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(54) INDEXING MULTIMEDIA WEB CONTENT

(71) Applicant: **CastTV Inc.**, San Francisco, CA (US)

(72) Inventors: **Edwin Seng Eng Ong**, San Francisco, CA (US); **Aleksandra R. Vikati**, San Francisco, CA (US)

(73) Assignee: **CastTV Inc.**, San Francisco, CA (US)

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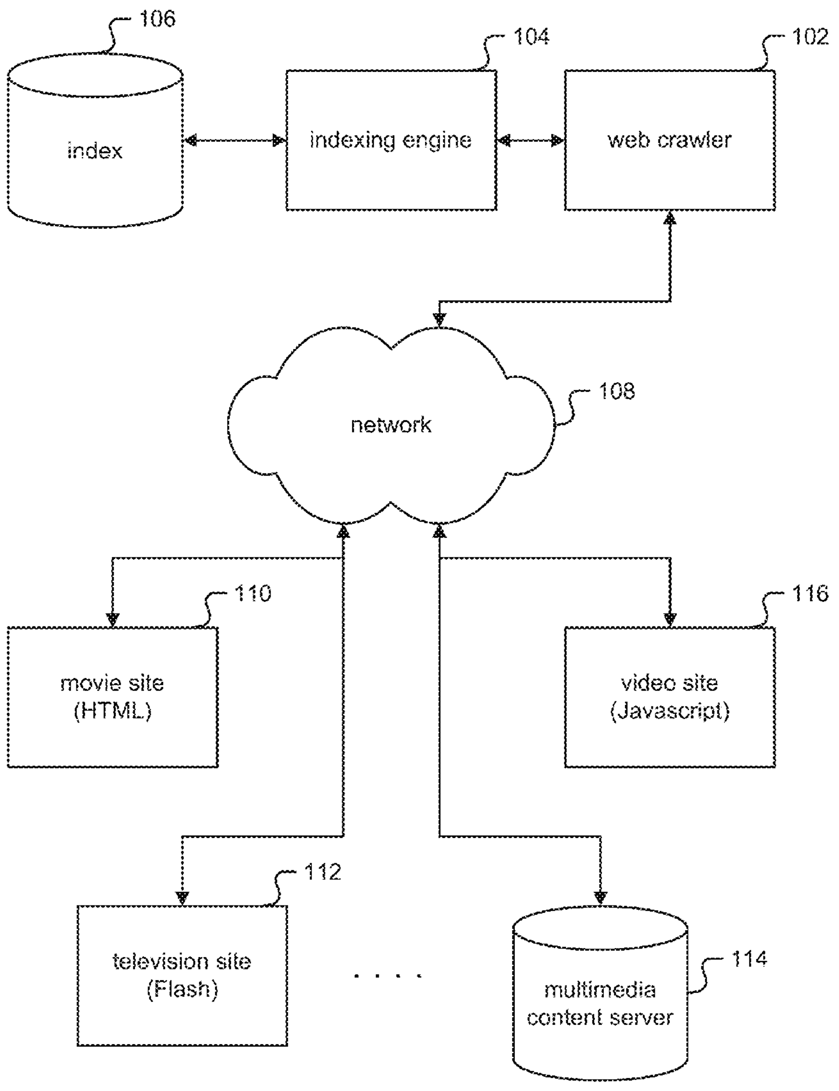
(57) **ABSTRACT**

A method of indexing multimedia content is disclosed. An element associated with a multimedia content is located in a display page. A potential multimedia content data file is identified through automated processing of data associated with the display page. An index data associated with one or more of the following: the display page, the multimedia content, and the potential multimedia content data file, is generated by processing the potential multimedia content data file.



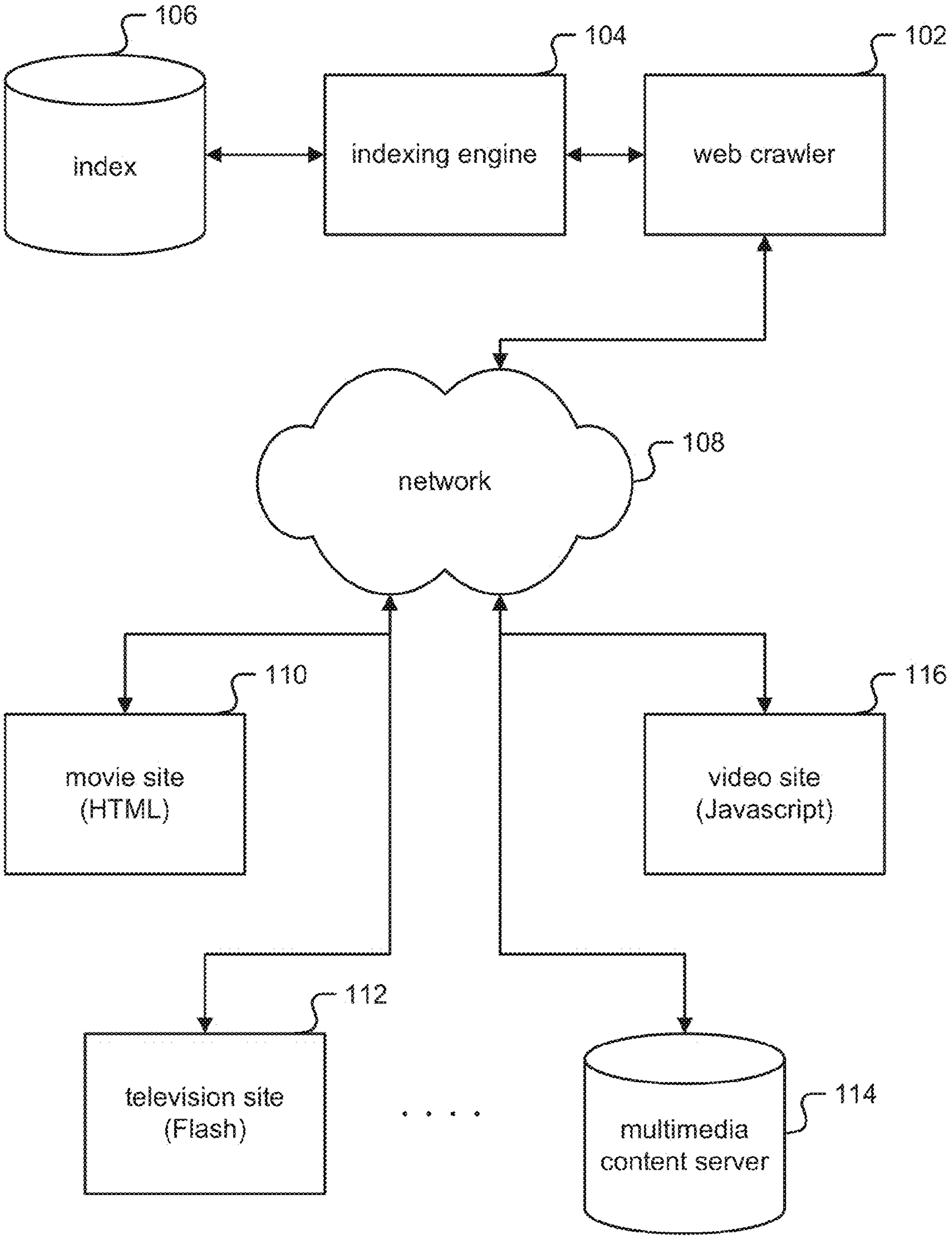

106
index
104
indexing engine
102
web crawler
network
108
110
movie site (HTML)
116
video site (Javascript)
112
television site (Flash)
. . . .
114
multimedia content server

FIG. 1

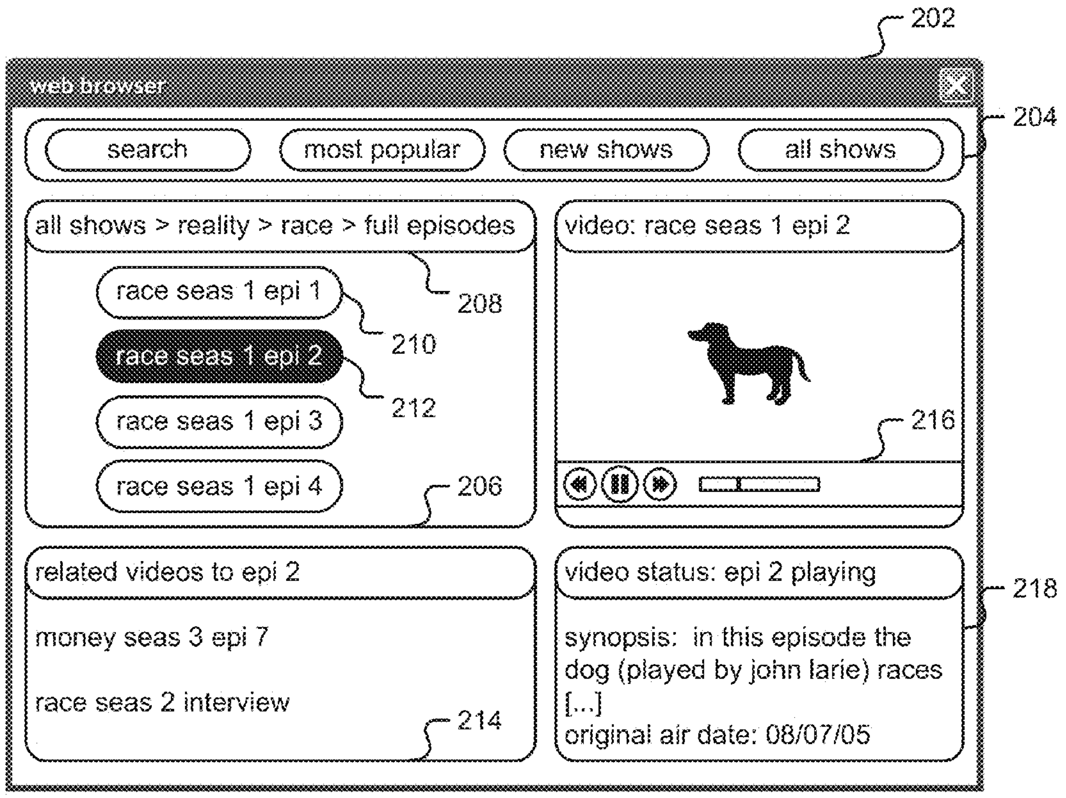

202
web browser
204
search
most popular
new shows
all shows
all shows > reality > race > full episodes
race seas 1 epi 1
race seas 1 epi 2
race seas 1 epi 3
race seas 1 epi 4
208
210
212
206
video: race seas 1 epi 2
216
related videos to epi 2
money seas 3 epi 7
race seas 2 interview
214
video status: epi 2 playing
synopsis: in this episode the dog (played by john larie) races [...]
original air date: 08/07/05
218

FIG. 2

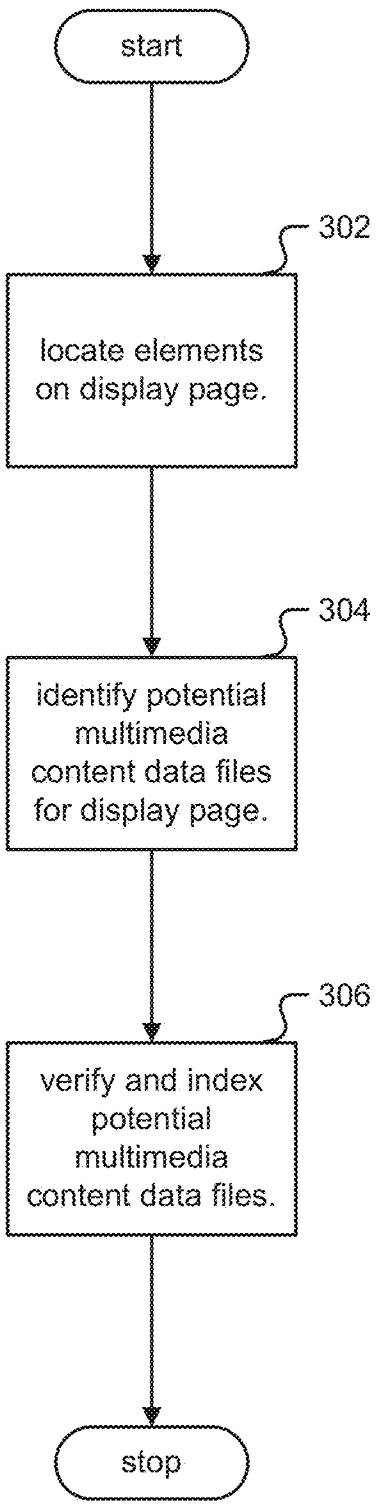

start
302
locate elements on display page.
304
identify potential multimedia content data files for display page.
306
verify and index potential multimedia content data files.
stop

FIG. 3

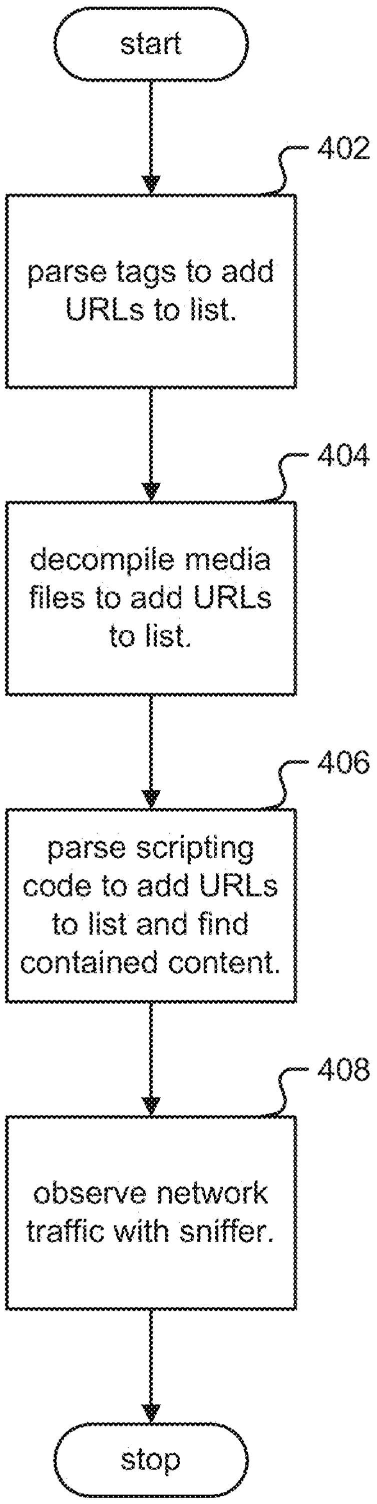

start
402
parse tags to add URLs to list.
404
decompile media files to add URLs to list.
406
parse scripting code to add URLs to list and find contained content.
408
observe network traffic with sniffer.
stop

FIG. 4

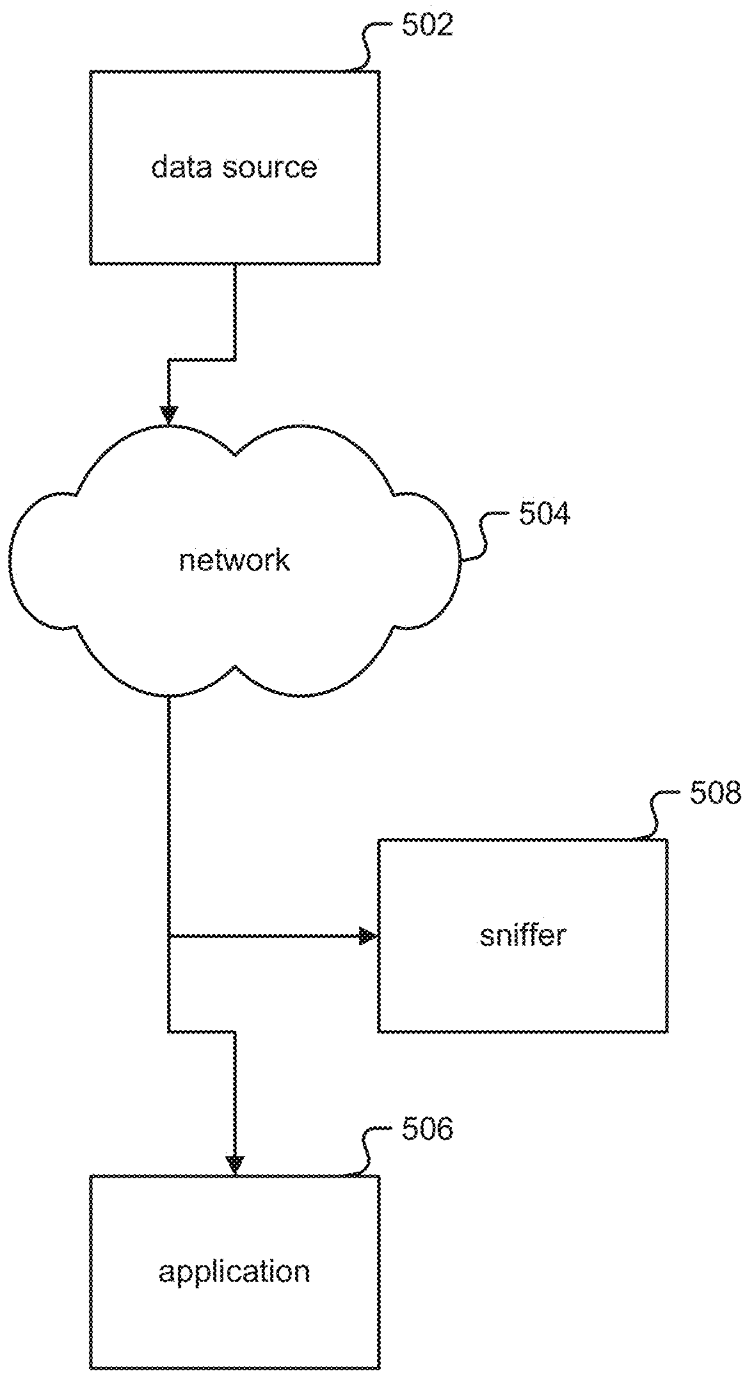


FIG. 5

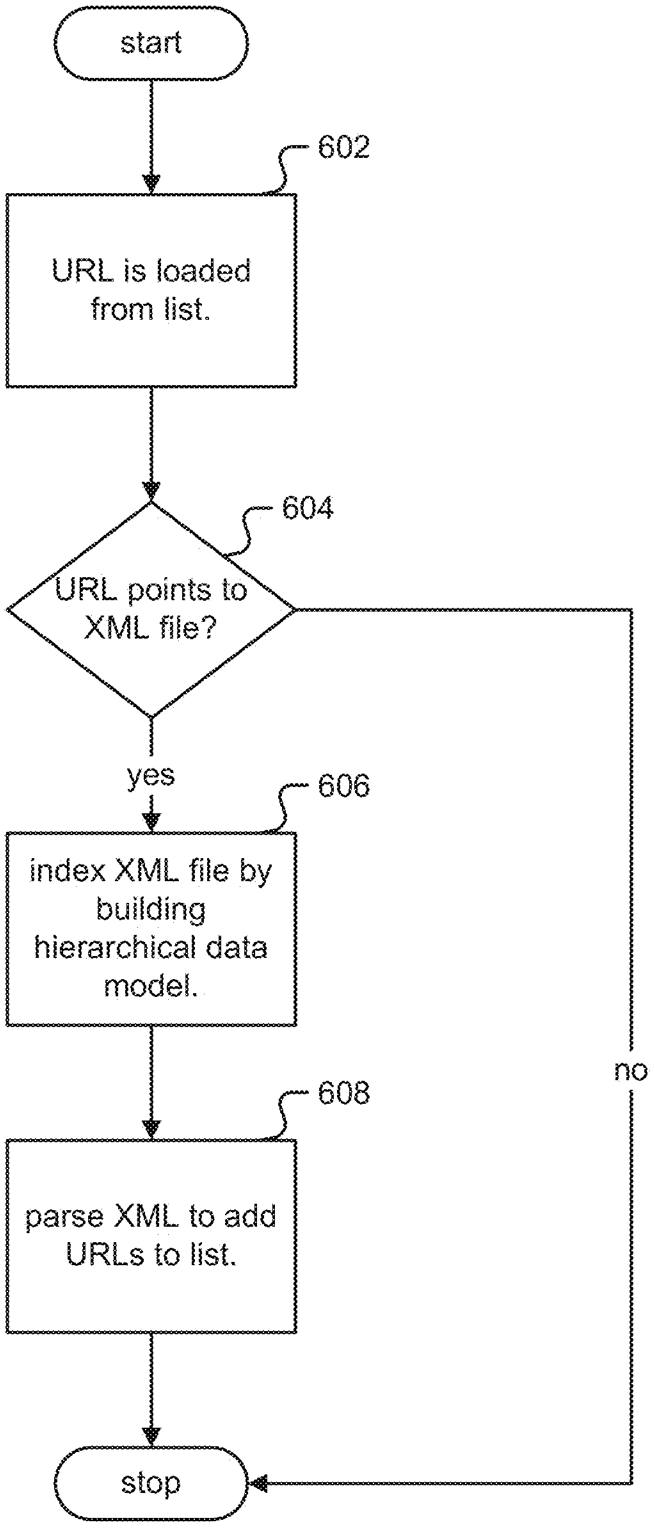

start
602
URL is loaded from list.
604
URL points to XML file?
yes
no
606
index XML file by building hierarchical data model.
608
parse XML to add URLs to list.
stop

FIG. 6

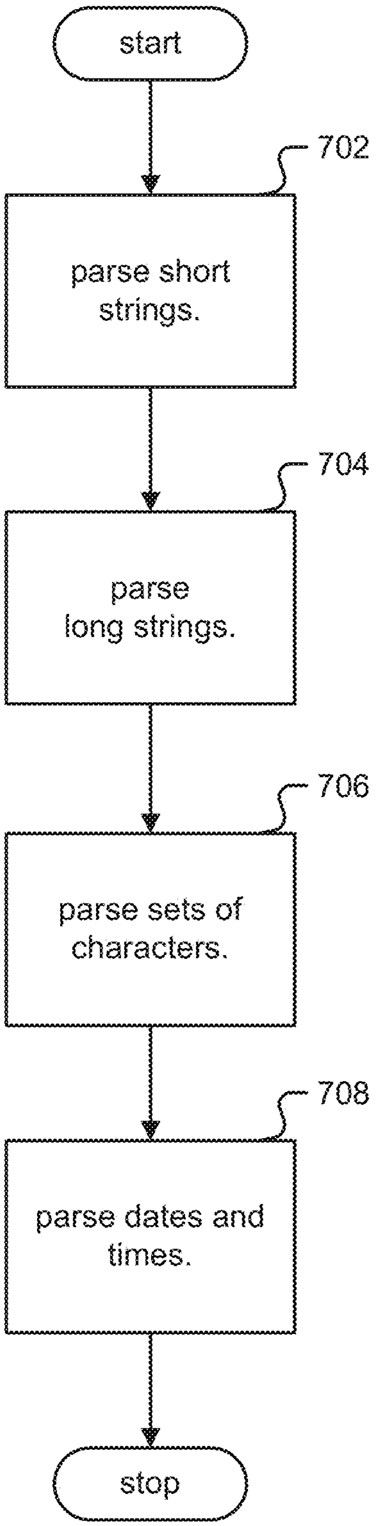

start
702
parse short strings.
704
parse long strings.
706
parse sets of characters.
708
parse dates and times.
stop

FIG. 7

INDEXING MULTIMEDIA WEB CONTENT

CROSS REFERENCE TO OTHER APPLICATIONS

[0001] This application is a continuation of co-pending U.S. patent application Ser. No. 11/891,289 (Attorney Docket No. CASTP001) entitled INDEXING MULTIMEDIA WEB CONTENT filed Aug. 8, 2007 which claims priority to U.S. Provisional Patent Application No. 60/821,703 entitled TECHNIQUES FOR LOCATING, EXTRACTING, AND INDEXING MULTIMEDIA WEB CONTENT filed Aug. 8, 2006 which are incorporated herein by reference for all purposes.

BACKGROUND OF THE INVENTION

[0002] With the advent of broadband, there is an increasingly large volume of video, audio, and other multimedia content being posted to the Internet and the World Wide Web ("web"). A significant portion of multimedia content is delivered via dynamic formats to web browsers with the appropriate dynamic format modular interface ("plug-in"). Unlike regular web pages, dynamic formats may not be programmed in Hypertext Markup Language ("HTML"). Rather, the code is typically compiled into a different format, which is embedded on a web page and played by a web browser's appropriate plug-in. Certain other multimedia products also follow a similar delivery pattern.

[0003] Web crawlers are programs that locate web content. While dynamic formats provide a rich, interactive experience, they present a challenge for web crawlers. Traditional web crawlers are built to parse HTML and other text content by following hypertext links, and automatically submitting forms in order to crawl database-driven information that is not accessible by following links alone. But traditional web crawlers are not able to fully crawl all relevant data upon encountering many web pages in dynamic formats.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] Various embodiments of the invention are disclosed in the following detailed description and the accompanying drawings.

[0005] FIG. **1** is a block diagram illustrating an embodiment of a system for indexing actual and/or potential multimedia content data files and/or other rich content.

[0006] FIG. **2** is a diagram illustrating an embodiment of a display page configured to provide access to multimedia or other rich content.

[0007] FIG. **3** is a flowchart illustrating an embodiment of a process to locate, extract and index multimedia content data files.

[0008] FIG. **4** is a flowchart illustrating an embodiment of a process to identify potential multimedia content data files.

[0009] FIG. **5** is a block diagram illustrating an embodiment of a system configured to use a sniffer to observe network traffic between a data source and an application.

[0010] FIG. **6** is a flowchart illustrating an embodiment of a process to verify and index potential multimedia content data files.

[0011] FIG. **7** is a flowchart illustrating an embodiment of a heuristic to build a standard data model.

DETAILED DESCRIPTION

[0012] The invention can be implemented in numerous ways, including as a process, an apparatus, a system, a composition of matter, a computer readable medium such as a computer readable storage medium or a computer network wherein program instructions are sent over optical or communication links. In this specification, these implementations, or any other form that the invention may take, may be referred to as techniques. A component such as a processor or a memory described as being configured to perform a task includes both a general component that is temporarily configured to perform the task at a given time or a specific component that is manufactured to perform the task. In general, the order of the steps of disclosed processes may be altered within the scope of the invention.

[0013] A detailed description of one or more embodiments of the invention is provided below along with accompanying figures that illustrate the principles of the invention. The invention is described in connection with such embodiments, but the invention is not limited to any embodiment. The scope of the invention is limited only by the claims and the invention encompasses numerous alternatives, modifications and equivalents. Numerous specific details are set forth in the following description in order to provide a thorough understanding of the invention. These details are provided for the purpose of example and the invention may be practiced according to the claims without some or all of these specific details. For the purpose of clarity, technical material that is known in the technical fields related to the invention has not been described in detail so that the invention is not unnecessarily obscured.

[0014] Locating, extracting, and indexing multimedia web content is disclosed. In some embodiments, a display page is processed to locate a page element that may be associated with an external multimedia content file, such as an external XML file, which is a data file rather than an actual media file, like a video file itself The page element is used in some embodiments to determine a locator, such as a URL, associated with an external file. If the external file is determined to contain multimedia content data, e.g., XML data, a data model of the file is built. The data model is used in some embodiments, either directly or indirectly by generating an index entry based thereon, to determine whether the multimedia content with which the external XML file is associated and/or the display page with which it is associated is/are responsive to a query. In some embodiments, data models for content files associated with different websites are normalized to facilitate search for multimedia content across websites.

[0015] FIG. **1** is a block diagram illustrating an embodiment of a system for indexing actual and/or potential multimedia content data files and/or other rich content. In the example shown, web crawler **102** locates, extracts and indexes actual and/or potential multimedia content data files. Web crawler **102** is connected to an indexing engine **104** that maintains the index **106** database. Web crawler **102** is also connected to a network **108**; a public or private network and/or combination thereof, for example the Internet, an Ethernet, serial/parallel bus, intranet, Local Area Network ("LAN"), Wide Area Network ("WAN"), and other forms of connecting multiple systems and/or groups of systems together.

[0016] The network **108** connects web crawler **102** with a variety of different web sites each of which may include or reference multimedia or other rich content. As shown in FIG. **1**, examples of web sites that may include or reference multimedia or other rich content include a movie site **110**, a television site **112**, a multimedia content server **114**, and a video site **116**. In the example shown in FIG. **1**, the movie site **110** comprises one or more display pages written primarily in HTML, the video content of which may be accessible directly to a traditional web crawler/search engine configured to parse HTML. By contrast, in the example shown in FIG. **1** the television site **112** makes video content, e.g., teasers, trailers, and/or entire episodes of shows, as Flash content.

[0017] Depending on the implementation, such content may be embedded in a display page in a form that a Flash or other browser plug-in can render, an SWF file for example, or the display page may include a Flash element or component that causes the browser Flash plug-in to retrieve and render an external file, such as an external XML file, that includes the content data. In some embodiments, the multimedia content is actually contained within the JavaScript block in the HTML display page rather than in an external file. In the example shown in FIG. **1**, the display pages of video site **116** include or point to JavaScript or other code configured to retrieve and/or to cause a browser or browser plug-in to retrieve video or other content data store in an external XML file. Multimedia content is not always stored within a web site, and in the example shown in FIG. **1**, network **108** connects web crawler **102** with at least one multimedia content server **114** that provides multimedia content to a web site like sites **110**, **112**, and/or **116**.

[0018] FIG. **2** is a diagram illustrating an embodiment of a display page configured to provide access to multimedia or other rich content. Examples of a web site that may include a page such as the one shown in FIG. **2** include web sites **110**, **112**, and **116**. Display page **202** shows the layout of the page as rendered by a browser.

[0019] Display page **202** includes a quick reference frame **204**, which allows the user to search multimedia content data files, see the most popular multimedia content data files, see new multimedia content data files, or browse all multimedia content data files. A browser frame **206** allows the user to browse through a hierarchy of multimedia by genre.

[0020] In the example shown in FIG. **2**, the browser frame **206** includes a navigation subframe **208**, which shows the hierarchy from browsing all shows, to a focus on a “reality show” genre, to a focus on a specific reality show called “race”, to a focus on all full episodes available. In some systems the multimedia content data files are interpreted by the web site to output the display in subframe **208**. Also within the browser frame **206** in this example are the multimedia content data files available with the given focus in subframe **208**. One example would be the first episode from season 1 of race, represented by button **210**. In the example shown, the user has selected the second episode from season 1 of race, represented by highlighted button **212**.

[0021] In the example shown in FIG. **2**, the page **202** also includes a related content frame **214** that shows related multimedia content data files to the multimedia content data file highlighted in button **212**. In some systems the multimedia content data files are interpreted by the web site to output the display in frame **214**. In the example shown in FIG. **2**, the display page **202** also includes a frame **216** in which the multimedia content is rendered, including controls for the viewing. In the example shown in FIG. **2**, the display page **202** also includes a synopsis frame **218**, which may include a title, a description, authors, producers, directors, cast, crew, ratings, run times, and release dates for the multimedia content data being rendered in frame **216**.

[0022] Many existing web sites use code other than HTML to make multimedia or other rich content available via a display page such as display page **202**. In some embodiments, Flash or Javascript or other formats and/or code may be used to make multimedia or other rich content available via a page such as display page **202**. In some cases, the actual multimedia content data file may be stored in an eXtensible Markup Language (“XML”) or other file stored externally to the display page and/or a server on which the display page resides. For example, such an external XML or other content file may be stored on an external multimedia content server such as server **114**. Locating, extracting and indexing such multimedia content data files is disclosed.

[0023] FIG. **3** is a flowchart illustrating an embodiment of a process to locate, extract and index multimedia content data files. The process may be implemented in web crawler **102**.

[0024] In step **302**, the display page **202** is analyzed to locate elements associated with multimedia content. In some embodiments this includes locating elements, such as HTML tags, that indicate multimedia content made available using technologies such as Flash or JavaScript. Examples of page elements associated with multimedia content include OBJECT, EMBED, and similar tags.

[0025] In some embodiments, the web crawler **102** finds elements on the HTML in display page **202**. In some embodiments, tags are included as elements. The web crawler **102** is configured to locate multimedia made available in formats like Flash or other multimedia web content by first finding the OBJECT, EMBED and other tags in the HTML comprising a display page such as display page **202**. Such tags may be used, for example, to embed or point to a multimedia content file, such as a Flash SWF (“SWF”) file. In some embodiments, the web crawler **102** finds the tags by regular expressions or Document Object Model (“DOM”) traversal.

[0026] In step **304**, a potential multimedia content data file is identified for display page **202** based on the elements located in step **302**. A list of potential multimedia content data files is built.

[0027] In step **306**, each entry in the list of potential multimedia content data files is loaded to verify whether the potential multimedia content data file contains multimedia content. In some embodiments the actual multimedia content is in XML. Each verified multimedia content data file is indexed, for example by processing one or more XML tags comprising the file to build a data model of the file. In some embodiments, the data model mirrors the model of the XML file. For each tag in the XML file, a corresponding category is created in the data model. For tags that are sub-tags of other tags, the parent-child relationship is captured in the data model.

[0028] FIG. **4** is a flowchart illustrating an embodiment of a process to identify potential multimedia content data files. In some embodiments, the process of FIG. **4** is included in **304** of FIG. **3**. The process may be implemented in web crawler **102**.

[0029] In step **402**, multimedia-related HTML tags included in the display page are parsed to locate any available pointers to potential multimedia content data files. In some embodiments, these pointers are Uniform Resource Locators (“URLs”) that point to potential multimedia content data files.

[0030] In some embodiments, the web crawler **102** parses the tag by parsing tag attributes, the tag body (which is content enclosed by the open and closed tags), and any URL argument that is part of the attributes or tag body. Upon locating a URL, the URL is added to the XML file list. The web crawler **102** continues this step until all URLs are added to the XML file list.

[0031] In step **404**, media files, if any, embedded in and/or linked to by the display page, such as a SWF file, are decompiled into source code, which source code is then scanned for any available pointers to potential multimedia content data files. In some embodiments, this includes scanning the binary source code for plain text URLs. Upon encountering a URL, the URL is added to the XML file list. The web crawler **102** continues this step until all URLs are added to the XML file list.

[0032] In step **406**, the web crawler **102** locates scripting code on the display page **202**. In some embodiments, the scripting code includes JavaScript. The code may be inline or located in a referenced external script file. In some embodiments, JavaScript external scripts may be referenced using the SCRIPT tag technique, for example using <SCRIPT SRC="external_file.js></SCRIPT> to refer to a script file named external_file.js. The web crawler **102** does the same with the frame parent or pop-up parent of display page **202**, if any exist. The web crawler **102** scans the scripting code to find any available pointers to potential multimedia content data files, or potential multimedia content data files actually contained within the scripting code.

[0033] In some embodiments, the web crawler **102** executes the scripting code via a code interpreter to locate additional pointers to potential multimedia content data files that are not evident by scanning un-interpreted script code alone. Upon encountering a URL, the URL is added to the XML file list. The web crawler **102** continues this step until all URLs are added to the XML file list.

[0034] In step **408**, a sniffer may be used to observe network traffic between a data source and the web crawler **102**. An analysis of the observed network traffic may infer additional pointers to potential multimedia content data files by parsing the sniffer output to identify potential multimedia content data files by locating tags and formats, or reconstruct obfuscated data.

[0035] In some embodiments, the process of FIG. **4** includes and/or is controlled at least in part by logic that omits one or more of steps **402**, **404**, **406**, and **408** depending on whether any URL's and/or potential multimedia content files have been located. For example, in some embodiments step **408** is performed only if no potential multimedia content files have been located after completing steps **402**, **404**, and **406**.

[0036] FIG. **5** is a block diagram illustrating an embodiment of a system configured to use a sniffer to observe network traffic between a data source and an application. This system may be implemented to process step **408**.

[0037] Data source **502** represents a source for the data in display page **202** with data coming either from a web site like television site **112**, or multimedia content server **114**. Data source **502** is connected to a network **504**; a public or private network and/or combination thereof, for example the Internet, an Ethernet, serial/parallel bus, intranet, Local Area Network ("LAN"), Wide Area Network ("WAN"), and other forms of connecting multiple systems and/or groups of systems together. The application **506** is also connected to network **504** to data source **502**, and an example of application **506** is web crawler **102**.

[0038] Sniffer **508** is set up to observe web traffic between data source **502** and application **506**. In some embodiments, the sniffer is optimized to analyze HyperText Transfer Protocol ("HTTP") traffic, and parses the HTTP traffic to recognize XML data as comprising or being associated with a potential multimedia content data file. In some embodiments, the sniffer identifies an XML file by parsing and identifying XML tags using regular expressions or DOM traversal. The sniffer **508** is useful in instances where either the pointer to multimedia content data files or multimedia content data files themselves are intentionally or unintentionally obfuscated within display page **202**.

[0039] FIG. **6** is a flowchart illustrating an embodiment of a process to verify and index potential multimedia content data files. In some embodiments, the process of FIG. **6** is included in **306** of FIG. **3**. The process may be implemented in web crawler **102**.

[0040] In step **602**, a pointer to a potential multimedia content data file is loaded from the list of pointers. In some embodiments, a URL is loaded from an XML file list. If it is determined in step **604** that the pointer points to a multimedia content data file, then control is transferred to step **606**. In some embodiments this can be determined by examining the loaded page for XML tags.

[0041] In step **606**, the web crawler **102** proceeds to index the multimedia content data file. In some embodiments, for each XML file, a data model is built. The data model "mirrors" the model of the XML file. For each tag in the XML file, a corresponding category is created in the data model. For tags that are sub-tags of other tags, the parent-child relationship is captured in the data model.

[0042] In some embodiments, a data model is a relational database. A table is created for each type of tag encountered. For example, if the XML file contains the tag <category>, a table is created for the <category> tag. Multiple occurrences of the same tag are entered as rows. For example, if both <category>Movie</category> and <category>TV</category> occur in the same file, two rows, one with value "Movie" and one with value "TV" are entered in the category table. To express parent-child relationship, an additional table or column can be created to express such a relationship. For example, if <subcategory>Drama</subcategory> is a sub-tag of <category>TV</category>, then the row which contains "Drama" in the subcategory table may have an additional column with the value being the ID of the row that contains "TV" in the category table.

[0043] By standardizing categories, a normalized index database **106** can be searched with the same search terms for different web sites **110**, **112**, and **114**. For example, by searching for a date, a search engine utilizing the index database **106** can find television air dates, movie release dates and video production dates that all match the searched dates.

[0044] In step **608**, for tag values or attributes that are pointers to potential multimedia content data files or URLs, the pointers or URLs are added to the XML file list for indexing.

[0045] FIG. **7** is a flowchart illustrating an embodiment of a heuristic to build a standard data model. In some embodiments, the process of FIG. **7** is included in **606** of FIG. **6**. The process may be implemented in web crawler **102**.

[0046] In step **702**, if the data type of a table is a short string, then a potential mapping to test includes using the values as titles of the multimedia content, or genres of the multimedia content. For example, a title may refer to the title of a television series or the title of a movie. In some embodiments, the mapping is tested by matching known values. In some embodiments, if a short string cannot be mapped and the heuristic fails, an exception is generated for human interaction and mapping. In some embodiments, a mapping received via user input, e.g., via a user interface, is learned in the sense that the association between a particular element of the data model and an information type to which it maps, e.g., title, is stored and used to generate the appropriate mapping without further human interaction when building subsequently a data model of a subsequently processed multimedia content file from the same source.

[0047] In step **704**, if the data type of a table is a long string or paragraph, then a potential mapping to test includes using the values as a description of the multimedia content. For example, a description may include a synopsis of a television episode or description of a movie. Within the description, proper names may be identified as authors, producers, directors, cast, or crew. In some embodiments, the mapping is tested by matching known values. In some embodiments, if a long string cannot be mapped and the heuristic fails, an exception is generated for human interaction and mapping.

[0048] In step **706**, if the data type of a table is a string of one or more characters included in a set of strings associated with a content rating, then a potential mapping to test includes using the values as a rating of the multimedia content. For example, a rating may include a Motion Pictures Association of America ("MPAA") rating. In some embodiments, the mapping is tested by matching known values such as "G", "PG, "PG-13", "R", and "NC-17." In some embodiments, if a string cannot be mapped and the heuristic fails, an exception is generated for human interaction and mapping.

[0049] In step **708**, if the data type of a table is a date or time, then a potential mapping to test includes using the values as a release date or runtime of the multimedia content. Throughout this specification a "release date" refers to any date related to the multimedia content, for example an airdate for a television show, a release date for a movie, or a production date for a video. A runtime refers to the play length of the multimedia content. In some embodiments, the mapping is tested by matching known values. In some embodiments, if a date or time cannot be mapped and the heuristic fails, an exception is generated for human interaction and mapping.

[0050] Although the foregoing embodiments have been described in some detail for purposes of clarity of understanding, the invention is not limited to the details provided. There are many alternative ways of implementing the invention. The disclosed embodiments are illustrative and not restrictive.

What is claimed is:

1. to **23**. (canceled)

24. A method, comprising:

locating in a display page an element associated with a multimedia content;

identifying through automated processing of data associated with the display page a binary multimedia application code;

decompiling the binary multimedia application code;

using a sniffer to parse network traffic to identify a potential multimedia content data file by parsing HTTP traffic to recognize XML files by identifying XML tags using regular expressions or DOM traversal;

applying a heuristic to the potential multimedia content data file that associates a short string as a title; a long string as a description; a string included in a set of rating strings as a rating; and a date as a release date; and

using the application of the heuristic to build a data model of the potential multimedia content data file.

25. A method as recited in claim **24**, wherein the element is a tag.

26. A method as recited in claim **24**, wherein the element is an OBJECT tag or an EMBED tag.

27. A method as recited in claim **24**, wherein the automated processing comprises one or more of the following: finding a URL in the element, decompiling a multimedia application code associated with the element, finding a script embedded in the display page, or monitoring a network communication associated with the display page.

28. A method as recited in claim **24**, wherein the potential multimedia content data file comprises XML.

29. A method as recited in claim **24**, wherein the potential multimedia content data file is contained within a script.

30. A method as recited in claim **24**, wherein the potential multimedia content data file is external to the display page.

31. A method as recited in claim **24**, wherein the potential multimedia content data file is stored externally to a system on which the display page resides.

32. A method as recited in claim **24**, wherein the display page comprises HTML.

33. A method as recited in claim **24**, wherein processing of data includes identifying through further automated processing of data a nested binary multimedia application code.

34. A method as recited in claim **24**, further comprising using the data model to determine that the multimedia content is responsive to a query.

35. A method as recited in claim **24**, further comprising using the data model to determine that the multimedia content is responsive to a search query.

36. A method as recited in claim **24**, wherein to build the data model comprises applying a heuristic and generating an exception for human interaction if the heuristic fails.

37. A method as recited in claim **24**, wherein the data model is implemented using a relational database.

38. A method as recited in claim **24**, wherein the data model is implemented using a relational database such that each element type represents a table.

39. A method as recited in claim **24**, wherein the data model is normalized when compared with a second data model associated with a second display page.

40. A method as recited in claim **24**, further comprising using the data model to determine that the multimedia content data file is responsive to a query, and if it responsive to the query, returning data identifying the display page.

41. A system, comprising

a processor; and

a memory coupled with the processor, wherein the memory is configured to provide the processor with instructions which when executed cause the processor to:

locate in a display page an element associated with a multimedia content;

identify through automated processing of data associated with the display page a binary multimedia application code;

decompile the binary multimedia application code;

use a sniffer, coupled to the processor, to parse network traffic to identify a potential multimedia content data file by parsing HTTP traffic to recognize XML files by identifying XML tags using regular expressions or DOM traversal;

apply a heuristic to the potential multimedia content data file that associates a short string as a title; a long string as a description; a string included in a set of rating strings as a rating; and a date as a release date; and

use the application of the heuristic to build a data model of the potential multimedia content data file.

42. A system as recited in claim **41**, further comprising using the data model to determine that the multimedia content is responsive to a search query.

43. A computer program product, the computer program product being embodied in a computer readable storage medium and comprising computer instructions for:

locating in a display page an element associated with a multimedia content;

identifying through automated processing of data associated with the display page a binary multimedia application code;

decompiling the binary multimedia application code;

using a sniffer to parse network traffic to identify a potential multimedia content data file by parsing HTTP traffic to recognize XML files by identifying XML tags using regular expressions or DOM traversal;

applying a heuristic to the potential multimedia content data file that associates a short string as a title; a long string as a description; a string included in a set of rating strings as a rating; and a date as a release date; and

using the application of the heuristic to build a data model of the potential multimedia content data file.

* * * * *