparatus/system, a method, and a computer-readable medium for upgrading and extending the functionality of published Blu-Ray disc titles as defined in the appended patent claims.

The general solution according to the invention is to create a directory structure for each disc in local storage on a BD player and then update the directory structure with new capabilities for each disc as they become available.

According to one aspect of the invention, a method is provided for upgrading and extending the functionality of published, preferably Blu-Ray, disc titles using a player, preferably a BD player. The method comprises the steps of reading an optical storage disc,

preferably a BD; creating a directory structure for the disc in local storage on the player; and updating the directory structure using a first Java application.

According to yet another aspect of the invention, an apparatus is provided for upgrading and extending the functionality of published, preferably Blu-Ray, disc titles using a player, preferably a BD player. The apparatus is adapted to comprise means for reading an optical disc, preferably a BD; means for creating a directory structure for the disc in local storage on the player; and means for updating the directory structure using a first Java application.

According to a further aspect of the invention, a computer-readable medium is provided having embodied thereon a computer program for processing by a computer. The computer program comprises a code segment for reading an optical storage disc, preferably a BD; a code segment for creating a directory structure for the disc in local storage on the player; and a code segment for updating the directory structure using a first Java application.

The present invention has the advantage over the prior art that it extends the functionality of published Blu-Ray disc titles.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other aspects, features and advantages of the invention will become apparent from the following description of embodiments of the present invention, reference being made to the accompanying drawings, in which

Fig. 1 illustrates a conceptual model of the known logical format for a BD-ROM;

Fig. 2 illustrates a conceptual model of the overlap between the movie mode and the full mode;

Fig. 3 is a flowchart illustrating the method for upgrading and extending the functionality of published Blu-Ray disc titles according to one embodiment of the invention;

Fig. 4 illustrates a directory structure created for a Blu-Ray disc according to one embodiment of the invention;

Fig. 5 schematically illustrates a computer-readable medium according to one embodiment of the invention; and

Fig. 6 illustrates a BD player according to one embodiment of the invention.

DESCRIPTION OF EMBODIMENTS

The following description focuses on an embodiment of the present invention applicable to a BD player and in particular to a BD player, which extends the functionality of published Blu-Ray, disc titles. However, it will be appreciated that the invention is not limited to this application but may be applied to many other optical storage media having a similar organization of data.

A Blu-Ray disc uses an index table to indicate the relation between a user-recognizable title on the disc and the corresponding structures on the disc. In the movie mode, a title in the index table refers to a movie object. This movie object is a set of commands that, for example, can select a playlist and start playback of that playlist. A playlist may refer to several streams, one type of stream being an Interactive graphics stream. This may contain menus with button objects, which also consist of commands. A movie object may use the button objects to get input from a user and to perform actions based on that input.

In a Java full mode title, the title entries in an index table may refer to a Java object. This Java object contains a reference to an Application Information Table (AIT). This table holds references to Java applications and also describes which applications may run within this title.

The Java objects referenced in the AIT table are carried inside a JAR archive. This JAR archive contains Java classes and application-related data (graphics, metadata, etc.). This archive also contains certificates, hash files and permission request files, all of which are used in the security mechanism that determines what an application (or even a class) is or is not allowed to do.

The Java applications on the full mode discs may provide a much richer interactive experience than the movie objects, which are nothing more than a very basic set of commands. A player that only supports the full mode part of the standard will have local storage (for example a HD) and network connectivity. The Java applications may use these resources to provide a truly interactive experience.

It is proposed that Blu-Ray discs containing only movie mode titles can be upgraded with full mode interactivity. This requires a linking mechanism between local storage and the disc, as it is not possible to replace or add files on a Blu-Ray ROM disc. Another prerequisite is the fact that files need to be replaced if the system is to be able to recognize and use the updated files instead of the files from the disc.

In a first embodiment of the method of the invention, with reference to Fig. 3, the following procedure is performed. First, a disc is read by a player when the disc has been inserted into the player in step 302. As will be described in more detail below, the player creates a directory structure for the disc in local storage on the player in step 304. The directory structure is then updated using a Java application in step 306. Finally, the player loads the files from the directory structure for the purpose of playing the disc in step 308.

The linking mechanism operates as follows. When a Blu-Ray ROM disc is inserted into a player, the player automatically creates a directory structure for the disc on the local storage. In Fig. 4, the directory structure is illustrated by:

Root	410	Title #2	409
BDMV	402	ApplicationID (Java title) or Movie ObjectID (movie mode title)	410
OrganizationID	403	From the Application listing Of AIT Table per title	411
DiscID	404	From the Index Table	412
Index Table	405	PLAYLIST	413
FirstPlayback	406	CLIPINF	414
TopMenu	407	Stream	415
Title#1	408	AUXDATA	416

Under the root directory 401 lies the BD directory, a sub-directory is created for each organisationID 403 (studio or publisher etc.), and under that sub-directory there is a directory 404 for every disc. This kind of structure is similar to the one used in persistent storage in MultiMedia Home Platform (MHP). In MHP, however, they have a sub-directory for each application. It is proposed here that the sub-directories are placed under the discID 404 sub-directory, so that they are aligned with the Index Table 405.

This has several advantages. It allows automatic creation of a directory structure on local storage without the need for additional metadata, and it has the same directory structure for the movie mode-only discs and for Java full mode discs.

It also provides enough information to link data on the local storage with data on the disc. Updates of application-related files 411 on the disc are placed under applicationID subdirectory 410. Updates of movie mode titles can be done on a title basis 412. This means that the files in the Title# sub-directory 408, 409 are updated.

To make it easy for the application to update the files required, when a disc is placed in the player, the player reads the database structures, creates the directory structures on the local storage, and copies the database files from the disc onto the DiscID sub-directory 404 on the local storage with, for example, sub-directories FirstPlayback 406 and TopMenu 407. This has the additional advantage that the player can show the disc menu faster when a disc is inserted a second time. The files copied are only the files in the PLAYLIST directory 413, the files in the STREAM directory 415 are not copied as these contain the actual streams on the disc.

The described linking mechanism is used when updating files for a Blu-Ray disc, which is already in a user's collection. A Java application disc scans the local storage for directory entries, which indicate discs in a user's collection. This application on disc has obtained permission to scan the local storage by means of a known mechanism. The Java application then compares the result of this scan with a list of available updates. It then presents the user with a message announcing that it has updates available. The user can decide whether or not to perform the updates. If the user agrees then the application replaces the files for a certain title of a certain disc (discID, titleID) with new files. The next time the user inserts a disc, the player scans the local storage to find the corresponding directory structure. The directory structure corresponds to the index table of the disc. Instead of loading the files, such as playlists/ movie objects/ Java classes/ AIT tables etc., from the disc, it loads the updated files in the local storage and uses these. Which files need to be updated can be determined dynamically by the application as a copy of the files on disc are stored locally (it does not have to read the disc it wants to update, i.e., the user does not have to insert the disc).

There are a number of variations possible to the above-described procedure. The Java application that performs the steps for the updating process may come from a disc, but also from the player as well as from the Internet. For example, a Java application on a disc may go to a website, which website sends an application to the player that performs the actual updating procedure. Again, this application has to have permission to be able to do this. The update files may come from the Internet or from the disc. It is alternatively possible to update streams such as subtitle streams or audio streams by using this mechanism and linking structure. Additional streams are placed under the STREAM sub-directory 415 and additional information for these streams is stored under the CLIPINF 414 or, in the case of audio, in the AUXDATA sub-directories 416 for click sounds. Of course adding new streams requires new playlists as well as new movie and or Java objects to reference the new

playlists. If a stream is replaced with a new stream, the IDs of CLIPINF files that refer to these streams are the same as the IDs of the files that should be replaced. The player always first checks the local storage for versions of the files, if present it uses those, otherwise it reads the files from the Blu-Ray disc.

There are several reasons why a studio might wish to provide updates for Blu-Ray discs, the most important reason being that it provides another channel through which the studio can make money. They could, for example, charge for an update if the update improves the features of the Blu-Ray disc. An example of this may be a new game that is based on a film and actually uses clips from the film on disc. Another option is the case in which a Java application on a disc has some bugs. The updates may also be used to promote the sale of new titles, for example, Lion King 2 could provide updates to Lion King 1.

In another embodiment of the invention is shown in Fig. 5, where a computer-readable-medium 50 is illustrated schematically. The computer-readable medium 50 has embodied thereon a computer program 110 for upgrading and extending the functionality of published Blu-Ray disc titles, to be processed by a computer 112. The computer program comprises a code segment 114 for reading a disc, a code segment 115 for creating a directory structure for the disc in local storage on the player, a code segment 116 for updating the directory structure using a Java application, and a code segment 117 for loading files from the directory structure so as to play the disc.

Figure 6 is a schematic illustration of an apparatus 60 according to one embodiment of the invention. The apparatus 60 is a BD player adapted to update and extend the functionality of published Blu-Ray disc titles. Preferably, the apparatus 60 is arranged to run the above-described program code segments in order to perform the method according to the invention. The apparatus 60 comprises, among other features, a disc reader 62, local storage 64, a computer 66, and an Internet connection 68. According to one embodiment of the invention, when a disc has been inserted into the apparatus 60 (and the apparatus 60 is on), the disc reader 62 reads the disc. The computer 66 then creates the directory structure for the disc in the local storage 64. The computer 66 then updates the directory structure when an update becomes available.

The invention may be implemented in any suitable form including hardware, software, firmware, or any combination of these. Preferably, however, the invention is implemented in the form of computer software running on one or more data processors and/or digital signal processors. The elements and components of an embodiment of the invention may be physically, functionally, and logically implemented in any suitable way.

Indeed, the functionality may be implemented in a single unit, in a plurality of units, or as part of other functional units. As such, the invention may be implemented in a single unit, or may be physically and functionally distributed over several units and processors.

Although the present invention has been described above with reference to specific embodiments, it is not intended to be limited to the specific form set forth herein. Rather, the invention is limited only by the accompanying claims, and embodiments other than those specific above are equally possible within the scope of the appended claims, e.g. file principles different from those described above.

In the claims, the term "comprises/comprising" does not exclude the presence of other elements or steps. Furthermore, even though individually listed, a plurality of means, elements, or method steps may be implemented by e.g. a single unit or processor. Additionally, although individual features may be included in different claims, these may very well be combined to advantage, and the inclusion in different claims does not imply that a combination of features is not feasible and/or advantageous. In addition, singular references do not exclude a plurality. The terms "a", "an", "first", "second" etc do not preclude a plurality. Reference signs in the claims are provided merely as a clarifying example and shall not be construed as limiting the scope of the claims in any way.

CLAIMS:

1. A method of upgrading and extending the functionality of published optical storage disc titles, such as Blu-Ray discs (BD), by means of a player, preferably a BD player, which method comprises the steps of:

reading a disc, preferably a BD;
creating a directory structure for the disc in local storage on the player; and
updating the directory structure by using a first Java application.

2. The method according to claim 1, comprising downloading of said first Java application to said player, wherein the first Java application is downloaded from the Internet prior to said updating of the directory structure.

3. The method according to claim 1, comprising downloading of said first Java application to said player, wherein the first Java application is downloaded from a second disc prior to said updating of the directory structure.

4. The method according to claim 1, comprising updating of said directory structure by using a second Java application.

5. The method according to claim 4, comprising the steps of accessing the local storage and of scanning directory structures therein with said second Java application, wherein said second Java application has permission to access the local storage to scan directory structures for possible updates.

6. The method according to claim 1, comprising the use of a second Java application to access a website which has a third Java application, and scanning the directory structures in the local storage for possible updates with said third Java application.

7. The method according to claim 1, further comprising
loading files from directory structure so as to play the disc.

8. An apparatus for upgrading and extending the functionality of published optical storage disc titles, preferably Blu-Ray discs (BD), configured for use in a player, preferably a BD player, comprising:
- means (62) for reading a disc, preferably a BD;
 - means (66) for creating a directory structure for the disc in local storage (64) on the player;
 - means (66) for updating the directory structure using a first Java application.
9. The apparatus according to claim 8, wherein the first Java application is downloaded from the Internet.
10. The apparatus according to claim 8, wherein a second Java application is used to access a website which has a third Java application that scans the directory structures in local storage for possible updates.
11. The apparatus according to claim 8, further comprising:
- means (66) for loading files from the directory structure so as to play the disc.
12. A computer-readable medium having embodied thereon a computer program that is to be processed by a processing device, preferably a Blu-Ray disc (BD) player, the computer program comprising code segments for upgrading and extending the functionality of published optical storage disc titles, preferably Blu-Ray discs (BD), comprising:
- a first code segment (114) for reading a disc, preferably a BD;
 - a second code segment (115) for creating a directory structure for the disc in local storage on the player;
 - a third code segment (116) for updating the directory structure using a first Java application.
13. The computer-readable medium according to claim 12, further comprising:
- a fourth code segment (117) for loading files from the directory structure so as to play the disc.

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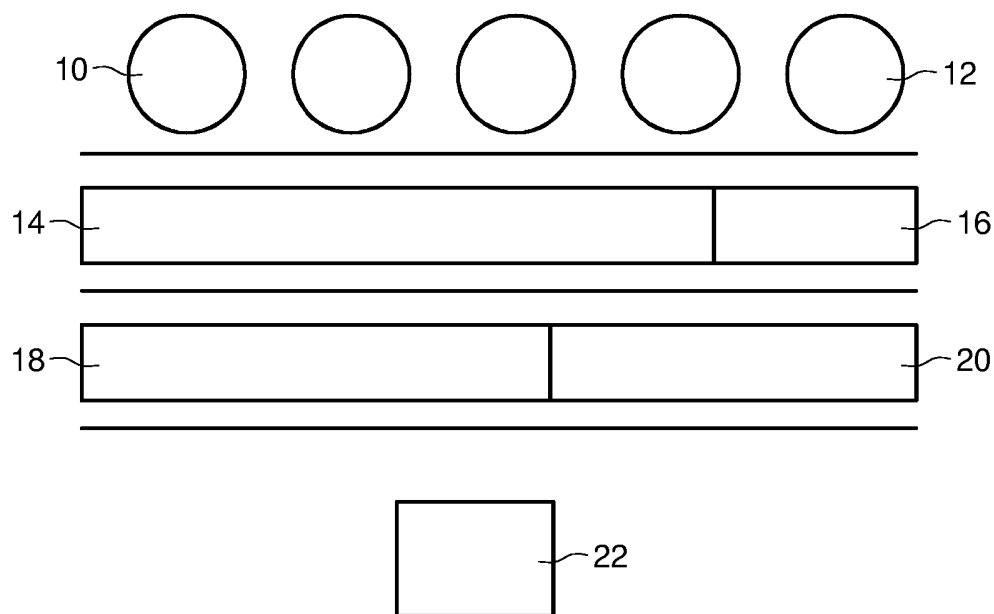


FIG. 1

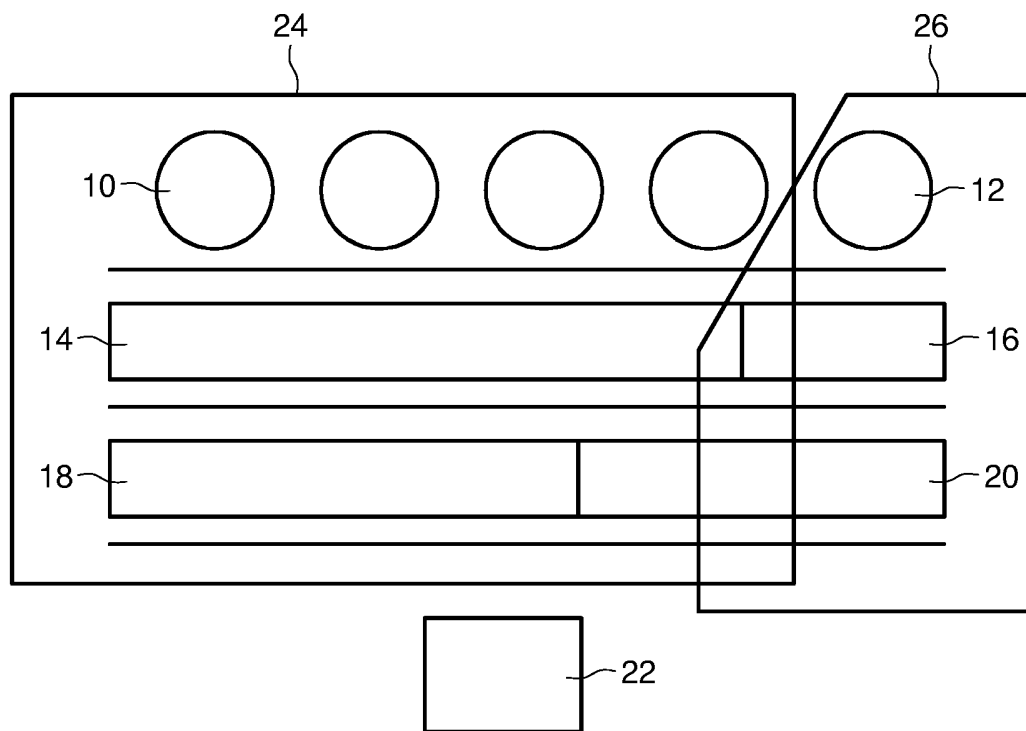


FIG. 2

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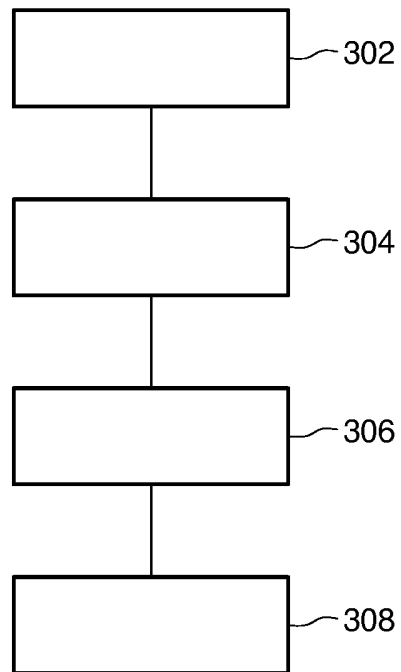


FIG. 3

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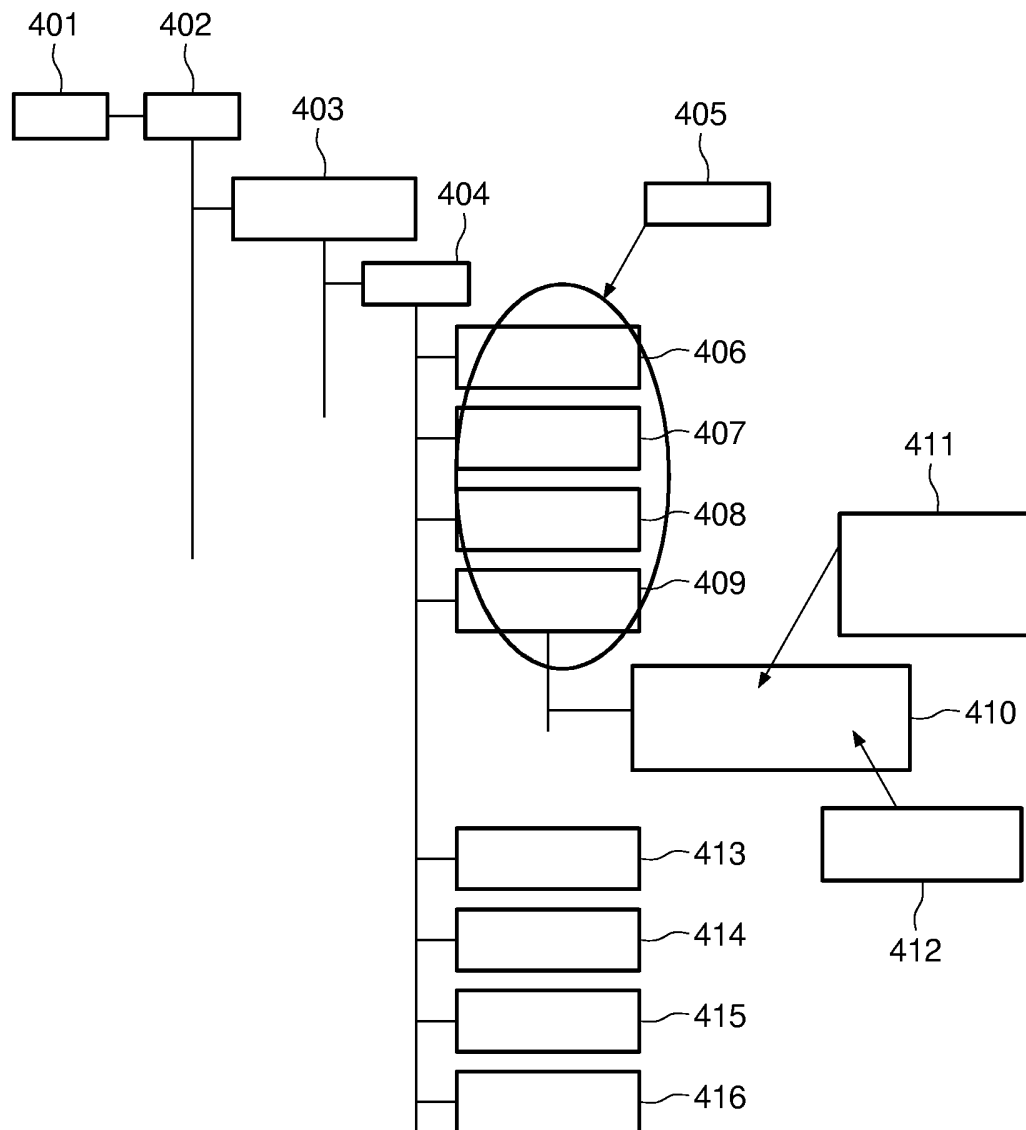


FIG. 4

4/4

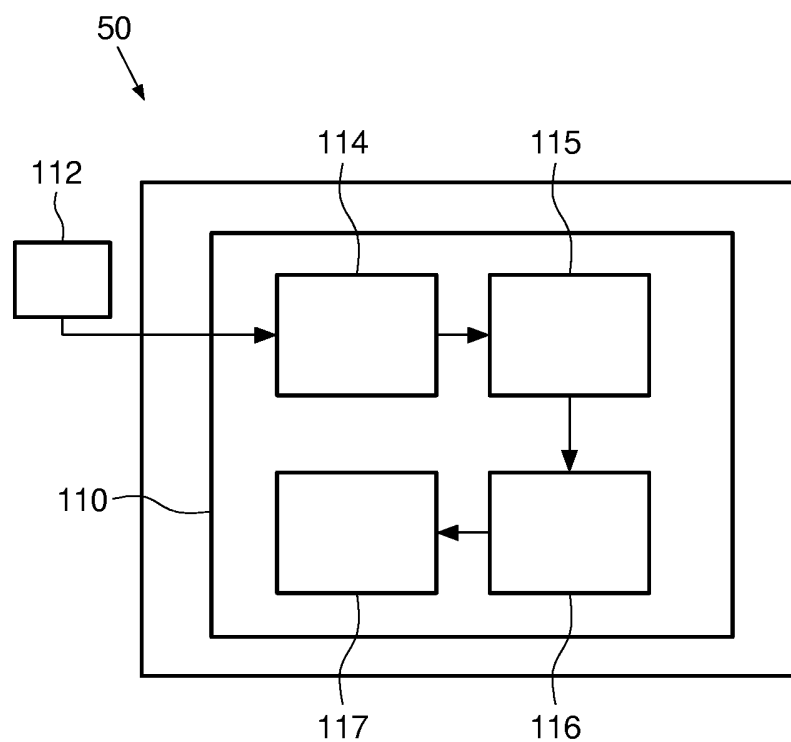


FIG. 5

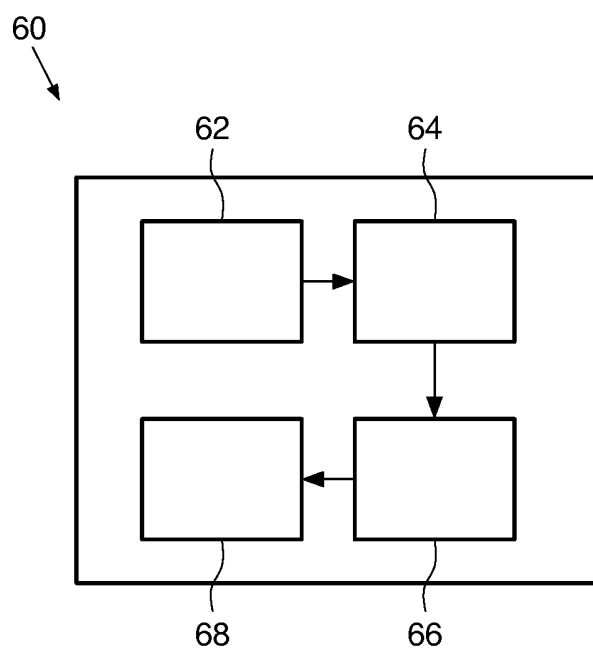


FIG. 6