BytePlus

Video Tech Stack 101:

The First Step to Your Video-First Strategy

Content Page

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Executive Summary

Companies across all sectors are adopting a video-first marketing strategy due to the prolific increase in video consumption worldwide and the benefits that video brings to their customers. From livestreaming sports events to on-demand explainer videos, each use case varies in its requirements.

Furthermore, there is a growing demand for interactive two-way communication with low latency. An example of this is when gamers engage in real-time interactions via text, audio, and video to win competitive games. Live interactive video conferencing is another application that has expanded rapidly over the last few years.

Video tech stack solutions are available to support this burgeoning demand and power a video-first business strategy. These comprise a combination of hardware and software needed to produce, deliver, and manage video content across various platforms and devices.

This process typically involves editing, encoding, and transcoding, which allows users to consume videos at the highest possible video quality, all while keeping the file size as small as possible. In short, you want to create a video that not only looks great, but doesn't take up too much storage space or require a high bandwidth to be streamed or downloaded. Achieving this would require a good understanding and use of video encoding tools.

Security and data protection are another integral part of a video tech stack. This is crucial to minimizing risks of piracy and unauthorized access. With threats from hackers and malware on the rise, picking the right protection solution can help to balance data security and, more importantly, the user experience.

One of the key considerations in building a video tech stack is the latency requirements of the application. There is often a trade-off between video quality and latency — both impact the user experience, but both can be mitigated with the right technology. Synchronization is also vital to ensure the metadata appears at the right time in the video stream.

BytePlus offers a variety of tools for developing a video tech stack, including Platform-as-a-Service (PaaS) solutions such as BytePlus MediaLive and BytePlus Real Time Communication, BytePlus Video-on-Demand as well as Software-as-a-Service (SaaS) solutions like BytePlus Live.

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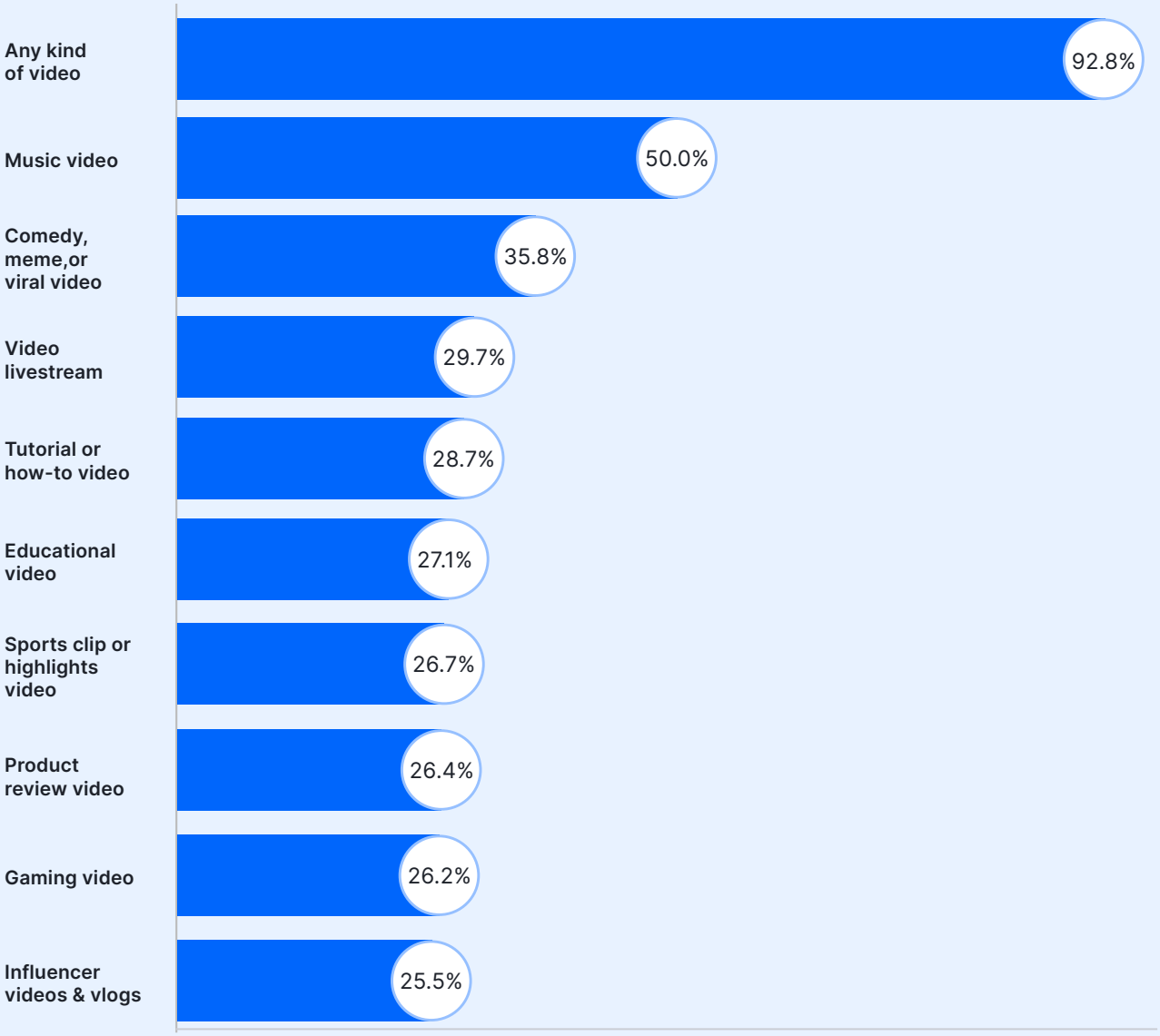
Getting Started: Planning the Video Tech Stack

If a person is on the internet, there is a good chance that he or she has consumed a video of some kind. According to the Digital 2023 Global Overview report by Meltwater and We Are Social, 92.8% of internet users worldwide watch digital videos on a weekly basis.

The variety of digital videos consumed is also vast. In terms of the types of videos, internet users are mostly using the internet to watch music videos (50%) and video memes (35.8%). However, beyond entertainment, a significant number of them are there to learn. The same report found that a third of internet users are consuming videos for educational purposes. It is evident, then, that businesses across different industries can benefit from a video-first strategy.

Most popular types of videos on the internet (2023)



Source: DataReportal

Each use case has its own unique requirements in terms of video distribution, which informs the design of the hardware stack for the business concerned. For instance, while livestreamed content often requires low latency to maximize viewer experience, video conferencing in a work setting has arguably lower, less stringent requirements. The specific hardware and software stack involved in both use cases would, naturally, be different also. Additionally, the technology is constantly evolving, making it imperative to futureproof the video tech stack and protect your investment.

Businesses looking to get started with their video tech stack investment should keep these seven key considerations in mind:

1. Type of video content

The requirements of a Live Commerce video stream are completely different to those of on-demand educational videos. For example, Live Commerce events typically involve a series of interactive elements between the host and the viewers. This means an additional software layer has to be added to the video tech stack. An on-demand educational video platform might not need to accommodate these real-time interactions, which makes the tech stack execution much simpler.

2. Audience size

The distribution strategy for a corporate training video platform differs significantly from the one adopted by a company seeking to create short-form videos with mass appeal. Viral videos rely on a widespread distribution infrastructure like a Content Delivery Network (CDN) to ensure all users can access the content with minimum delay. However, such requirements are perhaps not so critical for training videos with a smaller audience.

3. Number of supported platforms

Some use cases may deploy their videos on a single platform like web or mobile, while others rely on cross-platform compatibility to achieve high levels of user engagement. Transcoders may be needed to generate additional video stream formats to ensure accessibility from any device.

4. Distribution strategy

CDN consists of physical nodes around the world that make it possible to achieve low latency regardless of user location. BytePlus CDN consists of 1,300+ Points of Presence globally, with over 110 Terabytes-per-second-worth of network capacity.

5. Number of features

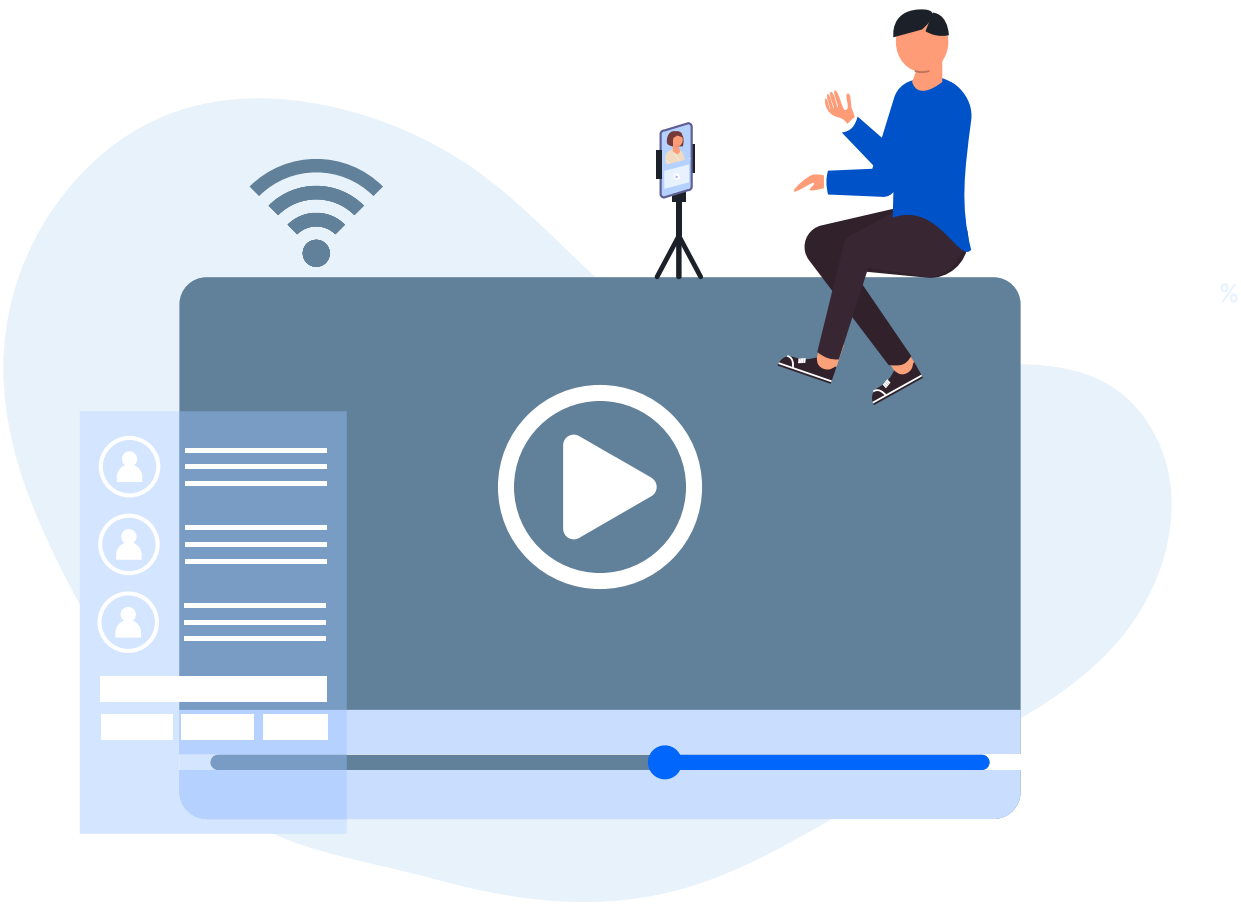
Every video feature adds to the complexity of a video tech stack. For a multidirectional streaming model, features could include everything from automatically-generated speech-to-text translations to immersive effects, stickers, and other video enhancement tools.

6. Size of managed data

For reference, Udemy is an educational technology company that has over 200,000 video courses on its digital platform, each about 4GB in size. Netflix, the video streaming giant, has a video catalogue of around 3.14 petabytes. As such, the larger the content library, the more extensive the data storage solution required.

7. Budget

The budget for implementing a video tech stack depends largely on the use case and the size of the application. A global presence with very low latency requirements will be far more costly to implement than a local solution with limited distribution.



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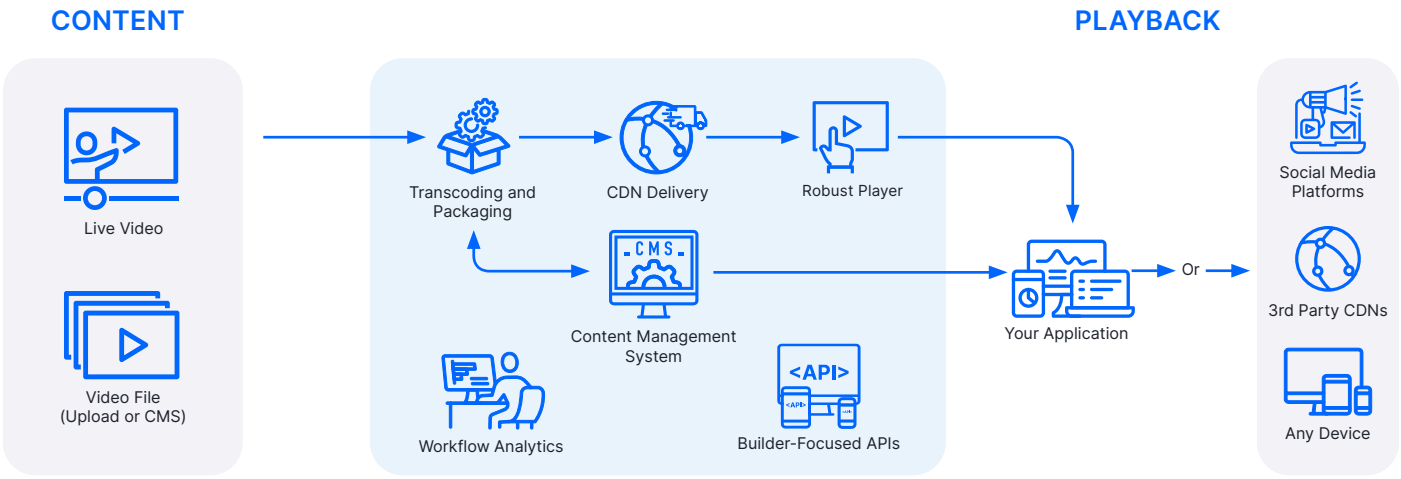
The Sum of its Parts: Key Components of a Video Tech Stack

An effective video tech stack is the sum of its parts. While there are certain basic core elements across all video tech stacks, others are more specific to individual features and use cases. It is also possible to implement a video tech stack in a multi-vendor approach by sourcing different components from different vendors or to go with a bundled approach, where one vendor supplies the video tech stack solution and is responsible for its ongoing maintenance and upgrade.

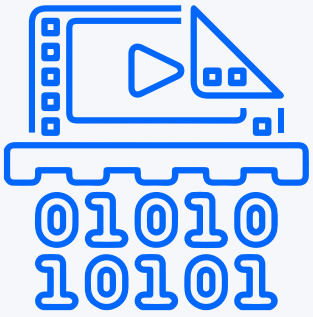
The diagram below shows the typical components for a video tech stack whether these come from multiple vendors or via a single vendor solution.



Video Hosting and Delivery Platform

Cloud-based video hosting and delivery platforms are third-party solutions that store, manage, and distribute videos on behalf of other companies. These applications provide services that include encoding, transcoding, and optimization. Working with a video hosting and delivery platform means that some of the video tech stack is taken care of by the third-party vendor of your choosing. Platforms that focus on user-generated content offer basic levels of optimization, analytics, and integration with other business applications.

Video Encoding



Encoding software converts raw video and audio files into a compressed digital format and implements a protocol for streaming the video over the internet.

This is how the process works: encoders use video and audio CODECs (Compressors Decompressors) to compress raw video files by removing information that are not noticeable to the human eye, thus making the bitrates low enough for livestreaming. Then, streaming protocols break the video file up into chunks of data for transmission using either standard internet protocols like Transmission Control Protocol (TCP) or User Datagram Protocol (UDP). Finally, the user's device unpacks the protocol and uses the CODEC to decompress the video for playback.

Developers can use these standalone encoders as part of their video tech stack to customize their streaming solution to their needs. Other bundled solutions include encoders and transcoders as part of the package, which do not require as advanced technical capabilities to configure.

The most common CODECs include:

	Acronym	Name	Description
H.264 AVC	H.264 AVC	Advanced Video CODEC	Established format compatible with most user devices
H.265 HEVC	H.265 HEVC	High Efficiency Video CODEC	A newer format for high definition (HD) video
4K UHD	VP9	Video Predictor 9	A popular format for streaming videos in 4K resolution
AVI	AV1	Alliance for Open Media Video 1	A highly optimized format that requires substantial computing power to execute

The most common protocols include:

	Acronym	Name	Description
	RTMP	Real Time Messaging Protocol	Well established for live video but can only transmit H.264 AVC
	SRT	Secure Reliable Transport	Works well for live video transmission on noisy networks and can transmit any CODEC format
	HLS	HTTP Live Streaming	Used for playback of H.264 AVC and VP9 CODECs
	MPEG-DASH	Dynamic Adaptive Streazming over HTTP	Can transmit any CODEC for playback video streaming
	WebRTC	Web Real Time Communications	Used for playback of H.264 AVC and VP9 CODECs

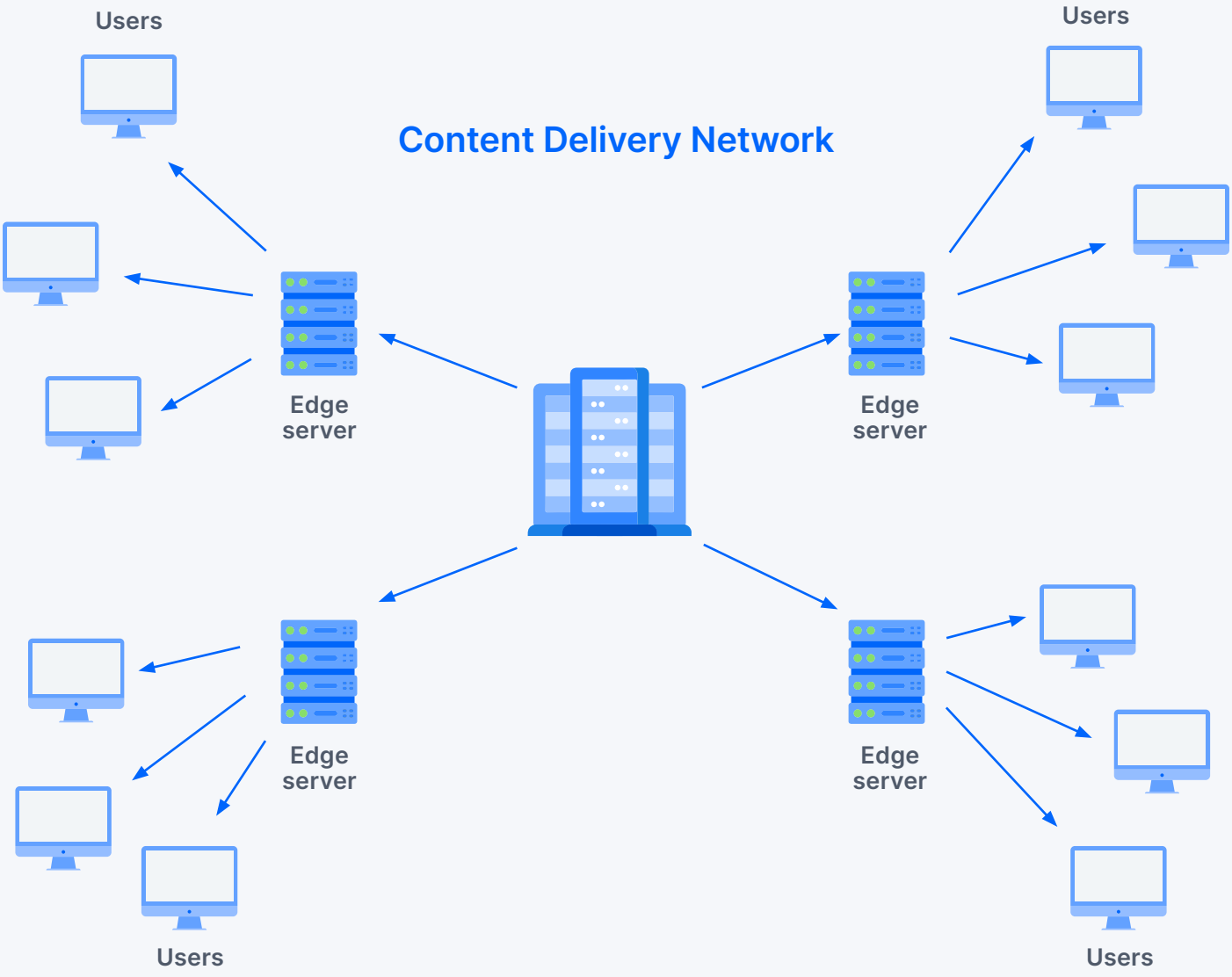
Video Transcoding

Transcoders decompress video files from one CODEC and recompress them using a different CODEC. They can also modify the video by 'transizing' (a technical term for resizing) it into a lower resolution or transrating (a technical term for converting audio and video files to a lower bitrate) it into a different bitrate. Transcoding could be useful for content creators who do not want to invest in several different CODECs. Instead, they can transmit a video to a cloud-based streaming platform using one CODEC and then allow their service provider to transcode the file using several different CODECS for delivery to their user base. This approach futureproofs their investment as the market adopts new CODECs in greater measure.

Content Delivery Networks

Distributing video to a global user base is challenging due to the large distances involved from the video hosting platform to user devices. An additional complexity is the widely different internet speeds in different locations. Yet, despite these challenges, users still expect low latency performance without buffering, lagging, or failure.

CDNs overcome these challenges by copying the source video onto edge servers around the world. These edge servers cache the live videos or highly accessed videos to minimize delays for users. Each user accesses the video from the closest server to their location using the protocol best suited to their internet speed. A typical CDN infrastructure is shown in the graphic below.



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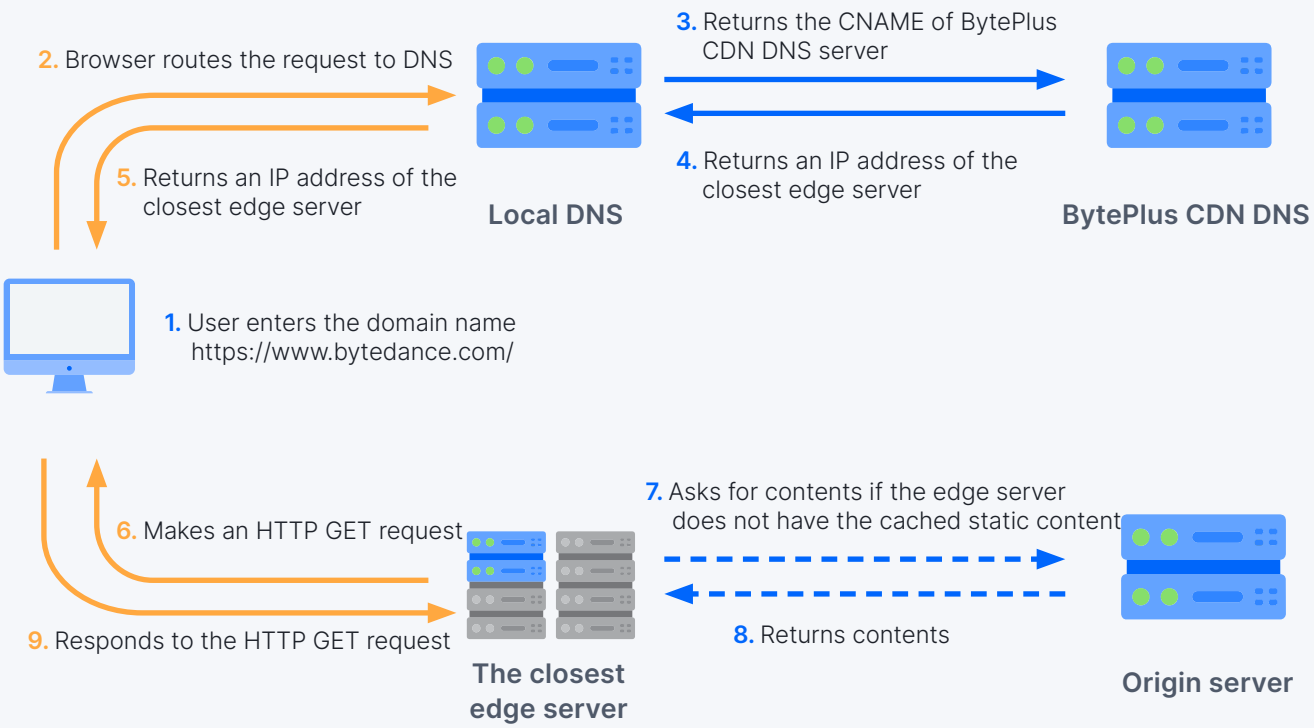


Applications that do not have a requirement for low latency may not need a CDN at all, but applications where low latency is critical could benefit from the extraordinary improvements in latency achievable with a CDN

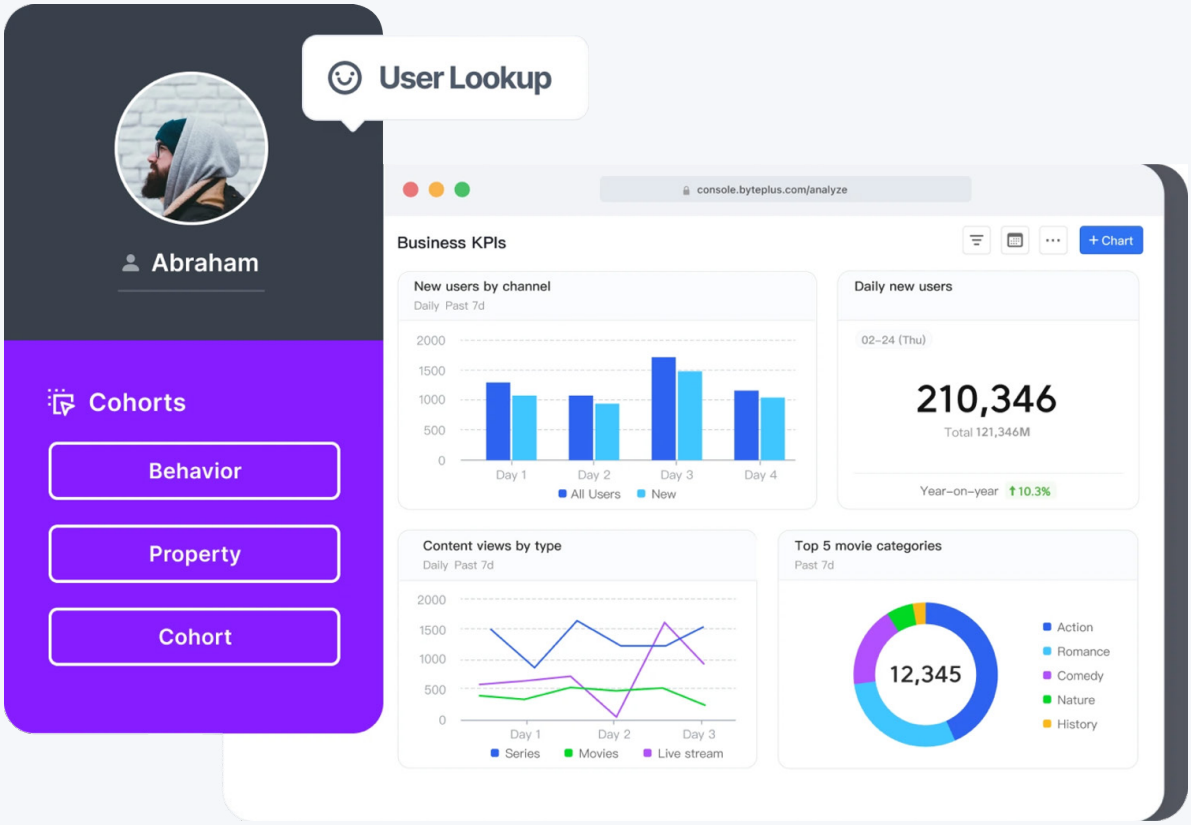
Video Analytics

An analytics component helps video providers analyze the stream performance and user behavior, which in turn facilitates the decision-making process. Video analytics should cover these main categories:

1. **Quality of Service (QoS) metrics,** such as throughput and packet loss
2. **Quality of Experience (QoE) metrics,** such as startup time, buffering, and playback bitrate
3. **Engagement metrics,** such as viewer count, viewing time, and a geographical breakdown of users

Here is a real-world example of video analytics in action. Netflix often uses data to determine whether to renew or cancel subsequent seasons of their original content. According to a report by Bloomberg, the streaming platform "relies on its own idiosyncratic data points to evaluate programs", and these include adjusted view share, internal efficiency scores, and impact value.

Take for example Squid Game, which had an adjusted view share (the show's share of Netflix viewing adjusted for the value Netflix ascribes to each viewer) of 353, an efficiency score of 41.7X (a show's value over its cost), and nearly US$900 million in impact value compared to the $21.4 million it cost to produce. While the exact figures are unclear, they are more than enough for Netflix to order subsequent seasons of the hit show.



Video Optimization

A key objective of a video-first strategy is to balance quality, latency, and cost. Improving one of these characteristics comes at the expense of another, making video optimization a critical factor.

Presently, the media streaming industry has shifted its attention towards ultra-low latency, primarily in the context of multi-person real-time interactive scenarios. Ultra-low latency is a crucial factor in ensuring seamless communication, and as such, has become a top priority for the industry.

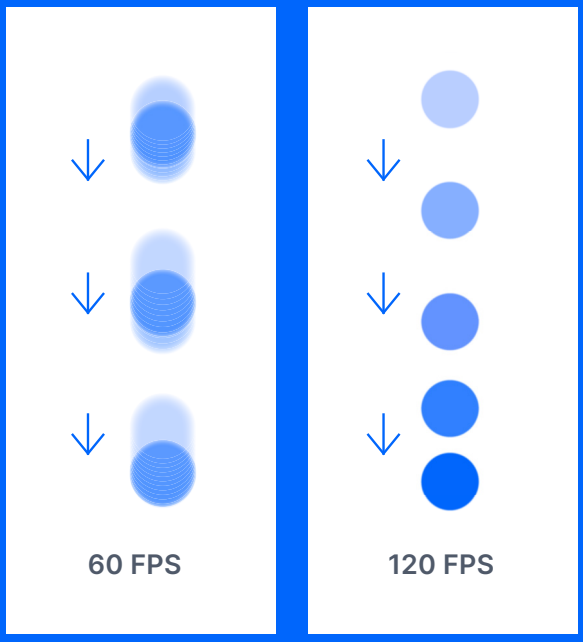
BytePlus RTC has taken a proactive approach towards addressing this challenge by deploying a vast network of more than 3,000 edge nodes across the globe. This strategic move ensures that users from all corners of the world can access the platform with optimal efficiency. The platform's impressive latency compliance rate of over 99.5% at a latency of less than 400ms bears testament to its commitment to providing high-quality real-time communication services.

A low quality video negatively affects the viewing experience. However, increasing video quality leads to higher bitrates, which in turn increases latency and impacts viewing experience down the line. Also, when a video loads slowly, it affects the way search engines rank a page. This can have a direct impact on the number of consumers engaging with your content and, therefore, your revenue. At the same time, high bitrate streaming is more bandwidth intensive and therefore more costly for streamers.

Some key parameters to consider when optimizing videos during encoding include:

- **Frame Rate:** The frame rate of your video makes or breaks the viewing experience. The rule of thumb is to maintain a frame rate of above 24 frames per second (FPS), which is the typical frame rate used for films and TV shows. YouTube and other game streaming platforms sometimes go as high as 60 FPS, which is also a good-enough frame rate for pleasant viewing. What is problematic is when the frame rate dips below 24 FPS, which is immediately noticeable for most audiences.
- **Keyframe Interval:** Video encoders save on bandwidth by transmitting the changes from the last frame rather than the entire picture. The keyframe interval defines how often the complete picture is transmitted
- **Overall Bitrate:** The higher the bitrate, the better the quality — and the higher the bandwidth requirements. Adaptive bitrate (ABR) video streams allow the video player to choose the highest bitrate it can support offering each user the best quality their device is capable of.

Some image suggestions for illustrating this point:



Video Editing

Video editing has experienced an incredible transformation over the past 10 years. From cost-effective applications to higher quality footage, technology and consumer demand have pushed the industry to new heights. Social media platforms like TikTok provide unprecedented global sharing capabilities, allowing aspiring editors to showcase their work to millions of viewers in mere seconds.

With such remarkable advances in this field, any business that wants to put together a video content platform needs to think about mobile- and cloud-based editing abilities, an easy-to-use interface, AI-aided editing capabilities, and integration with well-known social media networks. By providing these capabilities, the platform can cater to the evolving needs of today's users and offer a compelling video editing experience.

Modern video editing tools, like BytePlus Video Editor, give users access to advanced editing technology previously only available to professionals. Users can integrate a wide variety of features for content creation using a compact SDK, which supports iOS and Android integration. They also have access to over 70,000 different filters and effects when coupled with BytePlus Effects.

BytePlus Video Editor has several features that make it an ideal component for any video tech stack:

1. **Professional editing** features like cropping, rotating, looping and masking videos along with the ability to adjust contrast, exposure, and brightness.
2. **Advanced multi-track editing capabilities** like layering multiple audio and video tracks for creative editing.
3. **Key frames** that allow animators to pinpoint different aspects of a graphic and determining their movement and alteration over time.
4. **An extensive library of filters and effects** through a user-friendly interface with BytePlus Effects.
5. **Magic Templates** that allow content creators to quickly create new and engaging content pieces using editable templates inside the Video Editor SDK.

In short, advancements in technology and changes in consumer preferences have revolutionized video editing over the past decade. With more accessible tools than ever before, cheaper cost barriers, and global sharing capabilities, video editing is on track for even greater development moving forward.

Video Security

Security is just as critical in video applications as in other sectors. For one, video streaming platforms that also facilitate payments, such as those with subscriptions, need security measures in place to prevent unauthorized access or cybersecurity attacks. Security measures also extend to video conferencing platforms. Zoom, for instance, introduced a waiting room feature to prevent uninvited guests from entering active online meetings.

Then there is DRM (Digital Rights Management), which prevents users from copying or accessing specific content. Some common security options include the following:

- AES (Advanced Encryption Standards) encryption ensures only users with a key can watch the content
- Password protection can be implemented with user accounts and offers medium protection considering passwords can be shared or hacked.
- TLS (Transport Layer Security) helps protect data like user payment information.
- Geo-blocking can be used to limit access from regions known to have high piracy rates.

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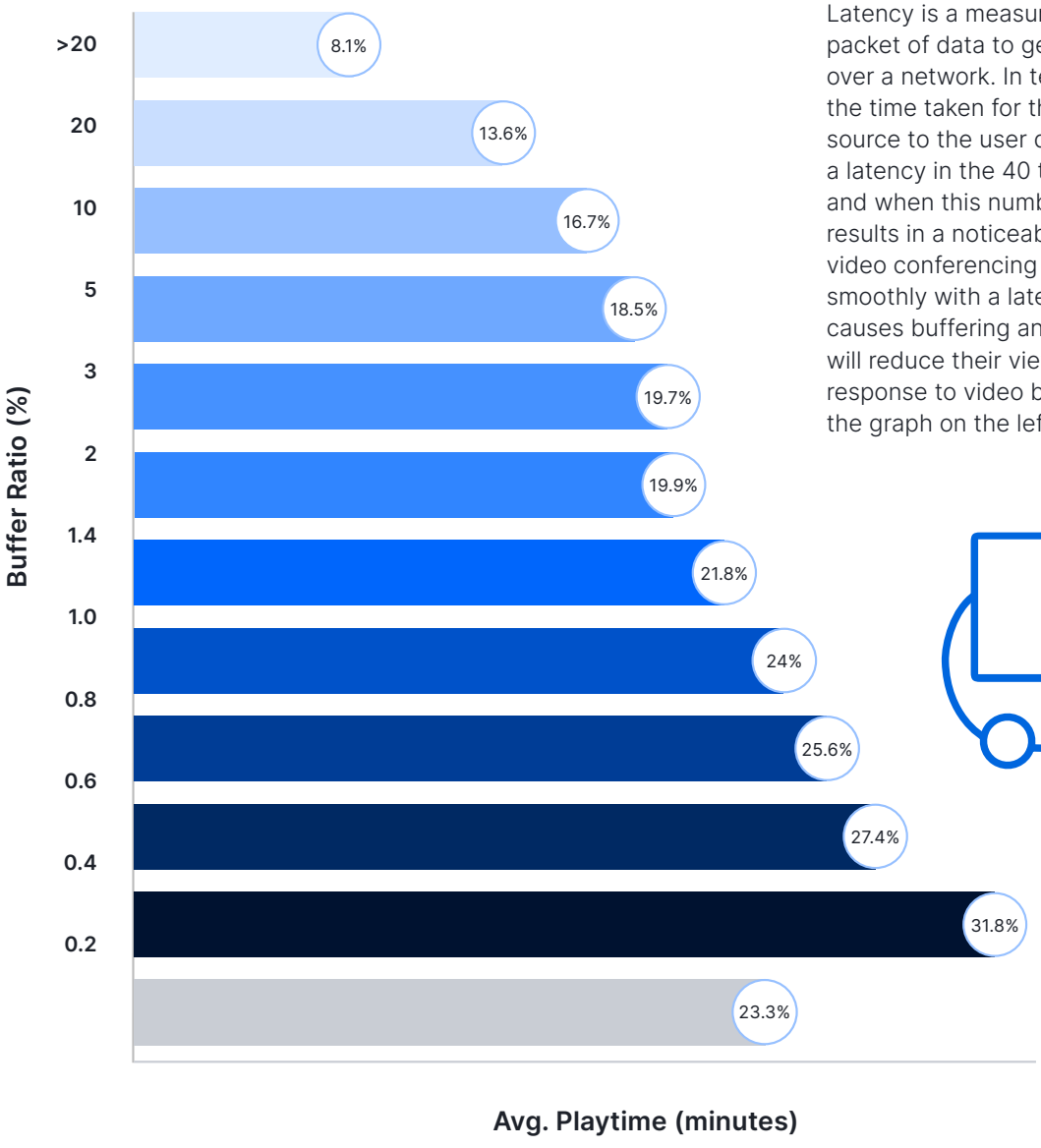
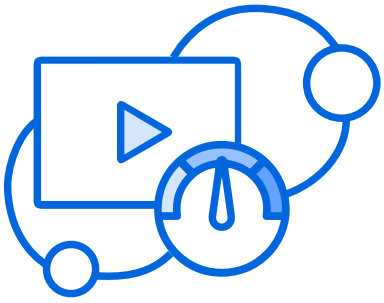
Other Key Considerations

When putting together a video tech stack, there are several key considerations businesses need to think about. Each consideration will have an influence over the best tech stack solutions for the use case in question:

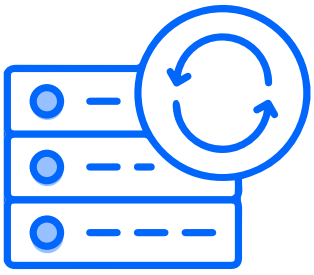
Latency



Latency is a measure of the time it takes for a packet of data to get from one point to another over a network. In terms of video streaming, it is the time taken for this data to get from the source to the user device. Gamers operate with a latency in the 40 to 60ms (millisecond) range and when this number creeps above 100ms, it results in a noticeable lag. On the other hand, video conferencing applications can run smoothly with a latency of 150ms. Poor latency causes buffering and research shows that users will reduce their viewing time significantly in response to video buffering as can be seen in the graph on the left.



Data Synchronization

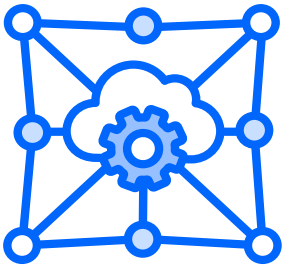


There are three types of data transmitted in a video stream: video frames, audio frames, and metadata.

To limit synchronization issues, video and audio signals are typically combined and sent together via a single communication link, while metadata is transported separately. This means that video overlays, the timing of GPS co-ordinates, or even opportunities to place an order may be out of sync with the video stream. It is thus vital for video tech stacks to transmit the metadata at a similar bitrate to the video stream either by slowing everything down or using low latency transport channels for metadata, such as a WebRTC data or web socket channel.

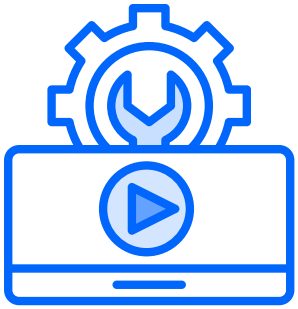
The more disparate the products in your video tech stack are, the more complicated it is to manage synchronization. As such, it is better to use a single development environment or a bundled cloud-based video platform.

Scalability



Scalability has to do with the ability to expand storage or computing power based on business needs. Choosing a scalable infrastructure allows video streamers to grow with the market demand for their services without major capital investments.

Customization



Customization is often the differentiator between video streaming providers. While some video tech stacks do offer standard features, they limit the ability for businesses to customize their platforms and stand out in the increasingly crowded video landscape. Meanwhile, PaaS solutions like BytePlus MediaLive allow more extensive customization using developer toolkits.

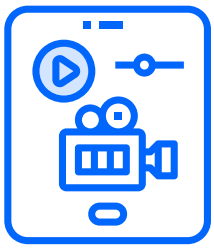
Lock-in

Whichever video tech stack solution you adopt, be careful not to get locked-in to a specific system. You may want to change your approach in future without having to rebuild your system from scratch.

While relying on multiple vendors for different components in your video tech stack offers the most flexibility, it also entails greater responsibility in terms of maintaining and upgrading your software in the long run. There is a thus a trade-off between flexibility and customization on the one hand, and comprehensive vendor support for the entire solution on the other.

Multi-cloud solutions, which are platform agnostic offer the benefit of being able to store your content on the best platform in a local area, rather than being locked in to one cloud provider globally.

Support



Vendor support for your video tech stack can make the difference between success and failure because a disruption in video streaming causes users to drop off. On the other hand, choosing a vendor that offers a leading technology solution as well as the technical resources to support your implementation can ensure success. The right vendor can advise you on your approach, help you select the best technology, scale your solution as your business grows, and keep you current with technology changes over time.

Pricing

There are several pricing models for video streaming providers from per minute or per stream models to monthly or yearly subscriptions. It is important to take future growth into account when negotiating a vendor contract as the costs may increase substantially when your user base grows.

Future Proofing

Video streaming technology is constantly evolving. New CODECs like AV1 offer benefits to video streamers but not all protocols can accommodate the new format. It is important to select components of your video stack that will evolve with the technology so that you don't have to migrate to a completely new system when your original approach goes out of date. This may mean a slightly higher investment in the short term but a lower total cost of ownership over the life of the technology.

05

Assembling the Right Team

Implementing a video tech stack is one thing but developing a team — with a video-first mindset — is just as important.

A video-first mindset is an organizational culture that prioritizes video as a medium wherever it can be used, like entertainment, explainers, training, testimonials, presentations, and even onboarding processes.

A video-first team understands the value of video, the requirements for each use case, and the infrastructure to support the application. Some team members may be focused on the use case, while others may be focused on the technology. However, a collaborative environment where each team member plays their part is instrumental in implementing a successful video streaming strategy.

Some common in-demand roles within video-first organizations include:

Multimedia Designers/Animators:

Traditionally, this would be a specialist team. However, BytePlus Video Editor makes it easy for users to create and edit videos even if they are not experienced multimedia designers or animators.

Software Developers

Software Developers are well versed in programming languages, such as like Java, Python, or C++, to design and develop each part of a video stack and integrate the components with each other.

Data Engineers

Data Engineers are responsible for converting raw data into usable forms, which in turn help Data Scientists and Data Analysts probe for deeper, more meaningful business insights.

Performance Engineers

A good software is one that runs well. Performance Engineers are focused on the reliability of software applications, making sure that they operate as designed and with each other.

Product Development Managers

These managers follow where the opportunities are in the market, then discover gaps that your product can fill.

06

The BytePlus Perspective

BytePlus offers four video cloud solutions:

BytePlus Live is a SaaS solution that offers an integrated end-to-end Live Commerce platform capable of streaming up to 50 or more social platforms at once.

BytePlus RTC is a PaaS solution for adding in-app livestreaming, audio, and instant messaging capabilities.

BytePlus MediaLive is a PaaS solution that allows larger organizations the ability to customize their own Live Commerce platform using developer tools.

BytePlus Video-on-Demand is a PaaS solution for storage and on-demand streaming of streamed and pre-recorded content.

BytePlus Live overcomes the challenges of integration faced by new entrants into Live Commerce. The entire solution can be implemented in a day using templates depending on the format of the event and the relevant industry. This platform also gives businesses access to real time analytics for making data-based decisions both during the stream and for planning future events.

BytePlus MediaLive allows customers to differentiate themselves from other brands with a customized livestream solution. They can tap into the BytePlus SDK to create their own environment for entertainment, E-Commerce, education, and new-media use cases. Implementation can take approximately a month with support from the BytePlus team.

BytePlus RTC allows customers to add high-quality audio and video experiences inside a wide range of web and mobile applications. It supports one-to-one or group communication in real time, improves viewer engagement and interactions via audio effects, screen sharing, and text-based messages, as well as provides visual tools to track audio/visual quality, performance, and streaming usage.

BytePlus Video-on-Demand is a comprehensive audio and video platform that offers an end-to-end solution for video content. It provides customers with a complete suite of tools to create, upload, store, manage, and share video content. The platform provides smart video processing capabilities to improve video quality, accelerated distribution and video playback.

07

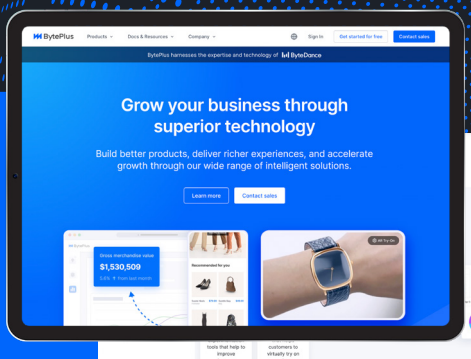
The Final Word

Video is a medium that continues to expand rapidly across different sectors and markets. Its utilities are also evolving, from video-on-demand and livestreaming to cloud gaming and even telemedicine in healthcare. Each use case would require a different set of requirements in terms of video quality, latency, and interactions.

It is without a doubt that video tech stack is such a vital component of a video-first strategy. It provides the necessary tools for compressing, managing, and distributing videos from providers to users. Processes, like encoding and transcoding, are especially important to the overall viewing experience, along with security and data protection features on the backend.

As for putting a video tech stack together, businesses can either opt for individual components from separate vendors or partner with a video cloud solution provider with several components bundled together.

BytePlus offers PaaS solutions like BytePlus MediaLive, BytePlus VOD and SaaS solutions like BytePlus Live, while BytePlus RTC provides the interactive features needed for gaming and Live Commerce Applications. Our video editing and analysis tools are developed from the same platform that powers billions of users on some of the world's most famous apps.



Visit BytePlus Live, BytePlus MediaLive, BytePlus RTC and BytePlus VOD and sign up for a free trial and consultation with our Cloud Video Platform specialists today. For further questions, please get in contact with us here.