

Protected Adaptive Bitrate Streaming using HTTP Live Streaming and Cryptographic Techniques

DR. R. Kannan¹, G. Umasankar²

¹Associate Professor, Department of Computer Science. Sri Ramakrishna Mission Vidyalaya College of Arts and Science, Coimbatore-20.

²M.Phil. Scholar, Sri Ramakrishna Mission Vidyalaya College of Arts and Science, Coimbatore-20.

Abstract - In this 21st Century Peoples live in technology and media suffused environment. Technology is an integrated part of Life. In this environment digital media used to convey the information. It's used for various industries. In this environment we need to protect that digital Assets of image, video and others.

We are using some techniques for protecting digital assets that are encoding encryption and license model, subscriptions and other techniques. In this paper we can see what is DRM and how it works and how to implement and protect our video assert.

Key Words: Digital Assets, Login, Licensing, Subscription, DRM, Multimedia, Cryptographic techniques, cdn

1. INTRODUCTION

In now a days everyone are using internet and they must watch videos in streaming. In this place that video copyright protection is important for that content provider or owner of the video.

In this place the providers using encryption and adaptive bit-rate streaming techniques. For protecting their digital asset (Video).

Greenpeace estimates that the global information and technology sector consumes around seven per cent of global electricity. Video streaming is responsible for around 60 percent of global internet traffic in 2015, and is projected to reach 80 per cent by 2020. In below we can see what is DRM and its detailed process.

2. DRM (Digital Rights Management):

DRM is the way to protect the copy rights for digital Medias. This approach includes the use of technologies that limit the copying and use of copyrighted works and proprietary software. In a way, digital rights management allows publishers and authors to control what paying users can do their work. For companies, implementing digital rights management systems or processes can help to prevent users from accessing or using certain assets, allowing the organization to avoid legal issues that arise

from unauthorized use. Today, DRM is playing a growing role in data security.

The Video assets protection using cryptographic techniques. It's used for Prevent for editing and sharing to the social Medias. In this media implement for watermarks for ownership. In this DRM is given better licensing and agreement technologies.

DRM requires that the key exchange and licensing mechanism is highly secure and is always out of reach of external tools and hackers. A DRM technology also has additional elements. It delivers a license file, which also specifies the usage rights of the viewer. Usage rights specify the conditions in which the video playback is allowed.

In Video on Demand video protection and streaming using some technologies there are HLS (HTTP Live Streaming) and HDS (Http Dynamic Streaming) and DASH (Dynamic Adaptive streaming Over HTTP) and Microsoft smooth streaming. In below we saw how is protect video using HLS and how is HLS working.

3. HLS (HTTP Live Streaming)

HTTP Live Streaming is an adaptive bitrate streaming protocol introduced by Apple in 2009. It uses m3u8 files to describe media streams and it uses HTTP for the communication between the server and the client. It is the default media streaming protocol for all iOS devices, but it can be used on Android and web browsers.

HLS streaming (HTTP Live streaming) has emerged as the standard in adaptive bitrate video. Adaptive bitrate video delivery is a combination of server and client software that detects a client's bandwidth capacity and adjusts the quality of the video stream between multiple bitrates and/or resolutions.

It's everywhere: on mobile phones, desktop computers, TVs, and even wearable. It needs to work flawlessly on every device and network type, be it on slow mobile connections, 2G, 3G, 4G, Wi-Fi, behind firewalls, etc. Apple's HTTP Live Streaming (HLS) was created exactly with these challenges in mind.

3.1 HLS File's

HLS is used m3u8 file extensions. The m3u8 is a playlist file. In this file contains the multiple file paths. The multiple m3u8 file used for playing one video. The master m3u8 file contains multiple file path for network level based switch that file path for streaming

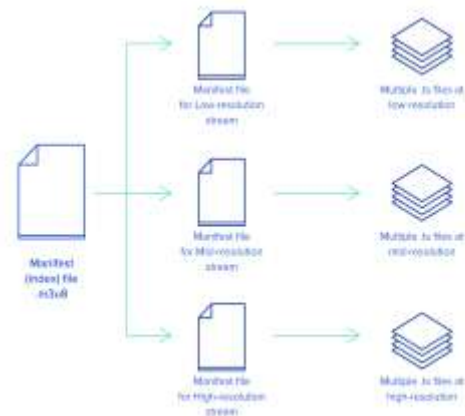
The HLS contains different file format's there are

1. .m3u8 files (Master and multiple resolution files)
2. .ts files (Video and audio chunks)
3. Bin (Key file)
4. .info (Map the URL and bin file)

Example master m3u8 file content.

In player read this master.m3u8 and picks the pairs of lines.

```
#EXTM3U
#EXT-X-MEDIA: TYPE=AUDIO, GROUP-ID="audio",
LANGUAGE="eng", NAME="English", AUTOSELECT=YES,
DEFAULT=YES, URI="audio/stream.m3u8"
#EXT-X-STREAM-INF: BANDWIDTH=500000,
CODECS="avc1.66.30, mp4a.40.2",
RESOLUTION=426x240, AUDIO="audio"
Video240/stream.m3u8
#EXT-X-STREAM-INF: BANDWIDTH=1000000,
CODECS="avc1.66.30, mp4a.40.2",
RESOLUTION=640x360, AUDIO="audio"
Video360/stream.m3u8
#EXT-X-STREAM-INF: BANDWIDTH=1500000,
CODECS="avc1.66.30, mp4a.40.2",
RESOLUTION=852x480, AUDIO="audio"
Video480/stream.m3u8
#EXT-X-STREAM-INF: BANDWIDTH=2000000,
CODECS="avc1.66.30, mp4a.40.2",
RESOLUTION=1280x720, AUDIO="audio"
Video720/stream.m3u8
```



Example m3u8 Varient file content

```
#EXTM3U
#EXT-X-MEDIA-SEQUENCE:0
#EXT-X-TARGETDURATION:2
#EXTINF:2,
Video360/seq-0.ts
#EXTINF:2,
Video360/seq-1.ts
#EXTINF:2,
Video360/seq-2.ts
#EXTINF:2,
Video360/seq-3.ts
#EXTINF:2,
.....
#EXT-X-ENDLIST
```

KEY. Info File

<http://localhost:52523/api/hlskey>

key.bin

Key Bin File

In this file is binary representation of key the key.info file contain return this file or runtime the actual key transform and send to this binary file. In this binary file or generate dynamically.

In this key file or bin is optional in info static file then the bin file is important otherwise runtime key is transformed and play this file.

3.3 HLS File Generation

The HLS files generated from high Quality video. The mp4 video to HLS format using many process there are encode, transform mux the video. In this transformed video.

In this video is transformed and cut multiple chunks and its separate the audio and video folders. The HLS Conversion we use the ffmpeg multimedia framework. It's used for encode, decode, transform, mux, demux and transcode the video and audio files into various formats.

In below we saw the quality of the HLS video file resolution and bitrate's for example 1080p 720p 480p, 380p, 240 p and other formats are widely used. In this table we saw the resolution, quality and bandwidth.

In this video scale we are use 16:9 aspect ratio. And it's for you tube recommendation. And transformed the various resolution stored in different folder.

Now a day this type of VOD using cdn network technologies for wide area coverage and availability. The cdn stored the files and serve the file based on request. In cdn checks the request origin and access token and subscription and other validation points.

Quality	Resolution	bitrate - low motion	bitrate - high motion	audio bitrate
240p	426x240	400k	600k	64k
360p	640x360	700k	900k	96k
480p	654x480	1250k	1600k	128k
HD 720p	1280x720	2500k	3200k	128k
HD 720p 60fps	1280x720	3500k	4400k	128k
Full HD 1080p	1920x1080	4500k	5300k	192k
Full HD 1080p 60fps	1920x1080	5800k	7400k	192k
4k	3840x2160	14000k	18200	192k
4k 60fps	3840x2160	23000k	29500k	192k

In above mentioned quality and resolutions based it's transformed into high quality video into multiple bitrate conversion based It's transformed for production ready VOD Streams. In this resolution conversion place we set the **aes-128** bit encryption for the video

In this encryption we use one key and optionally we add **the IV (Initialization vector) key**. In this key based the video streaming content is protected.

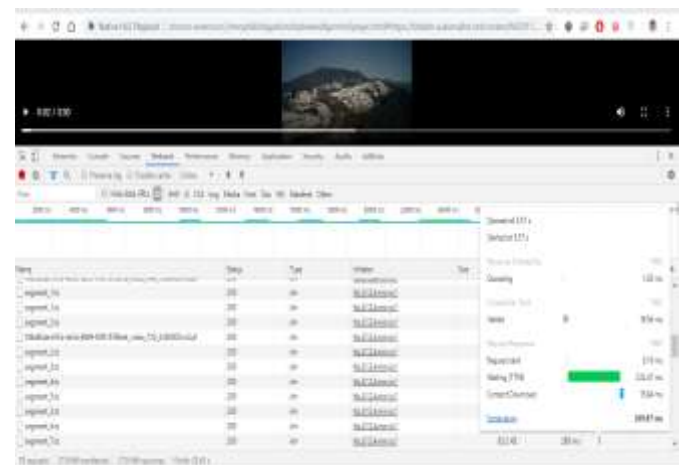
In this video streaming is one more level protection using access token. If the video url request the binary key file at runtime dynamically. In the request method decorate the authorization check the access token is present and check it's a valid user. Then only the binary key is send the requested origin.

3.4 HLS Process

These are called variants of the same video prepared for different network speeds and screen resolutions. This specific M3U8 file (640x360_1200.m3u8) contains the video file chunks of the video resized to 640x360 pixels and prepared for bitrates of 1296kbps. Note that the reported bitrate must take into account both the video and audio streams in the video.

The Mater Playlist URL or Variant files are given into the video player. The video player read the master file and read the network bandwidth based read video and audio chunks. The multiple audio and video chunks. If the network bandwidth when changed the video quality also changed.

If, example the 4G High Speed data is available then 1080p if speed is slowed 3G or 2G then the media quality is changed to 640p or 480p of the next video chunk read.so, this type of video quality change based on the network bandwidth based it's called as Adaptive Bitrate Streaming..



In above image show the we can see the video playing from HLS streaming the master m3u8 file is given in browser. The HLS native playback playing the video using master m3u8 file. In the network section of goggle chrome we saw download all chunks. In this chunk download decrypt and decode and merge and play in the browser.

4. CONCLUSIONS

In above we saw Digital rights management how is VOD and HLS and video protection. What is the use of HLS implementation and we know some of what is adaptive bitrate streaming and how it's works? Encode encryption decode adaptive bitrate streaming and other and subscription management. And in this place how to use access token and how to implement and protect the subscription and user license-based authorization.

In this video resolution and aspect ratio based transformed videos helps avoid adding padding or black bars directly to your video

REFERENCES

- [1] <https://docs.peer5.com/guides/production-ready-hls-vod/>
- [2] <https://radek350.wordpress.com/category/video-html-streaming/hls/>
- [3] <https://www.keycdn.com/support/how-to-convert-mp4-to-hls>
- [4] <https://bitmovin.com/mpeg-dash-hls-examples-sample-streams/>
- [5] https://en.wikipedia.org/wiki/Dynamic_Adaptive_Streaming_over_HTTP
- [6] <https://support.google.com/youtube/answer/6375112?co=GENIE.Platform%3DDesktop&hl=en&oco=1>

BIOGRAPHIES



Dr. R. Kannan. MCA, M. Phil., Ph.D. Associate Professor, Department of Computer Science. Sri Ramakrishna Mission Vidyalaya College Of Arts and Science, Coimbatore, TamilNadu



G. Umasankar, He was complete MCA and currently studying in M. Phil., in Sri Ramakrishna Mission Vidyalaya College of Arts and Science. Coimbatore. TamilNadu