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(54) **METHOD AND APPARATUS FOR IDENTIFYING MEDIA CONTENT PRESENTED ON A MEDIA PLAYING DEVICE**

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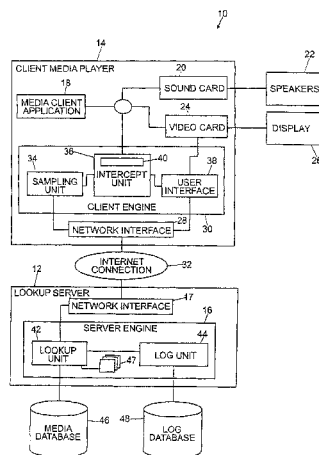
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(57) **ABSTRACT**

A computing device executing a server engine receives a digital fingerprint created from a segment of a work, the work being a single rendering, the segment being less than an entirety of the work, and the digital fingerprint being based on perceptual features of the segment. The computing device compares the digital fingerprint to a plurality of digital fingerprints from a plurality of known works to identify a known work of the plurality of known works that corresponds to the work. The computing device transmits content-related data associated with the known work to a client device.

**11 Claims, 5 Drawing Sheets**



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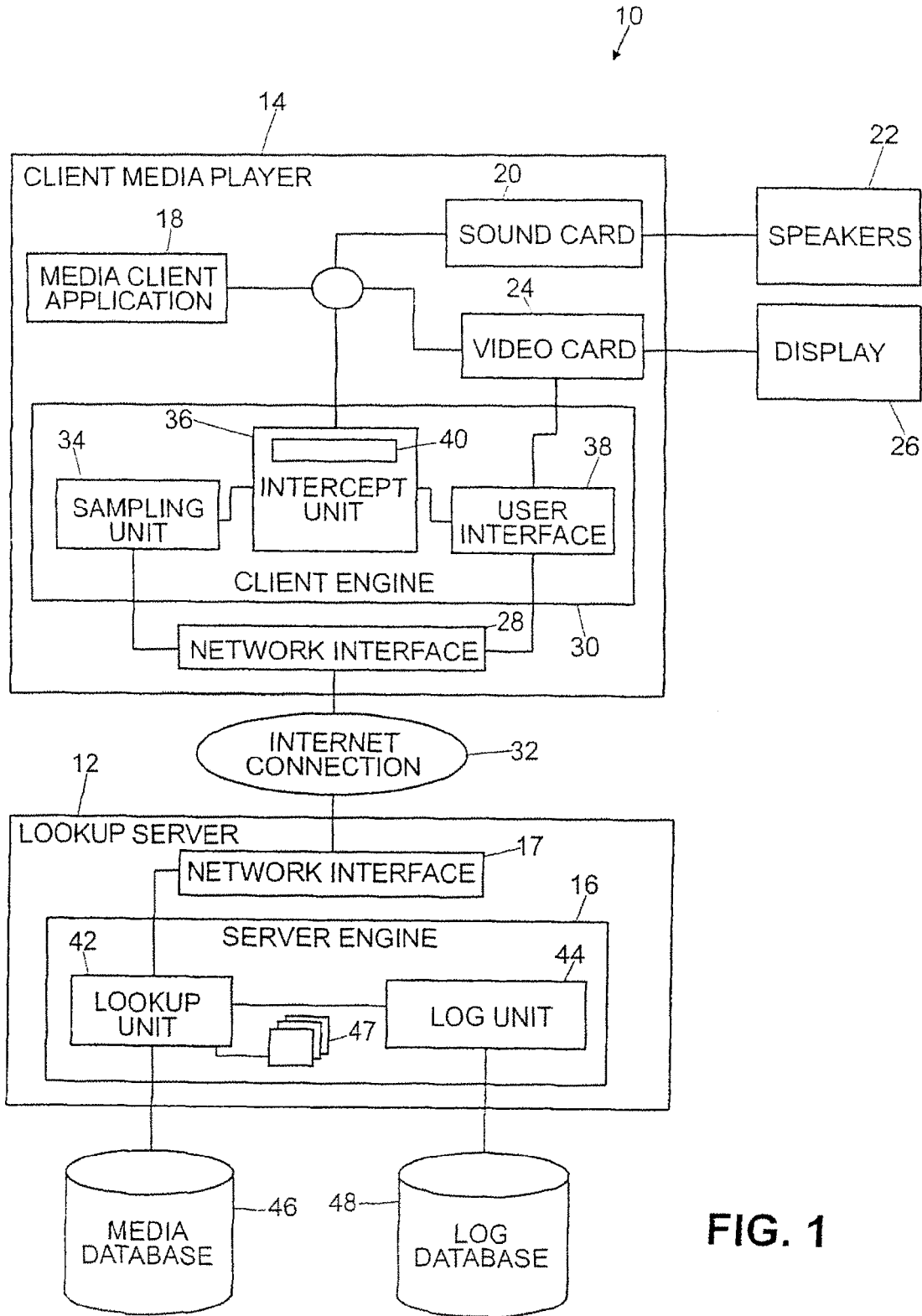


FIG. 1

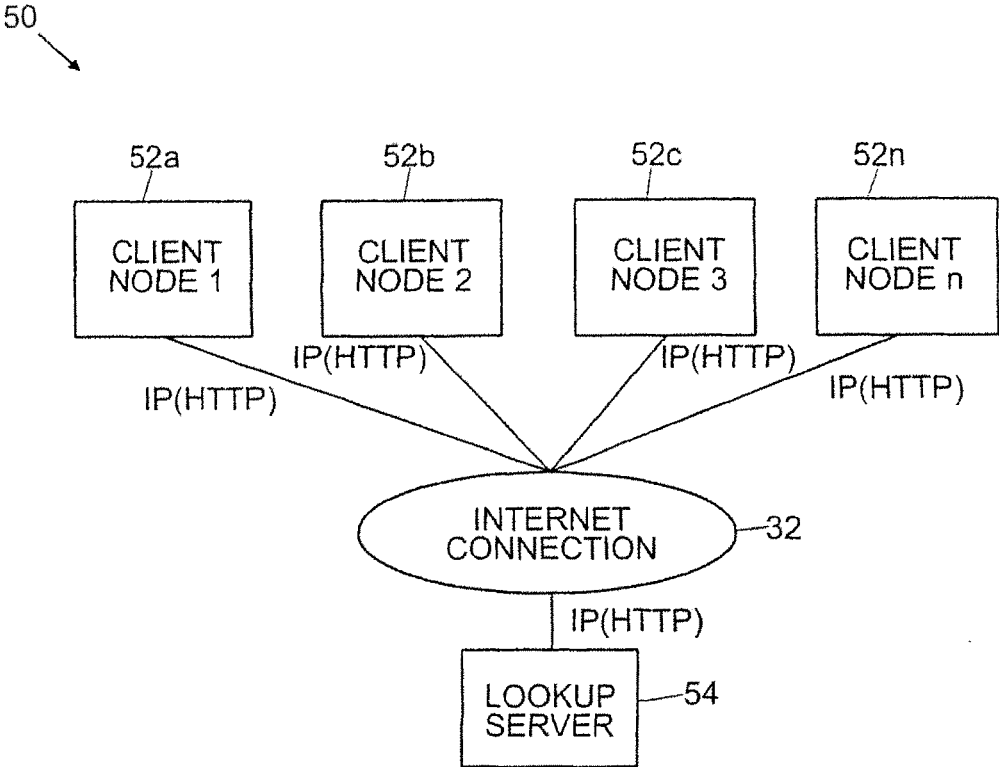


FIG. 2



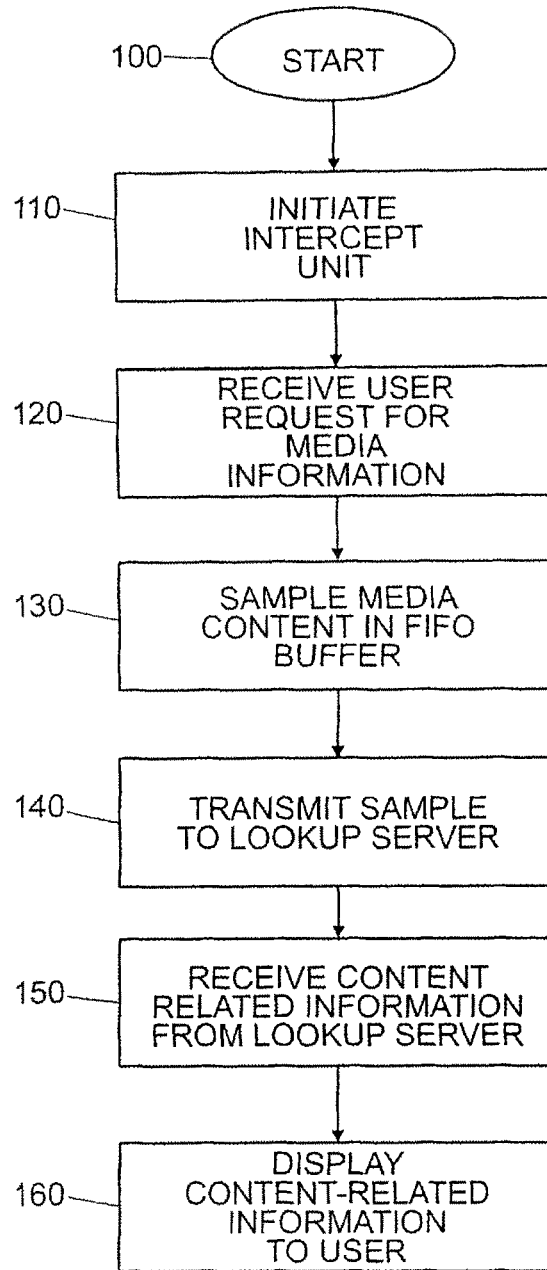


FIG. 3

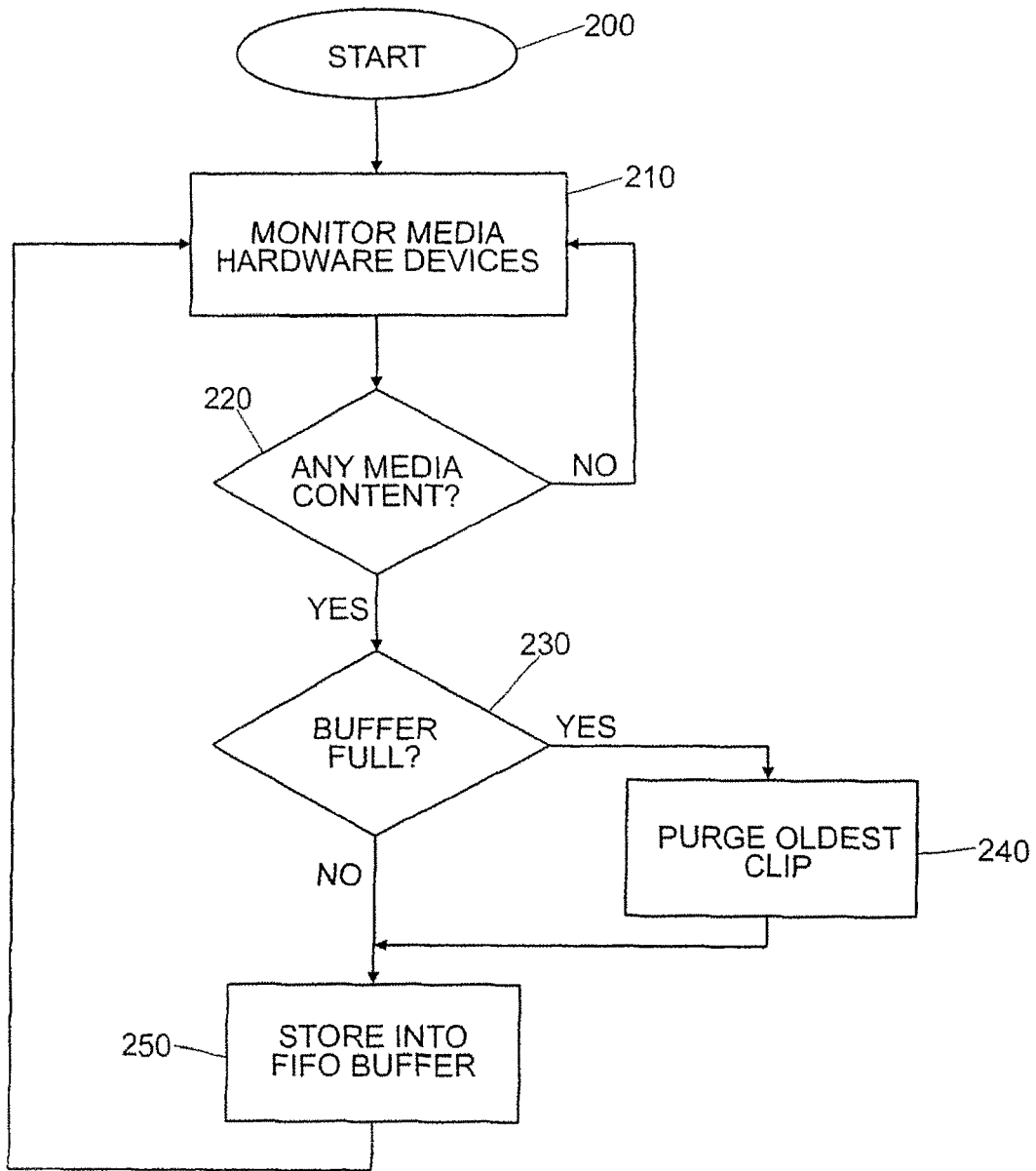


FIG. 4

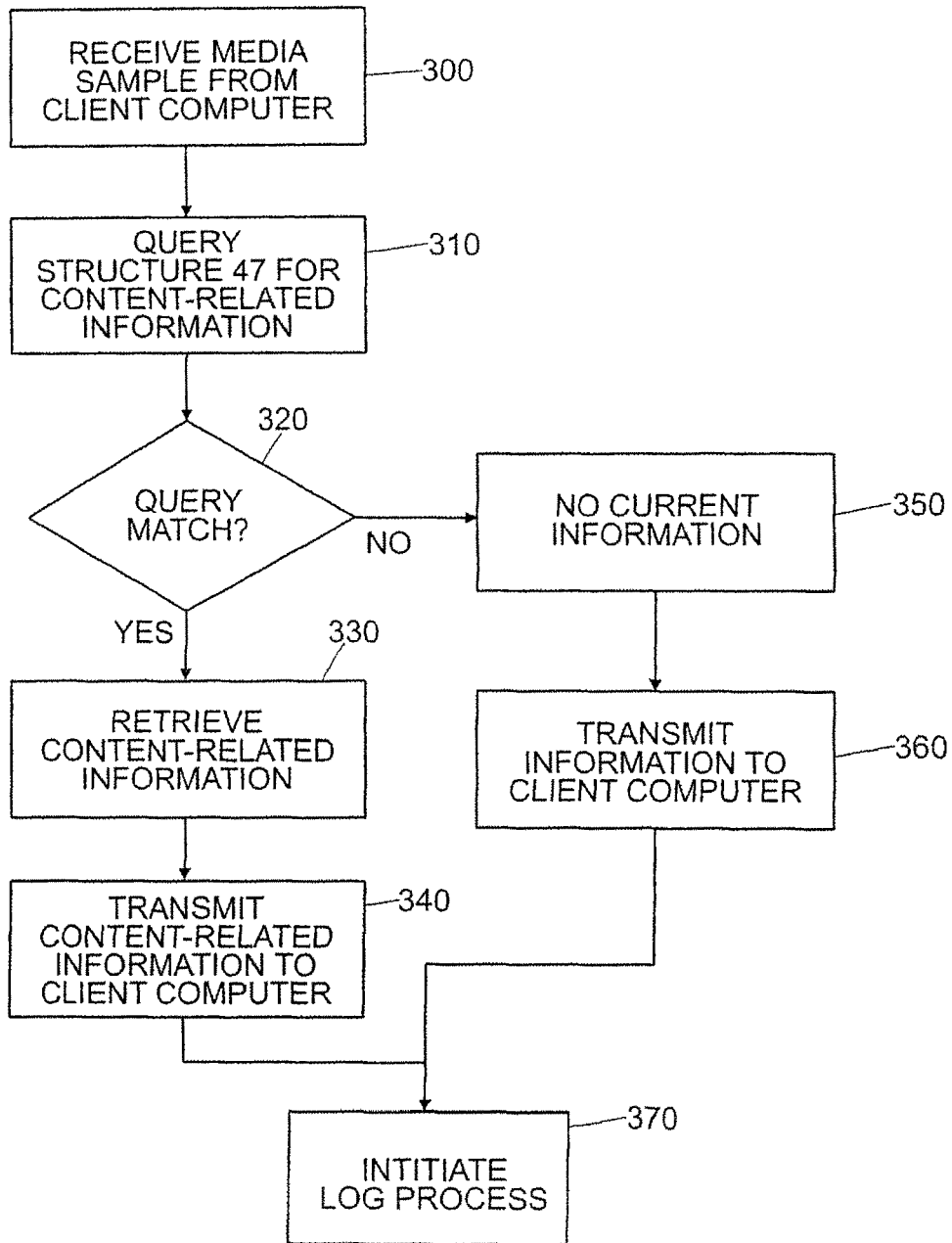


FIG. 5

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**METHOD AND APPARATUS FOR  
IDENTIFYING MEDIA CONTENT  
PRESENTED ON A MEDIA PLAYING DEVICE**

RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 13/011,776, filed on Jan. 21, 2011, which is a continuation of U.S. patent application Ser. No. 12/251,404, filed on Oct. 14, 2008, now U.S. Pat. No. 7,917,645, which is a continuation of U.S. patent application Ser. No. 10/955,841, filed Sep. 29, 2004, now U.S. Pat. No. 7,500,007, which is a continuation of U.S. patent application Ser. No. 09/511,632, filed on Feb. 17, 2000, now U.S. Pat. No. 6,834,308. U.S. patent application Ser. No. 13/011,776, U.S. Pat. No. 7,917,645, U.S. Pat. No. 7,500,007, and U.S. Pat. No. 6,834,308 are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention pertains generally to media content identification methods. More particularly, the invention is an apparatus and method for identifying media content presented on a media playing device and presenting media-content related information and/or action to the user of the media playing device.

2. The Prior Art

The use of a data processing means, such as a computer or personal digital assistant (PDA), for playing works is well known. For purposes of the present discussion, a work is anything that is fixed in a tangible medium. Some examples of works include, but are not limited to, audio renderings, video renderings, images, video/audio renderings, and software. An example of an audio rendering is a song or other audio track. Examples of video renderings include animation or video sequence. Examples of an image include photographs and paintings. Examples of audio/video renderings include movies, television shows, and cartoons. Examples of software include word processing programs and video games.

Some examples of playing a work include using a personal computer (PC) to play songs from audio compact disks (CD), normally with the use of a CD-ROM drive, a sound card, and speakers. Other types of media, including various formats of audio and video, are also commonly played using a PC.

With the increasing popularity of the global information network commonly known as the "Internet", various audio and video formats have been introduced to provide live (as well as archived) broadcasts of works over the Internet. These broadcasts may be viewed by users connected to the Internet with the use of a PC and the proper client application. For example, Real Networks™ provides Real Player™ (a client application) for playing streaming audio and video works (in Realm™ format) which is broadcast over the Internet. Various servers (also connected to the Internet) carry out the operation of making such works available and streaming data for the appropriate works to users upon request. In this way, Real™ media content of the work may be played by a user using Real Player™ on the user's PC. Like other media client applications, Real Player™ plays audio content of a work via the user's sound card and speakers and video content of a work via the user's video card and monitor (or other viewing device).

Internet radio broadcasts (or webcasts) are also known in the art. In general, Internet radio broadcasts are provided over the Internet by one or more server computers equipped to provide streaming audio works, much like traditional AM or

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FM radio broadcast. A user that would like to listen to an Internet radio broadcast would use a client application (such as Real Player™, Microsoft™ media player, or Apple Quick-Time™ viewer, for example) and direct the client application to the appropriate server computer. The server computer then transmits the media content of a work to the client application via the Internet. The client application receives the media content of the work transmitted from the server computer and plays the content of the work using the user's sound card and speaker.

Internet video broadcasts (another form of webcast) are carried out in a similar fashion to that of Internet radio broadcasts, except video broadcasts typically contain both audio and video content of a work. As such, the audio component of the work is played to the user via a sound card and speakers, while the video component of the work is displayed using a video card and a monitor.

In many cases, webcasts will not provide content identifying information, such as song title, artist name or album name, as part of a broadcast work. Other information, such as where the content of the work can be purchased in the form of a CD, DVD (digital video disk) or VHS (video home system) tape, for example, are also typically not included. The primary reason a webcast provider (station) fails to provide such content-related information of the work is that the station does not have real-time access to accurate playlists. For example, it is common for a station disk jockey to make real-time adjustments to the playlist order and timing. Thus current radio station systems do not transmit or attach identification data of a work with the broadcast.

In addition to webcasts, many Internet sites provide archived or pre-recorded works for download and playback on a user's PC. Examples of such content of works include "wav", "mp3", "mov", and "midi" files, among others. Once these files have been downloaded from the Internet site to the user's PC, the user is able to play back the audio or video content of a work using an appropriate client application. Many of these media files, like webcasts, also fail to provide identifying data or other information for a work.

Additionally, PCs often have the ability to play other forms of media content for other works via PC sound card and speakers and/or PC video card and monitor. For example, tuner expansion cards (tuners) which may be inserted into (or interfaced with) a user's PC are presently available (some computers already include such tuners). In either case, "television" (TV) tuners allow a user of the PC to view conventional television, cable or satellite transmissions on the PC monitor and hear the audio via the PC speaker. "Radio" tuners allow a user to hear conventional (FM or AM) radio broadcast using the PC speaker. Conventional TV and radio broadcast also fail to provide rich content-related information of a work to the user.

Other media playing devices such as televisions, radio/stereo systems, and portable audio devices also typically do not provide content-related information of a work on demand for the user. For example, in automobiles, current car stereo systems fail to provide a system and method for identifying a song being played on the stereo. Typically a user would either rely on the disk jockey to identify the artist and song title or call the radio station to ascertain the information.

Users may also read and/or store media content of works from storage mediums such as compact disk and magnetic tapes. Sometimes these copies of works do not include metadata or the metadata for the work may be incorrect. Furthermore, there may be no proper way to identify the work.

Accordingly, there is a need for an apparatus and method which provides real-time media content-related information

of a work and context specific action choices to users viewing and/or listening to media content of the work over media playing devices. The present invention satisfies these needs, as well as others, and generally overcomes the deficiencies found in the background art.

### BRIEF DESCRIPTION OF THE INVENTION

The present invention is a system and method for identifying a work from media content presented over a media playing device, such as a computer. The system generates a media sample or analytical representation from the media content of the work, such as audio and/or video, played on the media player. The media sample or representation is compared to a database of samples of media content or representations of known works to query and ascertain content-related information related to the work. This media content-related information of the work is then displayed on the media player.

The invention further relates to machine readable media which are stored embodiments of the present invention. It is contemplated that any media suitable for retrieving instructions is within the scope of the present invention. By way of example, such media may take the form of magnetic, optical, or semiconductor media. The invention also relates to data structures that contain embodiments of the present invention, and to the transmission of data structures containing embodiments of the present invention.

By way of example only, and not of limitation, the media player may comprise any data processing means or computer executing the present invention including devices carrying out the invention via an embedded system. For example, the media player may comprise cellular or mobile phones, portable media players, and fixed media players including analog broadcast receivers (such as car stereo, home stereos, and televisions, for example).

In a first embodiment, the database of media content samples of known works resides on a "lookup server" which carries out the database query described above. In general, the lookup server is operatively coupled for communication to one or more media players (client) via the Internet as is known in the art. Under this arrangement, media samples of works are first communicated from the client to the lookup server before the media samples are compared to the database. Then after the database query is carried out on the lookup server, the content-related information of the work is transmitted to the client for presentation thereon.

According to this embodiment, the system of the present invention generally includes one or more client media players, each operatively coupled for communication to a lookup server. As noted above, the lookup server is generally connected to the client media players via an Internet connection, although any suitable network (including wired or wireless) connection may also be used.

For example, the client media player may comprise a computer. The client computer typically plays audio files via a sound card and speakers. Video files are played via a video card and a monitor. The client computer has executing thereon a "client engine" software application comprising a sampling unit, a media intercept unit (intercept unit), and a user-interface.

By way of example, and not of limitation, the intercept unit carries out the operation of monitoring the client computer for media content of a work presented thereon. In general, the intercept unit carries out the operation of monitoring audio signals transmitted to the sound card and/or video signals transmitted to the video card. The intercept unit may also monitor the operations of other hardware suitable for com-

municating audio and/or video signals, such as USB (universal serial bus) and IEEE (Institute of Electrical and Electronics Engineers) standard 1394 connections, for example. Preferably, the intercept unit maintains a FIFO (first in first out) buffer of fixed size (150 seconds, for example) containing media content played on the client.

The sampling unit carries out the operation of creating a media sample from the media content of a work played on the client computer in order to represent and identify the work. In general, the sampling unit creates a sample of the work from the FIFO buffer maintained by the intercept unit. The sampling unit may create media samples from the media content of a work according to a predetermined or user-defined interval or upon the request of the user of the client computer. A user request may be received via commands issued using the user-interface. In general, the media sample created by the sampling unit comprises a "digital fingerprint" or "digital signature" using conventional digital signal processing known in the art. For example, a sound file may be sampled according to its acoustic/perceptual features over time. It is noted that "media sample" is defined herein to include actual recordings of the media content and/or analytical representations of the media content of the work. One example of such a digital signal processing technique for creating a media sample is described in U.S. Pat. No. 5,918,223 issued to Blum which is hereby incorporated by reference as if set forth in its entirety. Other examples of methods for creating media samples are given in PCT application number WO200444820 having inventors Jin S. Seo, hap A. Haitisma and Antonius A. C. M. Kalker and assigned to Koninklijke Philips Electronics and PCT application number WO03091990 having inventors Daniel Culbert and Avery Li-Chun Wang and assigned to Shazam Entertainment, Ltd. The media sample is then transmitted to the lookup server for further processing, as described in further detail below.

The user interface carries out the operation of receiving commands from a user of the client computer, and displaying content-related information to the user. As noted above, a user may issue a request for content-related information via the user-interface. This request is communicated to the sampling unit for further processing. As described above, in response to this request, the sampling unit creates a sample of the media content being played on the client computer and transmits the sample to the lookup server for further processing. In response, the lookup server provides the information related to the media sample to the client computer. This content-related information is received by the user interface which then displays the received information to the user of the client computer.

The content-related information for the work returned from the lookup server may also be used for a plurality of purposes including, for example, generating a log of the user activity, providing an option to purchase media to the user, and displaying the content-related information on the media playing device, among others.

The lookup server has executing thereon a "server engine" software application comprising a lookup unit, and a log unit. The lookup unit is further coupled to a media database, and the log unit is coupled to a log database. While the present invention describes the lookup server as a single machine, a group or cluster of server machines may be used to carry out the tasks of the lookup server described herein to thereby balance the load between several machines as is known in the art.

The lookup unit carries out the operation of receiving media samples of the work from client computers and performing database queries on the media database to ascertain

content information related to the media sample provided. This content-related information of the work may include such information as song title, artist, and album name, for example. The content-related information of the work may also include product fulfillment information, such as how and where to purchase media containing the work, advertising banners, and/or promotional offers, for example. This content-related information of the work is transmitted back to the client computer for further processing thereon.

The log unit carries out the operation of tracking media requests made by the users of the client computers to the lookup server. The log unit maintains a plurality of information related to the requests made by the user including, for example, media type, genre or category. This user information is maintained in the log database.

The source of the media content of the work played on the client computer includes conventional media sources such as Internet sources or webcasts, including streaming media and archived media. The media content source may also be audio CDs, DVD, or other formats suitable for presentation on media playing devices, such as the client computer.

In a second embodiment of the present invention, the database of sampled media content resides within the client computer. The database resides on conventional storage medium, such as a computer memory, a hard drive, CD-ROM, or other appropriate storage medium. Under this arrangement, the database query is carried out "locally" on the computer playing the media content. It will be readily apparent to those skilled in the art that various other topological arrangements of the system elements (including the location of the database) may be used with the invention without departing from the scope and spirit of the invention.

An object of the invention is to provide an apparatus and method for identifying media content presented over a media playing device which overcomes the deficiencies of the prior art.

Another object of the invention is to provide an apparatus and method for identifying media content presented over a media playing device which does not require the media content provider to provide content-related information.

Further objects and advantages of the invention will be brought out in the following portions of the specification, wherein the detailed description is for the purpose of fully disclosing the preferred embodiment of the invention without placing limitations thereon.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be more fully understood by reference to the following drawings, which are for illustrative purposes only.

FIG. 1 is a functional block diagram of a media content identifying system in accordance with the invention.

FIG. 2 is a functional block diagram of a media content identifying system having a plurality of client nodes in accordance with the invention.

FIG. 3 is a flow chart showing generally the processes associated with the client engine in accordance with the invention.

FIG. 4 is flow chart showing generally the processes associated with the media intercept unit in accordance with the invention.

FIG. 5 is flow chart showing generally the processes associated with the server engine in accordance with the invention.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Persons of ordinary skill in the art will realize that the following description of the present invention is illustrative only and not in any way limiting. Other embodiments of the invention will readily suggest themselves to such skilled persons having the benefit of this disclosure.

Referring more specifically to the drawings, for illustrative purposes the present invention is embodied in the apparatus shown FIG. 1 and FIG. 2 and the method outlined in FIG. 3 through FIG. 5. It will be appreciated that the apparatus may vary as to configuration and as to details of the parts, and that the method may vary as to details and the order of the acts, without departing from the basic concepts as disclosed herein. The invention is disclosed generally in terms of an apparatus and method for identification of a work on a personal computer, although numerous other uses for the invention will suggest themselves to persons of ordinary skill in the art.

Referring first to FIG. 1, there is generally shown a functional block diagram of a media content identifying system 10 in accordance with the invention. The system 10 comprises a lookup server 12 and at least one client media player 14. The lookup server 12 can be any standard data processing means or computer, including a minicomputer, a microcomputer, a UNIX® machine, a mainframe machine, a personal computer (PC) such as INTEL® based processing computer or clone thereof, an APPLE® computer or clone thereof or, a SUN® workstation, or other appropriate computer. Lookup server 12 generally includes conventional computer components (not shown), such as a motherboard, central processing unit (CPU), random access memory (RAM), hard disk drive, display adapter, other storage media such as diskette drive, CD-ROM, flash-ROM, tape drive, PCMCIA cards and/or other removable media, a monitor, keyboard, mouse and/or other user interface means, a modem, and/or other conventional input/output devices. Lookup server 12 also includes a Network Interface 17 for communication with other computers using an appropriate network protocol.

Lookup server 12 has loaded in its RAM a conventional server operating system (not shown) such as UNIX®, WINDOWS® NT, NOVELL®, SOLARIS®, or other server operating system. Lookup server 12 also has loaded in its RAM server engine software 16, which is discussed in more detail below.

Client media player 14, may comprise a standard computer such as a minicomputer, a microcomputer, a UNIX® machine, mainframe machine, personal computer (PC) such as INTEL®, APPLE®, or SUN® based processing computer or clone thereof, or other appropriate computer. As such, client media player 14 is normally embodied in a conventional desktop or "tower" machine, but can alternatively be embodied in a portable or "laptop" computer, a handheld personal digital assistant (PDA), a cellular phone capable of playing media content, a dumb terminal playing media content, a specialized device such as Tivo® player, or an internet terminal playing media content such as WEBTV®, among others. As described above, client media player 14 may also comprise other media playing devices such as a portable stereo system, fixed stereo systems, and televisions suitable for use with embedded systems carrying out the operations of the client engine as described further below.

Client media player 14 also includes typical computer components (not shown), such as a motherboard, central processing unit (CPU), random access memory (RAM), hard disk drive, other storage media such as diskette drive, CD-

ROM, flash-ROM, tape drive, PCMCIA cards and/or other removable media, keyboard, mouse and/or other user interface means, a modem, and/or other conventional input/output devices.

Client media player **14** also has loaded in RAM an operating system (not shown) such as UNIX®, WINDOWS® XP or the like. Client media player **14** further has loaded in RAM a media client application program **18** such as Real Player™, Windows™ Media Player, Apple Quicktime™ Player, or other appropriate media client application for playing audio and/or video via client media player **14**. Client media player **14** also has loaded in its RAM client engine software **30**, which is discussed in more detail below.

Client media player **14** further includes a conventional sound card **20** connected to speakers **22**. As is known in the art, the media client application **18** will generally play audio signals through the sound card device **20** and speakers **22**. For example, audio streams, audio files, audio CDs, and other audio sources are communicated from the client application **18** to the sound card **20** for output. The sound card **18** then produces the audio signal via speakers **22**.

Client media player **14** also includes a conventional video card **24** connected to a display means **26**. As is known in the art, the media client **18** will generally play video content through the video card **24**, which then produces an appropriate video signal suitable for display on the display means **26**. The display means **26** may be a standard monitor, LCD, or other appropriate display apparatus. Client media player **14** also includes a Network Interface **28** for communication with other computers using an appropriate network protocol. The network interface **28** may comprise a network interface card (NIC), a modem, ISDN (Integrated Services Digital Network) adapter, ADSL (Asynchronous digital subscriber line) adapter or other suitable network interface.

Client media player **14** is networked for communication with lookup server **12**. Typically, client media player **14** is operatively coupled to communicate with lookup server **12** via an Internet connection **32** through a phone connection using a modem and telephone line (not shown), in a standard fashion. The user of client media player **14** will typically dial the user's Internet service provider (ISP) (not shown) through the modem and phone line to establish a connection between the client media player **14** and the ISP, thereby establishing a connection between the client media player **14** and the Internet **32**. Generally, lookup server **12** is also connected to the Internet **32** via a second ISP (not shown), typically by using a fast data connection such as T1, T3, multiple T1, multiple T3, or other conventional data connection means (not shown). Since computers connected to the Internet are themselves connected to each other, the Internet **32** establishes a network communication between client media player **14** and server **12**. One skilled in the art will recognize that a client may be connected to any type of network including but not limited to a wireless network or a cellular network. Generally, client media player **14** and lookup server **12** communicate using the IP (internet protocol). However, other protocols for communication may also be utilized, including PPTP, NetBEUI over TCP/IP, and other appropriate network protocols.

Client media player **14** and server **12** can alternatively connect to the Internet **32** using, a network means, wireless means, satellite means, cable means, infrared means or other means for establishing a connection to the Internet, as alternatives to telephone line connection. Alternative means for networking client media player **14** and server **12** may also be utilized, such as a direct point to point connection using modems, a local area network (LAN), a wide area network (WAN), wireless connection, satellite connection, direct port

to port connection utilizing infrared, serial, parallel, USB, FireWire/IEEE-1394, ISDN, DSL and other means known in the art.

In general, client engine **30** is a software application executing within the client media player **14**. However, client engine **30** may also be an embedded system carrying out the functions described herein and suitable for use with various media player platforms. Client engine **30** comprises a sampling unit **34**, an intercept unit **36**, and a user interface **38**.

The intercept unit **36** carries out the operation of monitoring the client media player **14** for media content of a work presented thereon, typically by media client application **18**, but may be from any media source. In operation, the intercept unit **36** monitors audio signals transmitted from the media client **18** to the sound card **20** and/or video signals transmitted from the media client **18** to the video card **24**. The intercept unit **36** may also monitor the operations of other hardware (not shown) suitable for communicating audio and/or video signals, such as USB, IEEE standard 1394 connections, and analog input devices (such as microphones). For example, in a media player comprising a mobile stereo system, the intercept unit **36** intercepts the audio signal played on thereon.

Preferably, the intercept unit **36** maintains a FIFO (first in first out) buffer **40** of fixed size (150 seconds, for example) for storing media content of a work played on the client media player **14**, and from which media samples of the work are created by sampling unit **34**. The operation of the intercept unit is further described below in conjunction with FIG. 4.

The sampling unit **34** carries out the operation of creating a media sample from the media content of a work played on the client media player **14**. In operation, the sampling unit **34** creates a media sample from the FIFO buffer **40** maintained by the intercept unit **36**. The sampling unit **34** may create media samples according to a predetermined or user-defined interval or upon the request of user of the client media player **14**. For example, user requests may be received via commands issued using the user-interface **38**.

As noted above, the media sample created by the sampling unit **34** typically comprises a "digital fingerprint" using conventional digital signal processing known in the art. For example, a sound file may be sampled according to its acoustic/perceptual features over time. One example of such a digital signal processing technique is described in U.S. Pat. No. 5,918,223 issued to Blum which is hereby incorporated by reference as if set forth in its entirety. Other examples are described in PCT application number WO200444820 having inventors Jin S. Seo, Lap A. Haitisma and Antonius A. C. M. Kalker and assigned to Koninklijke Philips Electronics and PCT application number WO03091990 having inventors Daniel Culbert and Avery Li-Chun Wang and assigned to Shazam Entertainment, Ltd. The media sample generated by sampling unit **34** is then transmitted to the lookup server **12** for further processing, as described in further detail below.

The user interface **38** carries out the operation of receiving commands from a user of the client media player **14**, and displaying content-related information to the user. The user interface **38** may be any conventional interfaces including, for example, a graphical user interface (GUI), a command line user interface (CLUI), a voice recognition interface, a touch screen interface, a momentary contact switch on a stereo system, or other appropriate user interface.

In operation, a user may issue a request for content-related information via the user-interface **38**. This request is communicated to the sampling unit **34** for further processing. As described above, in response to such a request, the sampling unit **34** creates a media sample from the media content of a work being played on the client media player **14** and transmits

the sample to the lookup server **12** for further processing. In response, the lookup server **12** provides the information related to the work, if available, to the client media player. This content-related information of the work is received by the user interface **38** which then displays the received information to the user of the client media player **14**.

The server engine **16** is a software application executing within the lookup server **12**. Server engine **16** comprises a lookup unit **42** and a log unit **44**. Lookup unit **42** is operatively coupled for communication with a media database **46**. Log unit **44** is operatively coupled for communication with a log database **48**.

The lookup unit **42** carries out the operation of receiving media samples from the client media player **14** and comparing the media samples to a collection of samples of the media content of known works (reference samples). The collection of reference samples of known works will typically reside in an in-memory structure (designated **47**). Upon initialization of the lookup unit **42**, the collection of reference samples of known works from the media database **46** is stored in the in-memory structure **47**.

The lookup unit **42** sequentially compares each reference sample of known works in structure **47** to the media sample provided by the media player **14**. The lookup unit will cut a media sample of the received work into a series of overlapping frames, each frame the exact size of the particular reference sample under examination. The lookup unit **42** will then compare the reference sample to every possible "frame" of information within the media samples of the known works and compute a "distance" between each frame and the reference sample. This process repeats for each reference sample. The reference sample which has the smallest distance to any frame in the sample is considered for a match. If this distance is below a predefined threshold, a match is considered to be found.

When a match is determined, the information related to the matching record of the known work is returned to the client media player for presentation thereon. This content-related information of a work may include such information as song title, artist, and album name, for example. The content-related information may also include product fulfillment information, such as how and where to purchase media containing the media sample, advertising banners, and/or promotional offers, for example. This content-related information of the work is transmitted back to the client media player **14** for further processing thereon.

The log unit **44** carries out the operation of tracking media requests made by the users of the client media player **14** to the lookup server **12**. The log unit **44** maintains a plurality of information related to the requests made by the user including, for example, media type, genre or category. This user information is maintained in the log database **48**.

Media database **46** and log database **48** comprise conventional relational database storage facilities. Thus, media database **46** may comprise one or more tables (not shown) for storing data associated with the media content samples of known works and related content-specific information (song name, title, album name, etc.) of the known works. In general, another computer (not shown) may be connected to the lookup server **12** for entering the content-specific media information into the media database **46**. Log database **46** may comprise one or more tables (not shown) for storing data associated with users and the user's related media content requests.

Referring now to FIG. 2, there is generally shown a functional block diagram of a media content identifying system **50** having a plurality of client nodes in accordance with the invention.

System **50** comprises a lookup server **54** operatively coupled for communication with a plurality of client media players **52a** through **52n** via Internet connection **32**. System **50** operates in substantially the same manner as system **10** described above. That is, lookup server **54** operates in the same manner as lookup server **12**, and clients **52a** through **52n** operate in the same manner as client media player **14**. However, in system **50**, lookup server **12** handles a plurality of media sample identification requests from the client **52a** through **52n**.

As depicted in FIG. 2, clients **52a** through **52n** communicate with lookup server **54** using the HTTP (hypertext transfer protocol) over IP. Although http is used in the example, one skilled in the art will recognize that any suitable protocol may be used. More particularly, the media sample signal generated by each client **52a** through **52n** is wrapped using a transport protocol before being transmitted over HTTP to lookup server **54** for processing. When lookup server **54** receives the HTTP transmission from the client media player, a transport protocol converts ("unwraps") the signal for processing therein by the server engine. Likewise, before transmitting content-related information retrieved from the media database to the appropriate client media player, the information is first wrapped using the transport protocol. The content-related information may be communicated using "XML" tags, or other appropriate programming, scripting, or markup language. The appropriate client media player upon receiving the transmission from the lookup server **54** unwraps the signal for processing therein by the client engine.

The method and operation of the invention will be more fully understood by reference to the flow charts of FIG. 3 through FIG. 5. The order of acts as shown in FIG. 3 through FIG. 5 and described below are only exemplary, and should not be considered limiting.

Referring now to FIG. 3, as well as FIG. 1 and FIG. 2, there is shown the processes associated with the client engine **30** in accordance with the invention. As described above, the client engine **30** is a software application or embedded system operating within a client media player for identifying media content played via the client media player.

At process **100**, the client engine **30** is initiated. The client engine **30** may be initiated by the user of client media player **14** or may initiate automatically upon the recognition of media content being played via the sound card **20** and/or the video card **24**. Box **110** is then carried out.

At box **110**, the intercept unit **36** is initiated. As described above, the intercept unit **36** carries out the operation of monitoring media content of a work played on client media player **14** (typically via sound card **20** and/or video card **24**). The processes of the intercept unit **36** are described more fully below in conjunction with FIG. 4. After the intercept unit **36** is initiated, box **120** is then carried out.

At box **120**, a user request for media information is received via user interface **38**. This request is communicated from the user interface **38** to the sampling unit **34** for further processing. Box **130** is then carried out.

At box **130**, the sampling unit **34** creates a media sample from the media data of a work contained in the FIFO buffer **40**. The media sample created by the sampling unit **34** comprises a "digital fingerprint" using conventional digital signal processing known in the art. As noted above, a sound file may be sampled according to its acoustic/perceptual features over time. Box **14** is then carried out.



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At box 140, the sampling unit 34 transmits the media sample created from box 130 to the lookup server 12 for content identification and content-related information. In the illustrative system depicted in FIG. 1 and FIG. 2, the media sample is first wrapped in a transport protocol and then communicated over IP (HTTP) via network interface 28. Box 150 is then carried out.

At box 150, the client media player 14 receives from the lookup server 12 the content-related information of the work requested in box 140. The process for generating the content-related information by the lookup server 12 is described in further detail below in conjunction with FIG. 5. This content data is first received via the network interface 28, unwrapped using the appropriate transport protocol and then communicated to the client engine 30. In the client engine 30, the user interface 38 receives the content-related information, and parses the data according to the appropriate format (XML tags, for example) transmitted by the lookup server 12. Box 160 is then carried out.

At box 160, the user interface 38 presents the content-related information of the work to the user via video card 24 and display 26, or other display device such as an LCD screen, or standard broadcast television. As described above, this content-related information of the work may include such information as song title, artist, and album name, for example. The content-related information of the work may also include product fulfillment information, such as how and where to purchase media containing the media sample, advertising banners, and/or promotional offers, for example.

Referring now to FIG. 4, there is generally shown the processes associated with the media intercept unit 36 in accordance with the invention. In general, the media intercept unit 36 maintains a FIFO buffer of predetermined size (150 seconds, for example) of media content played via client media player 14, 52a through 52n.

At process 200, the intercept unit 36 is initiated. This is carried out from box 110 of FIG. 3, during the start up of the client engine software 30. Box 210 is then carried out.

At box 210, the intercept unit 36 monitors the media hardware devices of the client media player 14. As described above, the media hardware devices may comprise a sound card 20 and/or a video card 24. Other hardware devices suitable for playing media content are also monitored by the intercept unit 36. Diamond 220 is then carried out.

At diamond 220, the intercept unit 36 determines whether any media hardware devices are playing media content of a work. If the intercept unit 36 determines that media content is currently being played, diamond 230 is carried out. Otherwise box 210 is repeated.

At diamond 230, the intercept unit 36 determines whether the FIFO buffer 40 is currently full. If the buffer is determined to be full, box 240 is carried out. Otherwise, box 250 is carried out.

At box 240, the intercept unit 36 has determined that all the buffer 40 is full and deletes the older sample in the buffer. As noted above, the FIFO buffer 40 is commonly configured with a predetermined size. For example, if the sampling rate is 22 KHz (HiloHertz), the oldest  $1/22,000^{\text{th}}$  of a second sample would be deleted, and the newest  $1/22,000^{\text{th}}$  of a second sample would be added to the buffer. Using this method, the intercept unit 36 is able to maintain the most recent one hundred fifty (150) seconds of media content of a work played via client media player 14. Box 250 is then carried out.

At box 250, the intercept unit 36 stores the media content of the work currently being played on client media player 14 into the FIFO buffer 40. Box 210 is then repeated to continue monitoring media hardware devices.

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Referring now to FIG. 5, there is generally shown the processes associated with the server engine 16 and the lookup server 12 in accordance with the invention. It is noted that the lookup server 12 is structured and configured to handle a plurality of requests from a plurality of client media players as depicted in FIG. 2 above.

Prior to box 300 as described below, the in-memory structure 47 is populated with reference media samples of known works. Upon initialization of the lookup unit 42, the collection of reference samples from the media database 46 is stored in the in-memory structure 47.

At box 300, the lookup server 12 receives a media sample request from one of the client media players 14, 52a through 52n. As described above, such requests are generally communicated over an Internet connection 32, although any suitable network connection may also be used. The request is first received via network interface 17 via the IP (HTTP) protocol or other suitable protocol. An appropriate transport protocol unwraps the message and communicates the request to the server engine 16 for processing. Box 310 is then carried out.

At box 310, the lookup unit 42 sequentially compares each reference sample of the known works in structure 47 to the media sample of the work provided by the media player 14, 52a through 52n, as described above. The lookup unit will cut the media sample into a series of overlapping frames, each frame the exact size of the particular reference sample under examination. The lookup unit 42 will then compare the reference sample to every possible "frame" of information within the media sample and compute a "distance" between each frame and the reference sample. This process repeats for each reference sample. Diamond 320 is then carried out.

At diamond 320, the lookup unit 42 determines whether a match was obtained. As noted above, the reference sample of the known work which has the smallest distance to any frame in the sample is considered for a match. If the distance is below a predefined threshold, a match is considered to be found. If a match is determined, box 330 is then carried out. Otherwise box 350 is carried out.

At box 330, the media sample from box 300 matches a corresponding record in the media database 46, and the lookup unit 42 retrieves the content-related information of the known work associated with the matching record in the media database 46. As noted above, this content-related information may include such information as song title, artist, album name, for example as well as other information such as product fulfillment information such as a sponsor or an advertiser. Box 340 is then carried out.

At box 340, the content-related information of the known work obtained in box 330 is transmitted to the client media player submitting the media sample request in box 300. In the preferred embodiment, this transmission is carried out over the Internet using the IP (HTTP) protocol or other suitable protocol. Box 370 is then carried out to generate a log.

At box 350, the lookup unit 42 has determined that the media sample of the work from box 300 does not match any reference sample in the in-memory structure 47. Box 360 is then carried out.

At box 360, a notice indicating that the requested information is not available is transmitted to the requesting client media player of box 300. Box 370 is then carried out.

At box 370 the log process is initiated. This log process involves tracking the user and related-media information associated with the request of box 300. The log unit 44 maintains a plurality of information related to the requests made by the user including, for example, media type, genre or category. This user information is maintained in the log database

48 and may be used for various marketing strategies, including analyzing user behavior, for example.

Accordingly, it will be seen that this invention provides an apparatus and method which provides real-time media content-related information to users viewing media content over a personal computer, or other data processing means. Although the description above contains many specificities, these should not be construed as limiting the scope of the invention but as merely providing an illustration of the presently preferred embodiment of the invention. Thus the scope of this invention should be determined by the appended claims and their legal equivalents.

The invention claimed is:

**1.** A method comprising:

receiving a media sample by a computing device executing a server engine, the media sample having been created by a media device from a segment of media content, wherein the media content was at least a portion of a streamed or broadcast work received by the media device, the segment being a portion of the media content that is less than an entirety of the work, and the media sample comprising a digital fingerprint based on perceptual features of the segment;

identifying, by the computing device, a known work of a plurality of known works that corresponds to the streamed or broadcast work based on comparing the media sample to a plurality of reference samples from the plurality of known works, wherein comparing the media sample to a reference sample from a known work comprises:

dividing the media sample into a series of overlapping frames, each frame comprising a distinct digital fingerprint and having a size that corresponds to a size of the reference sample;

making comparisons between one or more of the overlapping frames and the reference sample for the known work; and

for each comparison between a frame of the media sample and the reference sample of the known work, computing a distance value representative of a similarity between the frame and the reference sample, wherein the known work is determined to correspond to the work if a computed distance value between any frame of the media sample and the reference sample of the known work is lower than a threshold;

transmitting, by the computing device, content-related data associated with the identified known work, wherein the content-related data is received by a client device and wherein the client device comprises the media device; receiving a log of user activity generated by the client device, wherein the log is based on the content-related data; and

transmitting an offer for purchase of at least one of a product or a service related to said content-related data based on said log, wherein the offer is received by the client device.

**2.** The method of claim **1**, wherein the work is at least one of an audio rendering or a video rendering.

**3.** The method of claim **1**, wherein the perceptual features comprise acoustical features including at least one of brightness, pitch and loudness.

**4.** The method of claim **1**, wherein the content-related information comprises at least one of a title of the work, an artist of the work, a name of an album associated with the work or product fulfillment information associated with the work.

**5.** A non-transitory machine-readable storage medium having instructions that, when executed by a processing device, cause the processing device to perform a method comprising:

receiving a media sample by the processing device, the media sample having been created by a media device from a segment of media content, wherein the media content was at least a portion of a streamed or broadcast work received by the media device, the segment being a portion of the media content that is less than an entirety of the work, and the media sample comprising a digital fingerprint based on perceptual features of the segment; identifying, by the processing device, a known work of a plurality of known works that corresponds to the streamed or broadcast work based on comparing the media sample to a plurality of reference samples from the plurality of known works, wherein comparing the media sample to a reference sample from a known work comprises:

dividing the media sample into a series of overlapping frames, each frame comprising a distinct digital fingerprint and having a size that corresponds to a size of the reference sample;

making comparisons between one or more of the overlapping frames and the reference sample for the known work; and

for each comparison between a frame of the media sample and the reference sample of the known work, computing a distance value representative of a similarity between the frame and the reference sample, wherein the known work is determined to correspond to the work if a computed distance value between any frame of the media sample and the reference sample of the known work is lower than a threshold;

transmitting, by the computing device, content-related data associated with the identified known work, wherein the content-related data is received by a client device and wherein the client device comprises the media device;

receiving a log of user activity generated by the client device, wherein the log is based on the content-related data; and

transmitting an offer for purchase of at least one of a product or a service related to said content-related data based on said log, wherein the offer is received by the client device.

**6.** The non-transitory machine-readable storage medium of claim **5**, wherein the work is at least one of an audio rendering or a video rendering.

**7.** The non-transitory machine-readable storage medium of claim **5**, wherein the perceptual features comprise acoustical features including at least one of brightness, pitch and loudness.

**8.** The non-transitory machine-readable storage medium of claim **5**, wherein the content-related information comprises at least one of a title of the work, an artist of the work, a name of an album associated with the work or product fulfillment information associated with the work.

**9.** A computing device comprising:

a memory comprising instructions for a server engine; and a processing device, coupled to the memory, to execute the instructions, wherein the instructions cause the processing device to:

receive a media sample created by a media device from a segment of media content, wherein the media content was at least a portion of a streamed or broadcast work received by the media device, the segment being a portion of the media content that is less than an

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entirety of the work, and the media sample comprising a digital fingerprint based on perceptual features of the segment;

identify a known work of a plurality of known works that corresponds to the streamed or broadcast work based on comparison of the media sample to a plurality of reference samples from the plurality of known works, wherein for the comparison of the media sample to a reference sample from a known work the processing device is to:

divide the media sample into a series of overlapping frames, each frame comprising a distinct digital fingerprint and having a size that corresponds to a size of the reference sample;

make comparisons between one or more of the overlapping frames and the reference sample for the known work; and

for each comparison between a frame of the media sample and the reference sample of the known work, compute a distance value representative of a similarity between the frame and the reference sample, wherein the known work is determined to correspond to the work if a computed distance

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value between any frame of the media sample and the reference sample of the known work is lower than a threshold;

transmit content-related data associated with the identified known work, wherein the content-related data is received by a client device and wherein the client device comprises the media device;

receive a log of user activity generated by the client device, wherein the log is based on the content-related data; and

transmit an offer for purchase of at least one of a product or a service related to said content-related data based on said log, wherein the offer is received by the client device.

**10.** The computing device of claim **9**, wherein the perceptual features comprise acoustical features including at least one of brightness, pitch and loudness.

**11.** The computing device of claim **9**, wherein the content-related information comprises at least one of a title of the work, an artist of the work, a name of an album associated with the work or product fulfillment information associated with the work.

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