

METHOD AND SYSTEM FOR UNIFIED CACHING OF MEDIA CONTENT

RELATED APPLICATIONS

[0001] The present application is related to, incorporates by reference and hereby claims the priority benefit of the following India Patent Application, assigned to the assignee of the present application: India Patent Application No. 551/CHE/2005, filed May 11, 2005, entitled "Method and system for Unified Caching of Media Content."

FIELD

[0002] The present invention relates to streaming media and, more specifically, to a technique for unified caching of media content.

BACKGROUND

[0003] In multimedia broadcast over a computer network, such as the Internet, users may request and receive a data stream (e.g., a media stream) broadcast over the network. In this context, the media data stream is a digitized form of video, audio, and/or other multimedia that may be broadcast over the network and presented to a user. "Streaming" is a process by which a media file can begin playing on the client before it has been completely downloaded. The data is broken by the streaming process into many packets sized appropriately for the bandwidth available between the client and server. Each data packet generally comprises "payload" data appended to one or more network headers that define the packet's routing through the network. When the client has received enough packets, the user's media player software can be playing one packet, decompressing another and receiving a third. The user can begin listening to or viewing the requested content almost immediately, without having to download the entire media file.

[0004] In general, the broadcasting server communicates with one or more clients in the network according to a client/server model of information delivery. In this model, the client may comprise an application, such as a conventional web browser, executing on a computer that "connects" to the server over a computer network, such as a point-to-point link, shared local area network (LAN), wide area network (WAN), or virtual private network (VPN) implemented over a public network such as the Internet. Each client may request a data stream from the server by issuing messages, usually in the form of packets, to the server.

[0005] The server is a computer that provides a requested media data stream to one or more clients. The media data stream may be stored in a data storage medium, such as a magnetic disk, attached to the server. In this case, the server may be a file server ("filer") configured to provide file service relating to the information stored in its attached storage devices. Alternatively, rather than storing the data stream in a form of mass storage medium attached to the server, the data stream may reside in the server's memory or buffer cache. Thus, the server may be configured as a "network cache" that provides clients access to media data streams stored in its "in-core" memory, i.e., random-access memory (RAM), or media data streams stored on one or more mass storage devices (e.g., disks) associated with the network cache. For instance, the server may be a NetCache® device made by Network Appliance, Inc. of Sunnyvale,

Calif., a proprietary application that manages file access requests for information stored in a computer's in-core memory.

[0006] A media player software installed on the client may be configured to accept streaming media in a particular format. The content provided to the user in response to a request for streaming data should be in the same format as indicated in the request. Some of the existing streaming media formats are Real Time Streaming Protocol (RTSP) and the Microsoft® Media Server (MMS). RTSP is a method of delivering streaming media content via the Internet in real-time. RTSP uses Real-Time Transport Protocol (RTP) to format packets of multimedia content.

[0007] Each media format is transmitted utilizing an associated streaming media protocol. The MMS protocol is used to transfer streaming data packets in the MMS format, while the RTSP protocol is used to transfer streaming data packets in the RTP format. The Windows Media Server HTTP streaming protocol (also called MMS over HTTP) is also used to transfer streaming data packets in the MMS format. Some versions of media players require streaming data in the MMS format, while other versions require streaming data in the RTP format.

[0008] When a media player opts for streaming data either via MMS or RTSP protocol, the data packets that the media player receives are encapsulated in a corresponding media format. A data packet received in the MMS format has an associated MMS header, while a data packet received in the RTP format has an associated RTP header. A data packet received in the MMS over HTTP format has an associated MMS header as well as an additional MMS over HTTP header.

[0009] A network cache may be used to provide streaming media to clients. In order to serve any media client that uses the RTSP or the MMS protocol, a network cache needs either to retrieve the content from its mass storage facility or to get the content from the origin server. If the requested content is stored on the network cache in a format that is different from the requested format, the network cache would have to fetch the requested content again from the origin server and store a copy of the content in the requested format. Consequently, twice the amount of disk space is used in order to cache the same content in different formats.

[0010] Caching two copies of the same data (payload) in order to accommodate streaming media requests over different streaming media protocols is inefficient, because it may cause twice the amount of disk space to be used in order to cache a particular content fetched via different control protocol, which, in turn, results in the network cache being able to cache only half of the number of potential unique streams. If fewer streams can be cached, the network cache may need to fetch more streams from the origin servers in order to accommodate client requests, which may result in diminished bandwidth savings.

[0011] Furthermore, when the disk space associated with the network cache approaches the limits of its capacity, the network cache needs to throw away (eject) data (e.g., the least recently used data) from its disk in order to cache the latest or fresh data. Thus, extra processing is required to handle the clients' requests, which may have a negative impact on the performance of the network cache.