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Multimedia Streaming and Related Issues

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Abstract: **Audio/Video Streaming services enable us to watch videos or listen to music from anywhere and from any web enabled multimedia device like our personal computers or smart phones. All that the user requires other than a personal computer or a smart device are Internet connection and a user account on the service's website. This will allow users to enjoy music anytime-while driving a car, taking an evening walk etc.. The need for Multimedia streaming arises from the following factors: First, storage capacities of our devices are limited .It is not possible to store all our favourite music/video files in them. Also new songs/videos are being added to the already existing list of millions of songs/videos on a weekly or monthly basis. Therefore, it is more convenient to stream from a service to our personal computers or smart devices connected to the Internet by logging into our account. Also, the need to frequently update the songs/videos on each device independently is eliminated. This saves time and money. Secondly, we are moving towards high quality audio/video. Streaming enables us to consume high quality audio/video without the need of high end hardware on the consumer side. Thus, it leads to reduced reduce hardware cost. We will discuss in this paper, how streaming works and the protocols and codecs associated with audio/video streaming. An improvement over the currently used model is suggested. Finally, we will discuss the challenges and legal issues related with multimedia streaming.**

Keywords: **Streaming, protocol, codec, cloud, service, copyright, TCP, UDP, RTSP, RTP, RTCP, P2P.**

I. INTRODUCTION

Streaming is the sending of audio or video files, in a way such that it is being processed before it's completely received. Streaming also means the act of playing media on our devices when the media is actually saved on another device. The media could be saved on a computer, media server or network attached server (NAS) on our home network. A network media player can access that file and play it on our local device and that file does not need to be copied to the device that is playing it. A client media player can begin playing the data (such as a movie/song) before the entire file has been completely transmitted. "Streaming media" is also applied to media other than video and audio such as live closed captioning, ticker tape, and real-time text, which are all considered "streaming text". "Streaming" was first used in technical literatures in the early 1990s for on demand video on IP networks. The audio stream is compressed using audio codec such as MP3 or AAC while video stream is compressed using a video codec such as H.264 or VP8.Encoded audio and video streams are assembled in a container bit stream such as as MP4, FLV, WebMD, ASF or ISMA. The streaming client may interact with the streaming server control protocol say MMS or RTSP.There are differences between Streaming and Downloading and these two terms should not be confused. We watch and listen to streaming video and music as it comes to our computer or network media player. A website that streams video will often have a buffer. Several seconds of video is streamed to our computer or network media player in order to keep the video playing in the event of an interruption of the Internet connection. We, the same time and the speed of the website's server connection, can influence how well the media is streamed to us. A streaming file is never saved on our device.

On the other hand, in Downloading, our device connects to the source of the file, then copies and saves it to our hard disk drive. In most cases, we must wait until the download is complete before we can play the media. We can copy the file or move it to other hard drives unless it is a copyright-protected file. The downloaded file can be streamed to other devices once it has been saved. All network media players can stream the files from our home network. Most players now have online partners from which they can stream music and videos. Some players have built-in hard drives or can dock a

portable hard drive to save files. Within our home network, a router must be able to pass on the video stream to your network media player. Audio Video Routers or Gigabit routers may be needed to stream high definition videos to more than one TV or player. A streamed file plays from other sources. The source of the media must be connected and turned on, or the streaming stops. When streaming from the internet, it is not only the speed of our connection that guarantees a smooth viewing experience. Metrics such as the amount of traffic on the website, that is, the number of people streaming the media at the same time and the speed of the website's server connection can also affect how well the media is streamed to us. A streaming file is never saved on our device.

II. STREAMING PROTOCOLS

Various protocols are necessary for the streaming mechanism to be realised. The protocols are discussed as follows: 1.RTP: The Real Time Transport Protocol delivers high quality audio and voice across IP networks with great reliability. Many Media codecs are used for RTP.MPEG is used for audio and video, ITU H.261 and H.263 for video, G.711, G.722, G.726, G.728 and G.729 for audio. Standards like AMR and GSM are also used for audio.RTP implementations integrate existing media codecs rather than developing them specifically. Many RTP implementations are used as part of complete system driven by control protocols like SIP, and RTSP.A system which uses RTP will use different forms of media codecs and employ some type of call setup, session initiation and control.RTP was developed by IEFT in the period 1992-1996 and includes facilities for media delivery, membership management, lip synchronization and reception quality reporting.2.SAP: Session Announcement Protocol is used for multicasting. Announcements of sessions are multicast and any multicast capable host could receive SAP announcement and learn what meeting and transmissions are happening. Within announcements, the session description protocol (SDP) described the transport address, compression and packetization.3. SIP: The Session Initiation Protocol is a lightweight means of finding participants and initiating a multicast session with specific set of participants.4. RTSP: Real Time Streaming Protocol is an application-level protocol that transfers real-time media data. The protocol establishes and controls media sessions between end points by serving as a network-remote-control for time-synchronized streams of continuous media. RTSP was developed by the Multiparty Multimedia Session Control Working Group (MMUSIC WG) of the Internet Engineering Task Force (IETF). 5. RTCP: The RTP Control Protocol (RTCP) is related to RTP. Its basic functionality and packet structure is defined in the 2003 RTP specification RFC 3550. RTCP provides out-of-band statistics and control information for an RTP flow. It works with RTP in the encapsulation and delivery of multimedia data, but it does not transport any media streams itself. RTP is sent on an even-numbered UDP port and RTCP messages being sent over the next higher odd-numbered port. RTCP is provides feedback on the quality of service (QoS) in media distribution by periodically sending statistics information to participants .RTCP gathers statistics for a media connection and information like transmitted octet, packet count, and round-trip delay time. An application uses this information to control quality of service parameters, perhaps by limiting flow, or using a different codec.6. TCP/UDP: Datagram protocols like the User Datagram Protocol (UDP) dispatches the media stream as a series of small packets but there is no mechanism within the protocol to guarantee delivery. It is left to the receiving application to detect loss or corruption and recover data using error correction techniques. Data loss results in the stream to suffer a dropout. Reliable protocols, such as the Transmission Control Protocol (TCP), guarantee correct delivery of each bit in the media stream. It is accomplished with a system of timeouts and retries and it becomes very complex to implement. When there is data loss on the network, the media stream stalls while the protocol handlers detect the loss and retransmit the missing data. Clients can minimize this effect by buffering the data for display.

III. CODEC

"Codec" is refers to "compression/decompression or "compressor/decompressor" or "code/decode". A codec is basically a computer program that both compresses large files, and makes them playable on our computer/multimedia system. Codec programs are thus necessary for our media player to play downloaded media files. Normally, video and music files are quite large; they become difficult to be transferred across the Internet in a quickly manner. To help speed up downloads, "codecs" were built to encode a signal for transmission and then decode it for viewing or editing. Without codecs, downloads would take three to five times longer than they do as of today. Today, hundreds of codecs in use, and we need to select the particular combinations that specifically play our media files-video or audio. There are codecs for audio and video compression, streaming media over the Internet, videoconferencing, playing audio files like mp3's, speech, or

screen capture. People who share their files on the Internet may use obscure codecs to compress their files and we may not know which codec to use in order to play the files. Some of the widely known codec are MP3, WMA, Real Video, DivX etc.. Many codec packs are available. Some of the popular ones are listed: 1. CCCP **:** Combined Community Codec Pack is one of the most complete codec packages available. CCCP was put together by various users who like to share and watch movies online, and the codecs chosen are designed for almost 99% of the video formats we will experience as a peer-to-peer downloader.2**.** XP Codec Pack XP Codec Pack is a spyware / adware free collection of codec that also offers a good playability. Just under 6 MB, it is also considered as a complete codec pack.3.K-lite Codec Pack: It is one of the easy to use and well tested packs which enables us to play most movie formats. K-Lite comes in 4 variants: Basic, Standard, Full and Mega. Basic is used for DivX and XviD formats. Standard pack can play most formats.

IV. STREAMING SCENARIO

A sample cloud based Streaming System can be implemented as follows: We develop a web based service on Java/Oracle platform to be hosted on the cloud that streams audio files with the help of an embedded media player. In the case of mobile devices, we develop a separate app with its own built-in media player. We can either open the URL of the cloud server through a browser (for a desktop) or just open our mobile app.After login, we can stream music from our library. Our server already has a vast library of songs and video files. Users can download these audio files into their own cloud storage. In addition, we can also upload songs/videos to our cloud storage using a built-in up loader.When we begin playing a streaming track, our service takes a few actions: 1.It finds out to see whether the user device already has that track/video in the device's cache. Having them in the cache saves us from having to re-download the content again. 2.It searches for other nearby computers that use the service — run by other application users — who may have local versions of the tracks/videos (or fragments of the tracks) stored in their caches.3.Otherwise it starts to retrieve the track from our cloud storage.4.This approach is much faster and more efficient than millions of requests overloading our servers.5. Essentially, the user's computer becomes an equal player in one big network of many other computers running our service. In this peer-to-peer network (P2P, for short), the computers communicate on an even footing, uploading (sending) and downloading (receiving) files.6. Our service is also clever enough to start pre-fetching the beginning of the next song /video in the playlist or album we are listening to a few seconds before the current song/video ends to ensure that we don't have a lag between one song/video and the next. 7. If a user decide to go off course and suddenly choose another song that our application isn't expecting, that's not a big deal our application still responds to user request almost instantaneously.
To summarize, the following features could be implemented: 1.Registered users on a pay per use (e.g. some amount per year for 50 GB) basis should be able to store and play various audio files. They can also stream music /videos from other users' cloud storage too.2.The service should provide for authentication and maintains a database for all the user related information .3.The storage capacity and validity of service should be based on the plan that the users opt for.4.Multiple Users should be able to connect to our servers at the same time. All that the valid users need is a supported web browser or an app to listen/watch (no extra software needed on the user side).5.There should be notifications of the popular songs/videos among the users through web service. Moreover, we should get feeds of new and popular songs.6.The service should be supported across various platforms like Windows/Linux/Mac/Android etc.

V. CHALLENGES

Various challenges are discussed as follows: 1.The first challenge is regarding the bandwidth availability and the speed of our Internet connection .A minimum of 30 kilobytes per second is required while 256 kilobytes per second is highly recommended for best possible experience. Also streaming consumes our available data availability. It is also necessary that we have sufficient data available.2.The next challenge is regarding copyrights violation issue. Strict monitoring policies need to be implemented to root out audio/video piracy. Third party users should take care not to violate the rights of the artists, producers and distributors and also to avoid lawsuits and complications.3.Platform independence is yet another issue. Our web based application should be able to stream music across various operating systems like Windows, Linux and Mac etc.

As of today, recording programmes on TV or other videos and uploading them on the Web is easy, and legal action from copyright owners is becoming more and more common. Streaming video has changed the way people watch TV programmes, and there have been claims from artists, actors, writers, producers and other entertainment industry workers

that they are not paid enough as compared to TV broadcasts or theatre screenings. In the 21st century, Internet TV and Internet radio have become competitors against traditional media like Television and radio. Many countries have varying laws on when and how much tax is imposed on digital goods/ services. Copyright laws are territorial in nature. An interesting case is when a service user is outside the country of the service provider. While there is some coordination, different countries have different rules on what is and isn't permissible absent a license, and how licenses are issued.When considering the legalities, it is best to think about the rights of the copyright holder. Websites that illegally upload and stream copyrighted material are infringing on copyright and therefore we should not use these; incidentally this offense is actually punishable by law in most countries. Even though streaming technology isn't illegal the nature of the content we are receiving might be.

Some websites may contain movie trailers, or short audio/video clips approved by the copyright holder only for promotional purposes. On the other hand, if some websites offer the entire movie/song or video for free, or at a reduced cost compared to legal online services, then this is certainly something to be highly suspicious of. Sometimes, there is a fine line between fair use and piracy and this area of the law may be blurred at times. The question we need to ask ourselves when visiting a website that streams media is-how much of the copyrighted material is being used, and in what context. If we come across a site on the Internet that has written a review of a music album, movie, or video and has included a short clip to illustrate the article, then this is usually accepted as fair use. However, a website that streams a good deal of copyrighted material, and even tries to make money from it, may be acting illegally-especially if they haven't been given permission by the copyright holder.

VI. CONCLUSION

Streaming will change the way how we store and play our media files granting us connect and play features from anywhere and any Internet enabled multimedia device. With a healthy completion among cloud service providers, we can be assured of a reduction in cloud services which in turn promotes Streaming services. As of today, many cloud based services are available such as YouTube, Google Music, Amazon, Cloud Player, iCloud, Subsonic, mspot, Grooveshark, rdio and spotify. But all of these are differ from each other and they have their pros and cons. The best features from these services could be combined with new proprietary features of our own to develop a new service that streams music and enable users access to their favorite music from anywhere and from any device. While hosting such a service, we should take into consideration the various requirements for optimum streaming and should also adhere to legal issues too.

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