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Study of video streaming standards

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Abstract: There are many types of devices developed by many companies. Some of these are Apple's MacBook, I-Pad and IPhone. Similarly these devices are used to access content like websites, audio, video, TV-shows, etc. Streaming is new technology which provides access to the audio, video contents anytime, anywhere & on any device. Streaming is getting popular day-by-day and is applied in various fields. Streaming Television shows, music, Lectures, Conference, Video-calling, etc. are many such popular uses. Technology of adaptive streaming is one such popular technology which is used for streaming over internet.

Keywords: Streaming,stream,stateful session-based streaming technologies,HTTP progressive download,Http adaptive bitrate streaming,MPEG-DASH,HTTP Live Streaming,(HLS),Smooth streaming

I. INTRODUCTION

Media streaming is type of multimedia which is continuously received and showed to the user while being delivered by provider. The term "to stream" can be considered as process where user gets a real time experience of watching a video or audio. The process of streaming is an alternative to file downloading where user has to download the file(s) before playing them on his or her machine.

As of 2017 streaming is one of the popular methods where a user watches or plays the various form of media the computer screen/smartphone and speakers over the internet. Although streaming gives user access to multimedia content without downloading it, there are challenges with streaming content on internet. Two popular streaming services are of YouTube which is video sharing website and Netflix which streams movies and TV shows.

We will now discuss the complete overview of streaming technology. The big picture of streaming will be divided into small parts for better understanding which are as below:

A. History about streaming

The history for the development of the streaming technology can be divided into two phases i.e. early 1920's and the second phase from late 90's and early 2000.

In early 1920s patent was granted for system to transfer and distribute the signals over electrical lines which later on became the basis for technology named Muzak used for streaming music continuously to the customers. The primary issues that time faced were: having enough CPU power and bus bandwidth to support the required data rates and creating low-latency interrupt paths in the operating system to prevent buffer under-run and thus enable skip-free streaming of the content.

However, computer networks were still limited in the mid-1990s, and audio and video media were usually delivered over non-streaming channels, such as by downloading a digital file from a remote server and then saving it to a local drive on the end user's computer or storing it as a digital file and playing it back from CD-ROMs.

B. Types of streaming

A media stream can be either "live" or "on demand". Live streams are generally provided by a means called "true streaming". True streaming sends the information straight to the computer or device without saving the file to a hard disk.

On-demand streaming is provided by a means called progressive streaming or progressive download. Progressive streaming saves the file to a hard disk and then is played from location. On-demand streams are often saved to hard disks and servers for extended amounts of time; while the live streams are only available at one time only (e.g., during the football game).

C. Applications

The technology of streaming is now very useful is being applied in many fields. The application can be using it for delivering lectures, news, speeches, etc. The technology of streaming is bringing the world more

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closely as like on your phone, television etc. There are many examples such as viewing a live match on ESPN, or even watching concerts. Today many popular live streaming services are provided some of them are Hulu, YouTube, etc.

D. Challenges

- Bandwidth challenge: Stable internet connection speed is a key success for good streaming. Sometimes the connection may experience some interruptions. To reduce the effect of bandwidth challenge it is better to have backups in case the main connection fails. As other option considering having alternative source may help.

- Unstable streaming flow: Important goal of streaming is to provide a stable flow of data regardless of the network conditions. There are other reasons which many break the steady flow of data they include physical damages that occur to the hardware, breakdown of software. You can deal with some by troubleshooting and rebooting, but this may result in minor interruptions of your streaming flow. Adaptive bit-rate streaming solutions allow you quick reconnect. There are various options to choose the technique. These techniques adjust the video quality and size according to the bandwidth available.

- Issues with live video encoding: Encoders are one of the main concerns if you are providing live streaming .You must choose proper encoder because of the compatibility issues that might occur. To be safe one must work correctly with devices such as smart phones, tablets, cameras, etc. This should help to prevent issues with encoding video streaming content.

II. CURRENT SCENARIO

There are various streaming technologies that are available in the market and streaming standards. Our aim is to explore various technologies available and study the video streaming standard.

III. TECHNOLOGIES AVAILABLE

In this section we discuss all the technologies that were developed and used as streaming technologies from past to the present. We will discuss how the traditional streaming technologies differ from the current technologies.

A. Stateful session-based proprietary streaming protocol technologies

The most important factors considered when streaming of any data taken in consideration are short start-up delay, smooth playback and high bit-rate. To meet these requirements the traditional streaming technologies used protocols such as Real Time Streaming Protocol (RTSP), Real-Time Messaging Protocol (RTMP) and Microsoft's MS-RTSP .When using these protocols the clients are connected to the server and their sessions are maintained or tracked till they disconnect from the server. In these sessions the user can do various operations such as PLAY, PAUSE, RECORD, and TEARDOWN.

session based proprietary streaming technologies have been proposed they have been widely used from pure audio conferences to multicast multi-part low delay video sessions applications for short startup latency, low control overhead, good user interactions performance and smooth audio and video playback experience.

There were following disadvantages of these protocols and are as below:

- These technologies required a special pre-configured and specialized server. Servers need special skills to set-up and maintain, and in large scale deployment maybe costly.
- These protocols are based on UDP protocol as transport protocol, UDP traffic is not allowed by default firewall and NAT settings
- Server has to keep track of the state of every streaming session which will cost a large of server's resources and the limit the system's scalability
- In conventional stateful session-based proprietary streaming protocols the bitrate the server transmitting the content to clients equal to the media encoding bitrate which equals to the client's media playback bit-rate. Under normal circumstances this will ensures that the client buffer level remains stable over time and optimizes the use of the network resources.
- However if the network environment becomes terrible packet loss or transmission delay occurs ,the client's buffer fillings rate is less than consumption rate, it is likely that client's buffer is drained out and causes the playback pause.

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B. HTTP progressive download

It uses a standard HTTP webserver rather than streaming server to transmit the media file. And the video is encoded as one big chunk, the client can playback once the first few seconds of content loaded in its buffer while the download process is still in progress. Many Popular websites today such as YouTube, Vimeo, Myspace, and MSN soapbox use progressive download. The main features of HTTP progressive download are:

- It is specialized for packet delivery.
- It uses TCP at transport protocol which makes it simple to pass firewall and NAT.

There are two major shortcomings which are explained below:

- The technology can't change video quality (bit rate) to adapt to the network congestion. Using the technology, all clients will receive the same encoding of the video despite the large variations in the underlying available bandwidth both across time for the same client.
- The other bandwidth is wasted. There were other strategies that such as slowing down the speed of video loading so media player does not keep loading the video in the background reduces the unnecessary delays.

C. HTTP adaptive streaming

With improvements and development in various devices and technologies have been developed where the user can instantly get access to one single content from various devices such as phones, tablets, computers, laptops and now even smart-television are also available to access the content from the internet. HTTP adaptive streaming help to complete requirement of a technology that is compatible to many devices.

In 2006 Http-based adaptive streaming was originally proposed by Move network company and also proved its possibility in year 2008 by adding live streaming and on-demand streaming features .In 2008 Microsoft announced that Internet information services IIS 7.0 would feature a new Http-based adaptive streaming in the form of smooth streaming which was used to cover the 2008 Beijing summer Olympics games . Afterwards many service providers such as Apple, Netflix and Akamai did put the technology in use.

Adaptive bitrate streaming detects bandwidth and CPU capacity in real time and adjusts the quality of the video streams. Most traditional video streaming technologies used RTP with RTSP this technology are based on HTTP and are designed to work on larger scale.

Adaptive bitrate streaming technology is hybrid way to deliver the content that acts as streaming and is based on the HTTP progressive download technology. The technology is firewall friendly and does not require Network address transfer(NAT).And by using CDN and standard HTTP optimizations the technology can reduce server side-cost and performance can be scaled easily.

HTTP based adaptive bit rate technologies are more complex than the traditional streaming technologies. Additional storage cost, encoding costs and challenges with maintaining the quality globally.

These criticisms are balanced when compared to the special requirements of the non-HTTP streaming solutions which require massive deployment of specialized server infrastructure.

D. Comparitive study of the technologies available

The videos that are delivered to the users today can be divided into live or on-demand. There are various devices such as desktops, smart TV, mobile web, iPad, gaming consoles, etc.

Flying back into time when users had to wait for complete video to get downloaded and then playing it .But it last few years the video streaming has developed at a great pace. The service providers are making efforts to make user experience, device adaptability some of the important aspects. These efforts get more complicated when you consider sharing it on the internet and to other people in the network.

Currently there are three video delivery technologies available namely progressive download, RTMP/RTSP streaming protocol and adaptive streaming. The three models are technically different but are equally popular.

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Table 1: Comparison of available technologies

Features	**Progressive Download**	**Streaming**	**Adaptive streaming**
Video Play at a timeline / location	Cannot jump ahead in timeline. Linear in nature	Possible to jump ahead in timeline	Possible to go to future point in timeline and request/receive segments for playback
Transport Protocol / Network Considerations	HTTP over TCP (port 80) No special consideration, works over HTTP using normal web server	RTMP (1395) , RTSP over TCP/UDP, RTMP (encrypted) Requires special provisioning for ports	Can work over simple HTTP server over TCP
Pre processing Requirements	No special processing	Server manages reading / sending chunks of data	Requires content to be encoded for multiple-bit-rates. Requires manifest lookup to determine which segment to request
Monitoring & Control	No monitoring and control. One way connection Downloads content as quickly as possible without any monitoring or control	Stateful data and control connection. Server based monitoring and control	Efficient monitoring and control. Client can switch low or high bit-rate stream based on client and network environment
Media Storage	File is downloading and stored in temporary directory	Media player requests and receives file fragments, plays and discards them.	Media player requests and receives file fragments, plays and discards
Key Benefits	Easy to Setup No special licenses required. Ensures quality of video is	Can access any part of video without waiting for entire file download Support	High flexibility to change video quality on the fly. Depending on network
	maintained although there could be delays based on network	real-time broadcasting. Added security as streaming video has no local caching	bandwidth and CPU conditions, client can request/receive a higher or lower quality stream.
Example of Online Video Platforms	YouTube, Vimeo	Hulu	BBC, Netflix, HBO GO
Disadvantages	Bandwidth is wasted on data which is downloaded but not watched. Fast Forward possible only for downloaded content Significant waiting time to start the play	Requires special network configuration for port enabling (RTMP/RTSP) which are often blocked by corporate firewalls RTSP is not widely supported by servers and CDNs.	Lack of standardization. Not fully supported on many platforms. Apple HLS is the most popular format. Possibility of having DASH as the common standard in future.
Content Security	Content is stored locally in temporary folder. Less secure	No temporary storage and hence more secure. Although stream capture software can	DRM integration available for specific adaptive streaming technolo

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Client/Server Requirement	No special client or Server requirements. Any web server with the correct MIME types/Content Handlers, etc. will deliver progressive media. E.g. Apache HTTP server	Streaming server like Adobe Flash Media Server, Wowza, Red5. Corresponding Client Player	No special Server Requirements e.g. Apache HTTP Server can delivery HLS. Client player which understands manifest /chunking model
Behavior in slow connection	Long wait before content made available. Can still enjoy high quality content	Wait before content becomes available. Publisher may provide options to choose content quality	A slow connection will force users to watch low quality content only
Basic Definition	Clients request for file using HTTP GET and server sends entire file over HTTP as fast as possible in best case delivery. It works similar to how content gets loaded in a normal web browser using repeated HTTP GET	Clients and server maintain a persistent control and data connection. Server transfers chunks of data based on clients (player) request. Just in Time transfer of data	Content is encoded for multiple bit rates, manifest is created Client periodically reviews capability and requests best suited chunk from available list. An intelligent and flexible HTTP GE
Bandwidth Usage	Less efficient and wastage of bandwidth since entire file is download and all may not be played	More efficient as downloads only part of file actually being watched	Chucks can be cached at CDN and reused by multiple clients (improving performance and saving bandwidth

Source: Nitin Narang, What is the difference between Progressive Download, RTMP Streaming and Adaptive Streaming.

IV. STUDY OF ADAPTIVE BIT-RATE STREAMING IMPLEMENTATIONS

A. Smooth streaming

The Smooth streaming technology helps implementation of adaptive streaming with the help of Silverlight over HTTP. Smooth streaming provides high-rated viewing experience that can be scaled with help of content distribution networks (CDN) making a Full high definition experience come to life. This technology depends on Windows server and Internet Information services (IIS) media services technology.

Smooth streaming can check the local bandwidth and other conditions to maintain the quality of media file that is being received. Customers who have high bandwidth then may high definition experience whereas the other customers with lower speed will receive a proper uninterrupted streaming maintaining the smoothness of the video. In short smooth streaming will create chunks of the requested file by the client; the actual video will be stored on the disk as single full-length file.

Smooth streaming is much better than the standard television because the user can see the same content but in high definition on their computers.

It provides options such as pause, rewind, multiple camera angles and various other features. The advertisements shows are few for user. Also the users who are engaged to streaming tend to stay for longer duration.

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Figure 1: Workflow smooth streaming

Source: https://www.slideshare.net/classicboyir/iis-smooth-streaming

The workflow of smooth streaming is straightforward:
1) Acquire: This phase is the start phase where content are acquired, the content generally acquired is high quality. It also can synchronize the subtitles and the captions that are required. Addition of audio tracks, commentary and director's cuts are also done.
2) Encode: The content is delivered as the request is received. Therefore the content can also be stored in various forms such as fragments, adjacent portions, etc. Generally the fragments of the mp4 files are small cacheable objects which are highly scalable and user also receive only the required fragments. The manifests are Server (.ism) gives available tracks and bit rates, clients (.ismc) give list of codecs, resolution and fragment index.
3) Rough cut editing: It is tool used for providing instant highlights during the live events; reuse the existing assets which reduce the work. It is a free tool so no additional costs occur and publishing of the work can be done faster. It also can be used with the encoders and other workflow tools. Example the tool used Olympics were Silverlight rough cut editor
4) Deliver: This is one of the important parts where the content that is to be delivered to client is created. Internet information services include various services which have their unique functionality which helps to create a dynamic content that is delivered.

1) Smooth Streaming (on demand): It is subcategory built on smooth streaming which uses cacheable http delivery of the live events. It also adds features such as replay, pause, and go to live.

2) Bit Rate Throttling: It is used as automatic format and encoding buffer detection. There are also pre-defined audio and video formats which can be used. These can extend any format and also works for data files

3) Web Playlists: Used for preventing third party playbacks. It is mix of client and server side playlists and can easily adapts to other formats

4) Advanced Logging: This feature is used for analysis, monitoring the data. It is also used for client logging for large networks.

5) Scaling the performance: Performance scaling is one of the important factors as content delivered to the clients must be proper and scaled according to client's device. Content delivery networks such as Akamai, CDNetworks are used. Online video platform (OVP) is used for monitoring, analysis and designing a media player. Caching is one of the factors which is important and are selected based on features and capacity, which provide high reliability.

6) Consume: The services that consumed must be uniform across various devices. The devices include various devices and platform including set-top boxes, television, etc.

B. HTTP live streaming

HTTP live streaming is communication protocol that helps you to send audio, video from a web server for replay on various iOS based devices such as iPhone, iPad, iPod touch, desktop computers and Apple television as well. HLS supports both live streaming and video on demand. It supports multiple streams at different bit rates; the client software can also switch streams intelligently as the bandwidth changes. HLS provides encryption and authentication both protecting the user's privacy perfectly.

The HTTP live streaming architecture has three main components i.e. Server component, Distribution component, Client software. The basic function of HLS architecture can be summarized as follows:

The inputs in the form of audio and video are taking into by a media encoder which encodes them as H.264 video, AAC audio and outputs them as MPEG-2 transport stream which further is broken down by stream segmenter into series of short media files. These files are now placed on the web server. The segmenter creates

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index files which contains a list of media files and maintains them.URL of the index file is published on web server. Client's software reads the index and requests the listed media files in the order and shows them without any gaps.

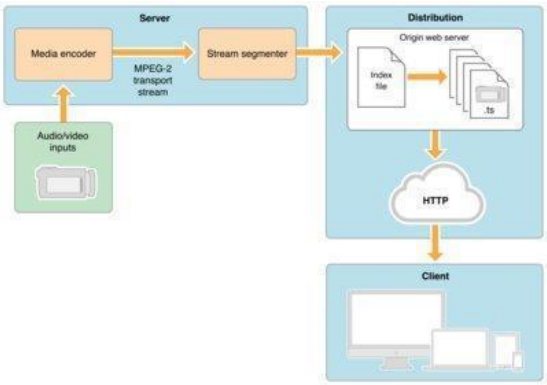

Figure 2 : Workflow HTTP live streaming

Source:
developer.apple.com/library/content/documentation/NetworkingInternet/Conceptual/StreamingMediaGuide/Introduction/Introduction.html#//apple_ref/doc/uid/TP40008332-CH1-SW1

- **Server component:** The server requires a media encoder which can be a way to break the encoded media into segments and save it as files which can either be software as media stream segmenter given by Apple
- **Media encoder:** The media encoder takes real time inputs from the devices, encodes the media and encapsulates it for transport. Encoding format should be supported by client devices. Currently supported format is MPEG-2.Transport streams for audio-video, MPEG elementary steams for audio only.
- **Stream segmenter:** Stream segmenter is a process where it reads the transport stream from the local network divides it into series of small media files of equal duration. Although each segment is in separate file videos are created from adjacent stream which can be reconstructed effortlessly. It also creates index file that has reference to each individual file. Index is used to track the file location and its availability. Key file is created and each media segment is encrypted by segmenter. These segments are saved as .ts files and index files are saved as .M3U8 playlists.
- **File segmenter:** File segmenter is used to encapsulate the media file using MPEG-2 transport stream and divide it into segments of same length. The file segmenter helps you to by reusing the existing library of audio and video to send video on demand using HTTP live streaming. File segmenter does a similar job that to of stream segmenter but it takes files as input instead of streams.
- **Index files:** These files are produced by stream segmenter or file segmenter and are saved in .M3U8 playlists are the extension of .m3u format. The index file format is an extension of .m3u playlist format and also that system supports mp3 audio media files, the client software may support the typical mp3 playlist used for internet radio.
- **Distribution component:** It includes two components mainly the web server which uses the HTTP to distribute the files to the client. No custom server modules are required to deliver the content.
- **Client component:** The client component starts with fetching the index file based on the URL identifying the stream. The index file specifies the location of available media, decryption key and any other streams available. Once the sufficient data is downloaded the reassembling of the data is done. The keys for authentication and decryption are important as they are responsible for authentication and encryption and decryption process**.**
- **Session types:** The Http live streaming protocol supports two types of sessions: events (live broadcasts) and video on demand (VOD).

1) VOD sessions: In video on demand media files represent the entire duration and the index file contains the list of files created from the start. This kind of session allows clients full access to the program. HTTP live

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streaming has advantages over progressive download for video on demand such as media encryption and random switching of streams of different data rates in response to changing connection speed.
2) Live sessions : For live sessions as new media files are created and then index are updated. Now the new index lists new media files and the older files can be removed from index and deleted giving a moving window into a continuous stream, such type of sessions are suitable for continuous broadcast. Similarly new media can be added to the existing list which then gets converted to video on demand.

- **Content protection:** There are three modes through which the content protection is applied and they are explained as below:

1) In the first mode you give path of an existing key on the disk. With this the segmenter adds the URL of the existing key file in the index file. All media files are encrypted using this key.
2) In the second method segmenter generates the random key file saves that in specific location and reference it in index file. It encrypts the file using this key.
3) In third mode the new random key file every n media segments are generated and saved in specified location and referenced in the index file. This is also known as key rotation

C. MPEG-DASH

There are three important implementations in the field of streaming. These include Microsoft's smooth streaming, Adobe's HTTP dynamic streaming and Apple's HTTP live streaming. These three standards have their own encoding techniques, which requires specific methods to deliver the contents to the user, also require the players to run the contents.MPEG-DASH is also known as Dynamic adaptive streaming over HTTP which is a first adaptive bit-rate HTTP based streaming solution which is an international standard. MPEG-DASH uses web server infrastructure which is used for delivery on the WWW.The content can be delivered to many devices such as television, TV set-top boxes, desktop computers, smart phones, tablets, etc.

MPEG-DASH was developed under MPEG which started in 2010,was published as ISO standard in April 2012.Technology is related to smooth streaming ,HTTP dynamic streaming and HTTP live streaming. It has many companies such as Google, Samsung, Ericson, and Netflix etc. who created the guidelines for using DASH.

All the adaptive streaming technologies use combination of encoded media files and manifest files that which find alternative streams and their URL. The monitor buffer status of respective players, CPU utilization and changes of streams as located in the manifest. The existing streaming media are very similar but yet are completely incompatible

MPEG-DASH Overview:

Media Presentation Description (MPD) Data Model:

- The client receives a manifest which is well structured text file in xml format and human readable .This text file describes a data model for a presentation. Dash is not just way send audio or video but you can able to easily recreate a Blue-ray experience which may have many audio tracks, subtitles and captions.
- All these contents are store in media presentation. A media presentation comprises of periods which have nothing in common except the sequential number.
- This easily helps to add advertisements. All the periods have different adaptation sets which includes different video and audio sets which may cover many angles and views of same object, for example a football match.
- Now these adaptation set have different representation set, which have separate bandwidth and different width and height. Every representation has segment information which includes initialization segments which initializes the decoder and this information gets repeated.

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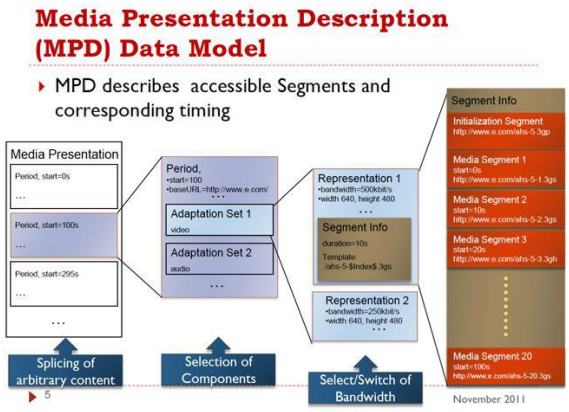

Figure 3 : MPD model in MPEG-DASH

Source: Hossein Sarshar, IIS smooth-streaming

Features:

1) **Live, on-demand and time-shift services**: Now because of the time-shift services the live videos can now be played, paused, fast-forward, replayed etc. This is also possible with the on-demand contents as well.

2) **Efficient use of existing CDN, proxies, NAT and firewalls:** This is one common attribute that can be seen after the start of Http based adaptive bit-rate streaming. This is also applicable to the audio and video Manifests.

3) **Independency of request size and segment size (byte range requests):** Until now you we required to break the on-demand files into pieces so you could load them individually. In DASH you do not physically break the segment, can keep them as contiguous file and in manifest you tell player make range request.

4) **Client controls the entire streaming session:** Benefits of this are you can just use a simple apache server and put files and the server just has to support get request. The days of custom build server are gone. Drawback of this the functionality depends on good client behavior; bad client behavior may or disturb the functionality of the streaming session.

5) **Support of seamless switching of track:** You can switch tracks like audio track, subtitles, and streams. It can also play stereo sound; surround sound depending on the device you playing on.

6) **Efficient trick mode:** Trick mode includes various functions such are replay, pause, fast-forward, etc. The method that DASH uses to implement this function is by maintain set of special tracks special scrubbing tracks which display the key-frames which is more light-weights than the original track.

7) **Common encryption:** With common encryption you encrypt the audio and video once, you use AES-128 and protect it with a key and protect the key different DRM schemes and can make all coexist in the manifest. And so you can encrypt once and deliver too many places.

8) **Profile :** These profiles are divided into two similar to what in Microsoft's smooth streaming. On-demand was created by Netflix which did not cut the segments unnecessarily and made them continuous segments. Live profile was created to cut the segments into pieces just as they were created in HLS. These both are ISO based media file formats or mp4 containers and the profile called main.

9) **Segment addressing:** These are basically the schemes that are used to make the content access very efficiently and in very few lines of code. These schemes help you to write the manifests in proper and more efficient way.

D. Comparative study of streaming standards

The adaptive bit-rate streaming is getting popular day -by-day as the standards and the popularity of the technology is increasing. Streaming technology which started in the 90s is now the most popular way to reach out to the people.

The traditional streaming involved a single video file at a single quality that is transferred and is played. If the use has less than the expected bandwidth the video player pauses and buffers. This can be because of several reasons such las low bandwidth, etc. But with adaptive streaming a high resolution video is also converted to the one that suits best to your network capacity giving you smooth uninterrupted connection. The process of converting such video into variety of qualities is known as encoding.

When a user tries playing video using adaptive technologies they receive a manifest file that gives information for all these different qualities. Adaptive technology then alters the quality depending upon connectivity strength.

Following table shows you a list of features and the standards that may provide the listed feature.

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Table 2: Comparison of standards

Features	Adobe HDS	Apple HLS	MS smooth streaming	MPEG-DASH
Deployment on Ordinary HTTP Servers		Yes		Yes
Official International Standard (e.g., ISO/IEC MPEG)				Yes
Multiple Audio Channels (e.g., Languages, Comments, etc.		Yes	Yes	Yes
Flexible Content Protection with Common Encryption (DRM)	Yes	Yes	Yes	Yes
Closed Captions / Subtitles	Yes	Yes	Yes	Yes
Ad Insertion				Yes
Fast Channel Switching	Yes		Yes	Yes
Protocol Support's multiple CDNs in parallel				Yes
HTML5 support				Yes
Support in Hbb TV(version 1.5)				Yes
HEVC Ready (UHD/4K)				Yes
Agnostic to Video Codecs				Yes
Agnostic to Audio Codecs				Yes
ISO Base Media File Format Segments	Yes		Yes	Yes
MPEG-2 TS Segments		Yes		Yes
Segment Format Extensions beyond MPEG				Yes
Support for multiplexed (Audio + Video) Content	Yes	Yes		Yes
Support for non-multiplexed (separate Audio, Video) Content		Yes	Yes	Yes
Definition of Quality Metrics				Yes
Client Logging & Reporting				Yes
Client Failover				Yes

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Remove and add Quality Levels during Streaming				Yes
Multiple Video Views				Yes
Efficient Trick Modes				Yes

Source: Christopher Mueller, MPEG-DASH vs. Apple HLS vs. Microsoft Smooth Streaming vs. Adobe HDS

V. OBSERVATION

Traditional streaming which is also known as progressive download involves a single video file at a single quality that is transferred and played. The video is uploaded to a server and then transferred to the user. If the download rate of the frames from server to the user is less than the playing rate then video has to buffer. YouTube subscribes to this method of playback but offers different quality levels that you manually select.
With adaptive streaming a high quality of base video source [also known as Mezzane] is converted into various qualities.

This process is known as encoding and they are stored on a CDN or content delivery network. These files are fetched by user in the form of request. When a user plays a video using the adaptive streaming technology they are given a MANIFEST that lists the other qualities available.

Depending on the users connection the quality of video is changed ensuring buffering is minimized. In order play video without any delay the video starts with low/medium quality depending on the connection and gradually gets scaled to high or ultra-quality giving minimum delay to the user. For example you may have noticed this when you play episode on Netflix. A video player on the client's side supports adaptive streaming will handle process of switching between the qualities.

Important features of video streaming standards are showed in tables below:

Table 3: Summary HLS

HLS	
Manifest:	M3U8 playlist
Video:	H.264
Audio:	MP3 or HE-ACC
Container:	MPEG-2
Server:	No special server needed

Table 4: Summary MSS

MSS	
Manifest:	XML file with ism/ismc file extension
Video:	VC-I or H.264
Audio:	ACC or WMA
Container:	MP4 (with *ismv/isma file extension)
Server:	Only quality of file stored but server virtually splits hem up into chunks at playback

Table 5: Summary MPEG-DASH

MPEG-DASH	
Manifest:	Media Presentation Description (MPD)
Video:	Codec agnostic
Audio:	Codec agnostic
Container:	MP4 or MPEG-2

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VI. CONCLUSION

Development of streaming standards has taken a great pace considering last few years. Many standards have been developed such as Apple's HTTP live streaming, Microsoft's smooth streaming and MPEG-DASH. These standards are very different from each other, but are very popular when it comes to their applications.

There are various features that are considered when creating a streaming standard such as development, transportation, server requirements, speeds, device compatibility, etc.

From customer's point of view the user experience is considered as very important factor as the services are directly served to the customers. The services that are provided must be efficient and able to provide the additional services such as pause, replay, fast-forward, etc.

Considering HTTP live streaming provides an ecosystem which helps to reduce the transport, development and other costs. The streaming services provided are used in the ecosystem, for certain devices that are developed by Apple. Although efforts are being made today so that the videos that are being played today within an ecosystem can or may be played outside the ecosystem. Unlike Apple Microsoft's smooth streaming provides you with a platform made up of services that help you to reduce the cost for transportation, encoding, decoding, etc.

MPEG-DASH is universal standard that is created so that it can reduce the cost for encoding and decoding .It is used so that the services can be provided to all the devices and platform smoothly and efficiently. Although the standard was developed with the help of Apple, Microsoft and other companies, Apple do not support MPEG-DASH fully and is making additional efforts to be more successful standard. When you consider MPEG-DASH, as upcoming universal standard that provides the set of services similar to Apple and Microsoft both. Thus it is giving best results using both systems.

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