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eGuide

A Live Streamer's Ultimate Guide to

Bandwidth Optimization

Live Streaming is The Future

Live streaming is an exciting technology that has revolutionized how brands, businesses and creative professionals connect with their audiences — instantly!

- Average time spent for video on mobile is 3.5 for livestreams vs 2.8 minutes for VoD
- Average time spent for video on tablets is 7.1 minutes for live streaming vs 4.1 minutes for VoD.
- Average time spent for video on desktop is 34.5 minutes for live streaming vs 2.6 minutes for VoD. Video will comprise 82 percent of the whole internet traffic by 2021.
- Every second, a million minutes of video content will cross global IP networks by 2021.
- Consumer Video-on-Demand (VoD) traffic will nearly double by 2021. The amount of VoD traffic in 2021 will be equivalent to 7.2 billion DVDs per month.

How **Live Streaming** Works?

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Key Frames and Video Compression

The video and audio data in streaming media files are compressed just like static image files are compressed using compression algorithm. It reduces the number of bytes in each frame thereby decreasing the bandwidth requirement to live stream a video.

Video files are basically a number of still images called frames that are combined one after another into a single file. Each frame is showcased at some certain number of frames per second to create the illusion of movement. However, most of the time there is no change in the video between two frames. If we take an example of a video demonstration of an application, it may show the opening of a new window in the application without change for few minutes while the audio narrates the application. If nothing changes, it is unnecessary to send a new frame of video data. This significantly decreases the bandwidth requirements.

But if we consider a video demonstrating some application and the mouse pointer moves around the application as a pointing device and pointing out different areas of the application, bandwidth requirements can also be tackled here by only sending the changes to the new frame. As the entire frame is not being sent each time, bandwidth requirements are reduced. So, more the movement, more area of the screen is changed and more video data will be sent to update the next frame. Similarly, if the entire screen changed from one to another, the whole frame would have to be sent.

Frame Rate

Another factor which may have an effect on the bandwidth requirement is frame rate. If there is substantial change between frames, then the size of each frame is larger and more data must be transferred for each frame. So, in case of higher frame rates, bandwidth requirement will be higher. Similarly, if there is a little to negligible change between frames, then little or no video data is transferred for each frame. Depending on the content of the video, increasing frame rate may or may not have an effect on the requirement of bandwidth.

Bandwidth Spikes and Buffering

Buffering is primarily implemented to avoid network congestion. Buffering works by storing a portion of the video locally and playing the video by retrieving data from the local buffer. Before the player starts playing, the player downloads some segment of the video which is usually of 10 seconds and stores it locally. It plays the video by retrieving frames from this local buffer while continually downloading more of the video to keep the buffer full.

Buffering is also helpful in encoding videos that contain spikes of high bandwidth. This happens when a video suddenly requires more bandwidth. Current media encoders take into account the time taken by the buffer, that while the extra data caused by bandwidth spike is being delivered, the video can be played from the buffer without interrupting the playback. So, amount of buffering time reflects the success of an encoding process.

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Multi-bitrate Streaming

As a streaming service provider, your streams reach thousands or even millions of people every day. While some viewers will prefer to stream in the best streaming quality, some might prefer streaming with lower resolution in order to save data. Similarly, while some might be using Wifi or fiber internet, some might be using uneven mobile network or DSL lines. So, what encoder setting do you think will be ideal to provide each group, a standard viewing experience?

Here comes multi-bitrate streaming. Multi-bitrate streaming requires you to set up your coding software to encode various versions of your live stream that is sent to your video streaming platform simultaneously. Muvi's adaptive bitrate video platform automatically serves each category of viewers with internet connection specific streaming quality.

Although multi-bitrate streaming is pretty apt for video hosting services, one must not forget the baggage it comes with.Consumption of more data, greater internet bandwidth, additional processing power are a few downsides of the technology. However, seamless content delivery without compromising with the streaming quality is a major USP of multi-bitrate streaming and this outshines the negative aspects of the technology.

Understanding **Bandwidth** Usage

Bandwidth is a measurement of the volume of data that a network or server receives/ transmits over a given amount of time. When you watch a one hour video, it takes around 500 MB of bandwidth in SD and 2 GB in HD mode, please check our help article on **encoding and resolution** for more details. You can calculate bandwidth based on this. For example, if 2000 people watch one hour SD video, it will consume 1000 GB = 1 TB and so on...

A video is delivered over the web to browsers and apps as data. During the process, the amount of data transferred is the bandwidth consumed to which a user gets charged for. So, bandwidth can be classified as

Used Bandwidth:
The amount of data colligated with portions of the video that the viewer watched.

Overhead Bandwidth:
Data associated with the portion of the video which was downloaded, but not viewed.

The overhead bandwidth is due to the video data that is buffered prior to the viewing progress for a seamless playback of the video while additional data is downloaded.

Reasons for increasing **Bandwidth**

Viewers Count

According to Google, it processes over 40,000 search queries every second on average which translates to over 3.5 billion searches per day and 1.2 trillion searches per year worldwide. If this is not enough, then almost 5 billion videos are being watched on Youtube every single day. Although the number is global and varies from site to site, the number is growing every single day resulting in an increase in the internet bandwidth.

Multi-Device Access

Consumption of online video has led to a significant increase in the bandwidth consumption. HDR Quality, 4K streaming, improvement in memory and networking for devices enable the user to consume higher quality videos that they could watch in the past.

Increased Internet Bandwidth

By virtue of Improvement in the infrastructure and network protocol supporting the internet, an average internet user has more bandwidth available than before although there are variations across geography. In case of online videos, more video data can result in quicker downloads irrespective of the video consumption.

Understanding **Bandwidth** Usage

Why **Bandwidth Optimization** Matters?

What determines Video Quality?

The global enterprise video market is estimated to clock $40.84 billion by 2022. This market is experiencing an annual growth rate of more than 20 percent. So, everything is dependent on broadcasters on how to tap the market potential. And there is no other way out than the simple solution called "**effective broadcasting**". Effective broadcasting is possible by adopting the best encoding software setting meant for a quality streaming.

How to know which is the right pick for you?

Live streaming is largely dependent on video bitrate and resolution. Bitrate is the amount of data being transferred in your stream. The resolution, on the other hand, is the size of a video stream which is assessed in pixels. More the resolution, higher is the video quality.

Higher bitrate and resolution, although have discrete settings, they are linked to each other since higher resolutions should be matched with higher bitrates. This is quite understandable since higher resolutions require more bits to transfer a large amount of image data to the audience.

Video Resolution	Popularly known as	Suggested Bitrate
426 x 240 pixels	240p	500 kbps
640 x 360	360p	1Mbps
854 x 480	480p	3Mbps
1280 x 720	720p	5Mbps
1920 x 1080	1080p	8Mbps
3840 x 2160	4K	25Mbps

[Load your live feed on Muvi platform and deliver real-time content to your viewers instantly. *Try now*.]

What determines Video Quality?

Encoding higher-resolution video streams result in additional strain on the device running your encoding software. Equip yourself with a configuration-rich machine for High Definition streaming. Also, internet speed varies from user to user. So, all users cannot watch higher resolution streaming. In order to counter the problem, you need multi-bitrate streaming.

5 Slick Bandwidth Optimization Techniques

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Hardware Compression

Compression is generally done by applying encoding techniques that eliminate repetition in data blocks and alter repeated elements with short and symbolic pointers to original content. This reduces the volume of data that transits a WAN link.

Deduplication

Compression dictionaries are a bunch of arbitrarily long strings or sometimes an entire file that applies on each end of a WAN link need to be exchanged only once. After this, they may be associated with short, unique symbols that may be of 64 to 256 bits in length. Once the dictionaries for a pair of the device are synchronized and repeated patterns are identified in the outgoing traffic. Then it will be substituted with a unique symbol that acknowledges the original uncompressed information in a dictionary, then sent across the WAN link. The receiving device will then alter each symbol it identifies in incoming traffic with its copy of the original information and restores the content in its original form.

Object Caching

Object caching exchanges and manages stored collections of software objects between pairs of devices. It represents ways to implement shared compression and symbol dictionaries. Object caching also involves refresh intervals or timeout session information with objects in the cache to force them to be refreshed whenever such intervals end.

Traffic Shaping

Traffic shaping is applied to a set of packets which are also called a flow or a stream. It enforces additional delays on some packets so that they adapt to a predefined set of constraints called a traffic contract. Traffic contract also called as traffic profile allows WAN devices to control the volume of traffic sent across a link over a specific period called as bandwidth throttling. The maximum rate at which traffic may transit the link is called “rate limiting”.

Rectifying Forward Error

Forward error correction (FEC) is a method to obtain error control in data transmission where the transmitter sends redundant data and the destination identifies only that portion of the data which is error-free. WAN optimization devices include error correction bits into packets instead of adding excessive overhead to such traffic. That data can then be used to reconstruct discarded packets on the receiving end of an appliance pair. It helps in controlling jitter in streaming with making the voice traffic smoother.

A WAN device with multiple optimization tool and techniques maximizes wide-area bandwidth and minimize data loss and latency, you can make better use of your WAN links and certainly can accommodate growth across existing links without having to purchase additional bandwidth.

Bandwidth Optimization

Best Practices for Your Live Streams

Muvi, a leading Live Streaming platform provider recommends the following best practices to optimize your live streaming.

Items	Muvi Recommendation
Input Bandwidth	2.5 Mbps - 10 Mbps
Encoders	OBS, Teradek
CDN	Amazon CloudFront

Recommended input for live streaming

Items	Muvi Recommendation
Protocol	Real Time Messaging Protocol (RTMP)
Video Format	h.264
Audio Format	AAC
Maximum audio sampling rate	48000 Hz (Muvi can increase the value on request)
Resolution	Upto 1080p
Bitrate	Must be at least as high as the highest output bitrate - maximum: 10mbps
Framerate	30 fps

Slate Source File Recommendations

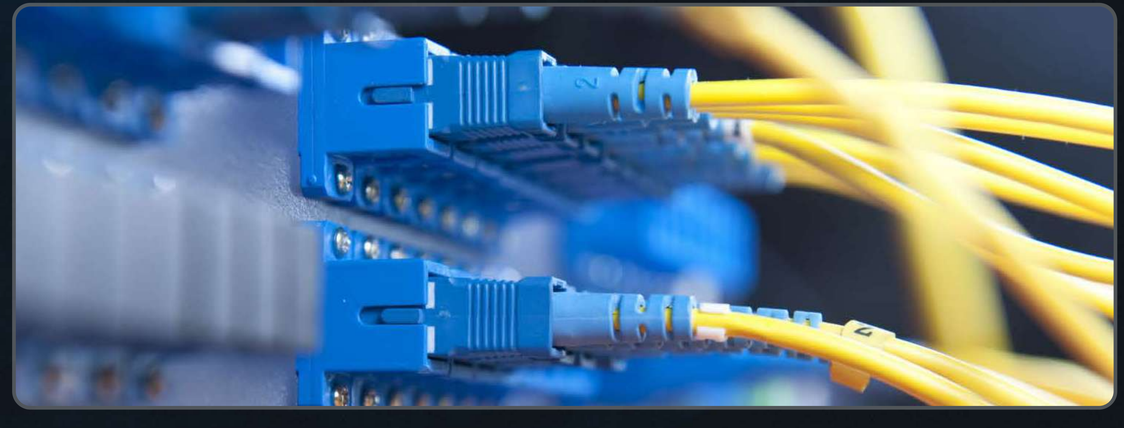
Resolution: (best in your encoding ladder)

FPS: (same as your source)

Bitrate: (best in your encoding ladder or better)

Audio: (best in your encoding ladder or better)

Video Resolution	Suggested Bitrate
Video codec	h264
Audio codec	aac
Width	omit to use source width
Height	omit to use source height
Bitrate	Match the input bitrate
Framerate	30 fps
Keyframe rate	1/second



AWS Regions

Muvi, a leading Live Streaming platform provider recommends the following best practices to optimize your live streaming.

Oregon: us-west-2

Virginia: us-east-1 (limited SSAI support currently)

Tokyo: ap-northeast-1

Singapore: ap-southeast-1

Sydney: ap-southeast-2 (limited SSAI support currently)

Mumbai: ap-south-1 (no SSAI support currently)

Frankfort: eu-central-1

Ireland: eu-west-1 (no SSAI support currently)

Sao Paulo: sa-east-1 (no SSAI support currently)

To step up your streaming service or to consult which video monetization model is best for your business, contact us:

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Test drive Muvi today!
Sign up for **Free 14-Day Trial**

Muvi is an enterprise-grade end-to-end Audio/Video Streaming Platform that allows content owners to launch their own multi-screen OTT platforms instantly! Muvi takes care of everything, including fully-managed IT infrastructure, online video player, DRM, security to website and apps for mobile & TV — all deployable in a click and at ZERO upfront investment.