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LOCAL CONTENT CACHING

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ABSTRACT

A content caching system caches content, predicted to be streamed in the future, locally at a device, thereby, enabling faster access to the content for a user of the device. The system indexes metadata describing content being offered by a media streaming application. Further, the system receives information about past content previously accessed by a user on the media streaming application. Based on the indexed metadata and the received information, the system determines content that will be accessed by the user in the future. Then, the system sends information about the determined content to be cached at the media streaming application. Further, the media streaming application caches the determined content locally at the device.

PROBLEM STATEMENT

Internet connected set-top boxes and other media devices are commonly used to stream online content to televisions. This content is delivered when users request the content from a media streaming application. If the network and/or media service is overloaded at a time when a user has requested content, it can delay streaming of the requested content. Extreme delays may further cause requests for content to time out, leaving the user unable to stream the content. This results in an unsatisfactory user experience. A more advanced and convenient system for streaming and caching content from the Internet is described.

CONTENT CACHING SYSTEM

The systems and techniques described in this disclosure relate to a content caching system. The system can be implemented for use in an Internet, an intranet, or another client and server environment. The system can be implemented locally on a client device or implemented across a client device and server environment. The client device can be any electronic device such as a mobile device, a smartphone, a tablet, a handheld electronic device, a wearable device, a set-top box, media streaming device, etc.

Fig. 1 illustrates an example method 100 for caching media content. The method can be performed by a system that manages caching of media content, for example, the content caching system. An example content caching system 200 that can be implemented at an electronic device is illustrated in Fig. 2. All the functions performed by the content caching system 200 can be performed by a processor of the electronic device executing instructions stored in a memory of the device. The electronic device can be a set-top box, media streaming device, or any other device that facilitates streaming of online content to televisions.

The system 200 indexes metadata describing content being offered by a media streaming application (Block 102). Media streaming applications 206 can include any application provided by a third-party on-demand media streaming provider capable of streaming content. The system indexes metadata describing content that is offered for streaming by a media streaming application 206. Media streaming applications 206 can stream content via associated application servers 208.

The system can index metadata describing the content via an Application Programming Interface (API) provided by the media streaming service. The APIs for various media streaming services can enable the system to interface with the various media streaming applications to obtain the metadata describing the content that can be accessed via the respective media streaming applications. The metadata can include data about the content such as title, release date, contributing parties (e.g., actors, directors, producers, writers, etc.), genre, whether it is an individual purchase or available as a subscription service, etc.

Further, the system receives information about past content previously accessed by a user on the media streaming application (Block 104). The system can receive information about past content previously accessed on one or more media streaming applications by the user. The system retrieves this information that is stored in a user data module 202 at the electronic device. Alternatively, or additionally, the system receives the information from the media streaming applications, which tracks content accessed by the user. Alternatively, or additionally, the system can retrieve the information from any other local memory at the electronic device or a cloud storage associated with the device. For example, if the user previously accessed/purchased episodes 1-4 of Season 7 of "Big Bang Theory" on a media streaming application, the system can receive this information from the media streaming application. The system can receive this information via the API from the media streaming application. As a further example, if the user previously accessed and watched episode 1 of Season 2 of "Sherlock" via another media streaming application, this information can be received by the system from local memory storage that has stored a history of content the user has previously streamed.

Based on the indexed metadata and the received information about past content previously indexed by the user, the system determines content that will be accessed by the user in the future (Block 106). For example, if the user previously used a media streaming application to stream episodes 1-4 of Season 1 of “Star Trek” over the previous four nights, the system can determine that it is likely for the user to stream episode 5 tonight.

In determining what content will be accessed by the user in the future, the system can determine a confidence score for content represented by the indexed metadata. The confidence score for a particular content can be based on a similarity to past content streamed by the user, e.g., similarity in actors, directors, genre, writers, and/or a logical progression to past content streamed by the user, e.g., next episodes in TV series previously streamed by the user. For example, the system will determine a higher confidence score for a movie with similar actors and directors than a movie with no similar actors or directors when compared to movies previously streamed by the user. As a further example, the system will determine a higher confidence score for episodes in a TV series the user has already seen other episodes for than a TV series in which the user has seen no episodes for. The system can determine that any content with a confidence score that satisfies a predetermined threshold score will be accessed by the user in the future. The system can use other information to determine or predict content that is likely to be accessed by the user. For example, the system can identify what has been previously accessed or watched, how much has been watched, and using which media streaming application. The system then sends information about the determined content to the media streaming application for caching (Block 108). The system uses the API provided by the media streaming application to send the information about the determined content to the media streaming application 206. Further, on receiving information about the determined content, the media streaming application can request and receive content from the associated application server. The media streaming application can further cache the determined content in a local cache 204. Additionally, or alternatively, based on the confidence score, the media streaming application can either cache just the first few minutes of the content to speed up initial playback or cache the entire content so that the user can play it back regardless of network connectivity. For example, if the confidence score for a particular media content is very high, the system can cache the entire content from the media streaming application. However, if the confidence score for the particular media content is relatively low, the system can cache only first few minutes of the content from the media streaming application.

The media streaming application can automatically cache the determined content, if the user has already purchased or has a subscription for the determined content. Additionally, or alternatively, if the system determines that the user is likely to purchase some content, the media streaming application can cache the content. For example, if the user had purchased Community Season 1, Episodes 1-4, from the media streaming application over the previous four nights, the system can predict that the user will purchase episode 5 tonight from the media streaming application. In this case, the content can be cached by the media streaming application in an encrypted form. Later, if the user does decide to purchase episode 5, then, the media streaming application can send the decryption key to the system and the episode can be decrypted and played. As the system has knowledge about all the content the user is consuming via any media streaming application, the system allows for improved local caching of content from any media streaming application.

FIG. 3 is a block diagram of an exemplary environment that shows components of a system for implementing the techniques described in this disclosure. The environment includes client devices 310, servers 330, and network 340. Network 340 connects client devices 310 to servers 330. Client device 310 is an electronic device. Client device 310 may be capable of requesting and receiving data/communications over network 340. Example client devices 310 are personal computers (e.g., laptops), mobile communication devices, (e.g. smartphones, tablet computing devices), set-top boxes, game-consoles, embedded systems, and other devices 310' that can send and receive data/communications over network 340. Client device 310 may execute an application, such as a web browser 312 or 314 or a native application 316. Web applications 313 and 315 may be displayed via a web browser 312 or 314. Server 330 may be a web server capable of sending, receiving and storing web pages 332. Web page(s) 332 may be stored on or accessible via server 330. Web page(s) 332 may be associated with web application 313 or 315 and accessed using a web browser, e.g., 312. When accessed, webpage(s) 332 may be transmitted and displayed on a client device, e.g., 310 or 310'. Resources 318 and 318' are resources available to the client device 310 and/or applications thereon, or server(s) 330 and/or web pages(s) accessible therefrom, respectively. Resources 318' may be, for example, memory or storage resources; a text, image, video, audio, JavaScript, CSS, or other file or object; or other relevant resources. Network 340 may be any network or combination of networks that can carry data communication.

The subject matter described in this disclosure can be implemented in software and/or hardware (for example, computers, circuits, or processors). The subject matter can be implemented on a single device or across multiple devices (for example, a client device and a server device). Devices implementing the subject matter can be connected through a wired and/or wireless network. Such devices can receive inputs from a user (for example, from a mouse, keyboard, or touchscreen) and produce an output to a user (for example, through a display). Specific examples disclosed are provided for illustrative purposes and do not limit the scope of the disclosure.

DRAWINGS

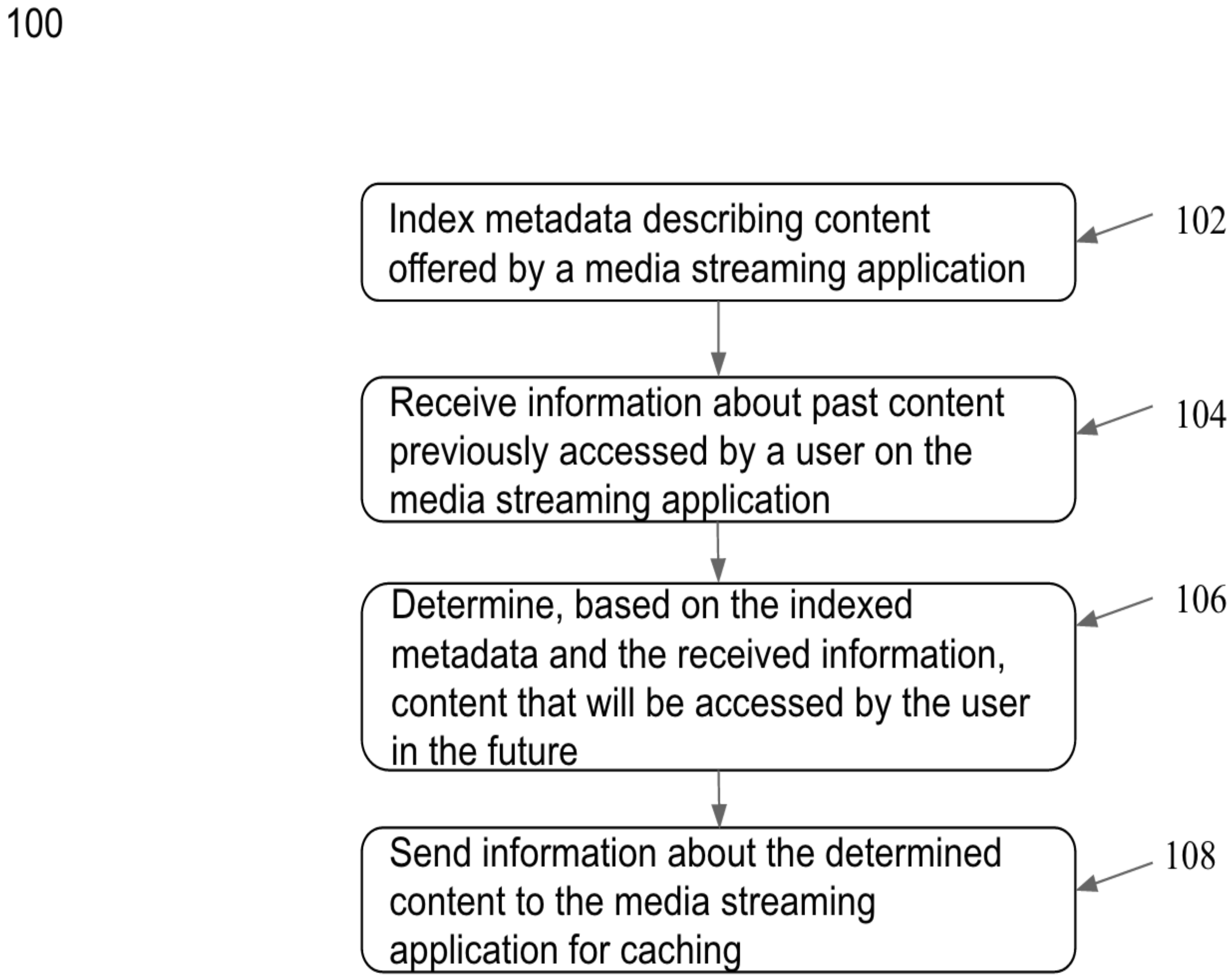
100
Index metadata describing content offered by a media streaming application
102
Receive information about past content previously accessed by a user on the media streaming application
104
Determine, based on the indexed metadata and the received information, content that will be accessed by the user in the future
106
Send information about the determined content to the media streaming application for caching
108

Fig. 1

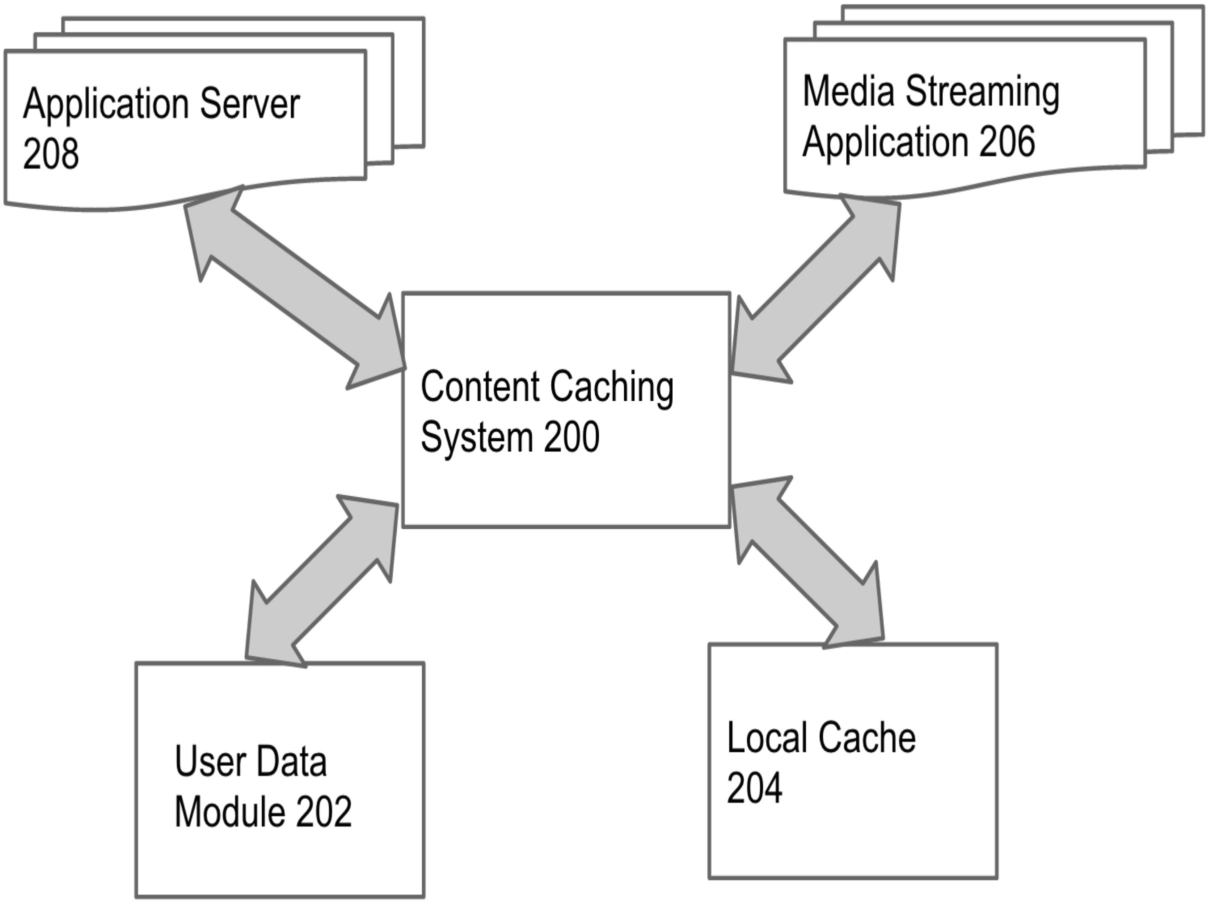
Application Server 208
Media Streaming Application 206
Content Caching System 200
User Data Module 202
Local Cache 204

Fig. 2

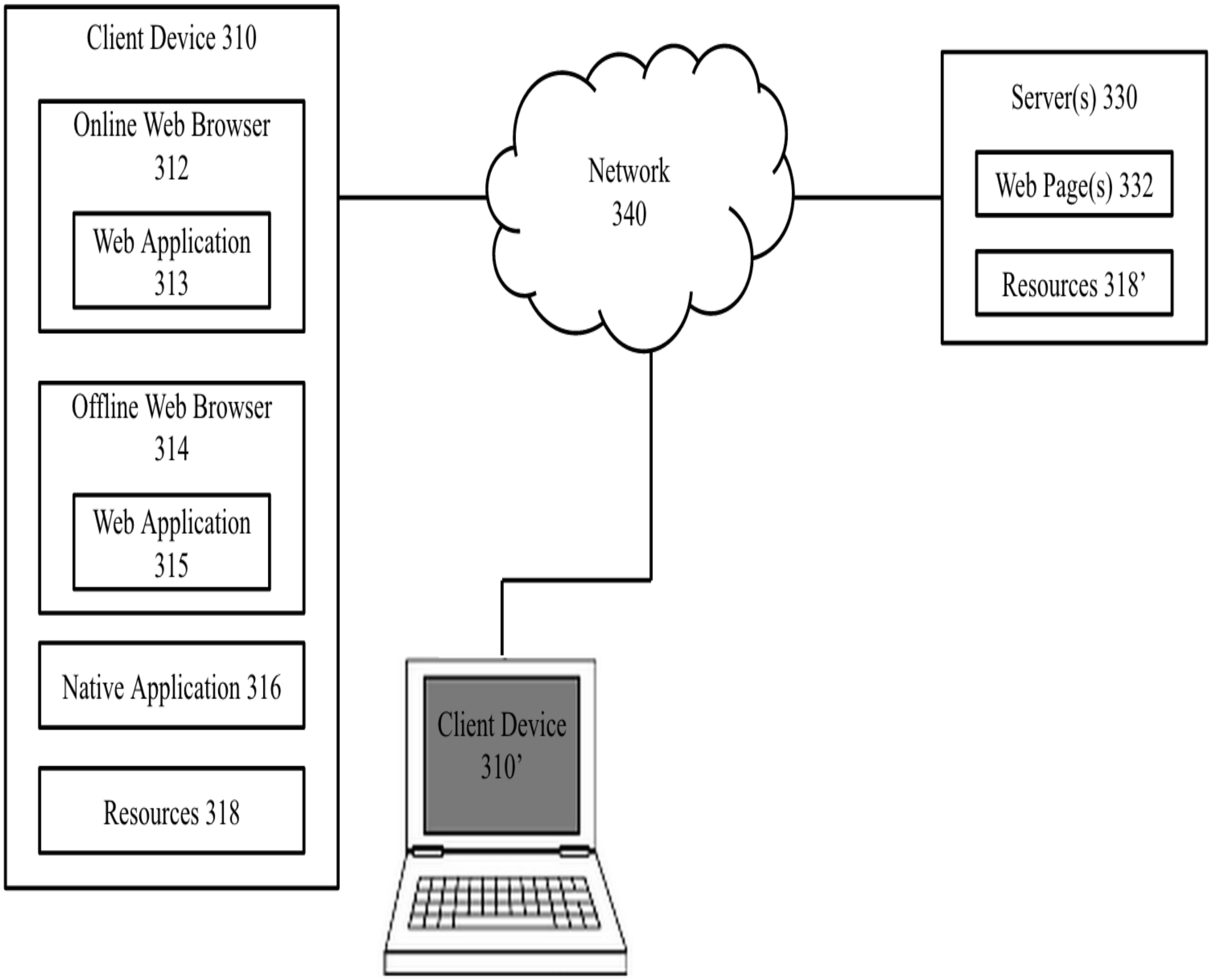
Client Device 310
Online Web Browser 312
Web Application 313
Offline Web Browser 314
Web Application 315
Native Application 316
Resources 318
Network 340
Server(s) 330
Web Page(s) 332
Resources 318'
Client Device 310'

Fig. 3