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Mike Sandler, President & CEO, and Misha Jiline, CTO

Democratization of live video

What an extraordinary decade and a half it has been! For 16 years, Epiphan has been dedicated to helping people capture, stream, and record high-resolution video in settings ranging from classrooms to operating rooms to the International Space Station. We are particularly excited about these past few years. We've spent them working on cutting-edge, user-friendly video encoding hardware.

We are incredibly proud and thankful for all the positive feedback we've received about the Pearl family of encoders. We were particularly excited to launch this product five years ago because we knew there hadn't been anything like it on the market. Over these years, Pearl-2 and Pearl Mini all-in-one live video production systems have proved to be reliable, easy to use, and versatile, fitting a wide range of customers' needs. Yet, as we continue to work on perfecting and upgrading Pearl features, there's definitely more to look forward to from Epiphan in the near future.

We believe that both listening to our customers and keeping a finger on the pulse of the industry are incredibly important. The demand for reliable, powerful, and cost-effective encoding hardware is higher than ever. Following the success of Pearl Mini, we are now on the road to developing Pearl Nano: a professional-quality single-channel encoder. The new product will fill the existing gap in the encoding space by leveraging the powerful feature set and reliability of Pearl firmware and the flexibility to fit a wide variety of use cases.

We've also been working on LiveScrypt, an automatic transcription solution that will make it easier and more cost-effective to deliver subtitles during live events – from business conferences and corporate town halls to broadcasts and sermons. Leveraging powerful AI technology, this new appliance will help organizations in every sector make their events more accessible.

Epiphan Video is equally excited to begin work on a completely new project: a remote video production solution for enterprises. The idea is to leverage existing network infrastructure to create a completely hands-off AV-over-IP video streaming and recording studio. A remote video production studio holds the key to streamlining and speeding up the process of live and recorded content creation. The demand for such a solution is driven by the need for a cost-effective, scalable, and secure way to produce high-quality video.

We are curious and eager to engage with the pioneers and risk-takers out there. And we also love sharing our ideas with you.

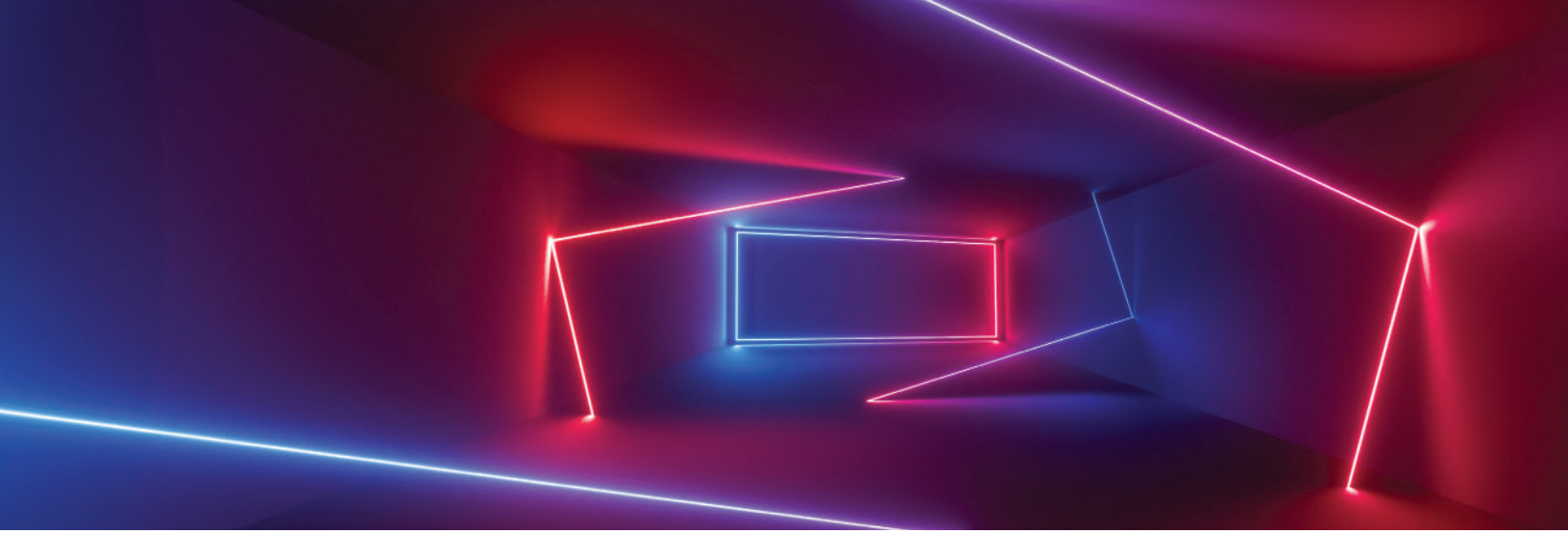
Over the years, we've been working hard on developing meaningful ways of interacting with you (e.g., via the website, at trade shows and exhibitions, through a weekly webcast, etc.). Why? Because we are always interested in sharing stories of how video is changing the world. We enjoy passing down our expertise. We are curious and eager to engage with the pioneers and risk-takers out there. And we also love sharing our ideas with you.

Transparency has always been a guiding principle at Epiphan Video. From day one, we've shared with customers and partners our latest developments and thinking. Because sharing is how ideas flourish and what helps people achieve their best work. Open discussion puts us more in tune with your needs and how our products and services can solve them. With each new insight, we're in a better position to build the solutions that will enrich your life and your work.

We'll continue to do business with this transparency mindset. *EVolution* magazine is one vehicle to help us do just that. We hope our excitement and enthusiasm shines through these pages, and that you'll see this publication for what it is: an invitation to start a conversation.

Mike Sandler, President & CEO at Epiphan Video, is a seasoned technology entrepreneur in the web and collaboration technology space. He has more than 20 years of management and software development experience in both private and public high technology organizations.

Misha Jiline, CTO at Epiphan Video, is the driving force behind Epiphan's technology strategy. Misha is responsible for maintaining awareness of technologies pertinent to Epiphan Systems, solution suite and for potential partnerships. Misha provides the vision and strategic leadership in the implementation of technology to further Epiphan's mission and goals.



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Live video streaming:

Top trends of today and tomorrow

Live video streaming is thriving as a medium. At the beautiful junction of improved connectivity and technological advancement, live video is accessible to virtually everyone. This democratization of live video has introduced enormous opportunities for experimentation, which has given rise to various trends. And there's more to come: Cisco projects that live video will account for 17 percent of all Internet video traffic by 2022.[1] That's a 15-fold increase from 2017 to 2022.

It's an exciting time for the industry, and it's equally exciting to consider what's on the horizon for live video streaming. Let's dig into the top live video streaming trends of today and tomorrow.

1 Cisco. *Cisco Visual Networking Index: Forecast and Trends, 2017–2022*. February 27, 2019.

Top trends of today

1 More industries are leveraging live video

With live video as accessible as it is, many industries are using it for both internal and external purposes. Educational institutions, enterprises, governments, healthcare providers, and other organizations are all live streaming for a variety of reasons. Overwhelmingly, live video is helping organizations enhance their workflows and improve communication, driving efficiency overall.

Live streaming is changing the way students learn. According to Kaltura's *State of Video in Education* report,[2] 53 percent of educational institutions live stream conferences, school events, and lectures. This figure has grown steadily over the past few years and is projected to soar even higher. Remote access to lectures and events helps students better retain knowledge, comprehend material, and take part in school events wherever they are.

Businesses are increasingly using webcasting for large-scale communications. Kaltura's *State of Video in Enterprise* report found that 80 percent of large companies broadcast events live.[3] Enterprises also use live video for internal communications, employee training, webinars, live event broadcasts, and all-hands meetings.

Similarly, healthcare organizations are using live video for telemedicine, conference streaming, and staff training. Governments are streaming court hearings, town hall meetings, and mandated sessions. This trend is projected to grow even further as more organizations add live streaming to their arsenals: Brandlive's *Video Solutions Benchmark Report* found that live video capture is a top priority for companies evaluating video solutions.[4]

2 Consumers are cutting the cord in favor of OTT services

Any discussion about streaming video today wouldn't be complete without mention of OTT (over-the-top) video platforms. OTT refers to any streaming media service offered directly to viewers over the Internet (rather than through a satellite or cable provider). Consumers across the world – in greater numbers each year – are cancelling their TV subscriptions entirely (aka "cutting the cord") in favor of OTT services like Hulu and Netflix. The choice to switch only makes sense: traditional broadcast TV bundles are often overpriced and available on a limited number of devices. Services like Roku and Apple TV offer much more flexibility in terms of pricing and device support. To stay competitive, many broadcast networks are launching their own OTT platforms (e.g., Disney+) and partnering up with popular online video platforms like YouTube to appeal to younger audiences.

While many consumers have in fact cut the cord, others are still reluctant to do so. One of the major issues with online streaming is latency. Internet live video is often a minute or more behind its TV broadcast counterpart, which can cause annoying spoilers for fans. As Limelight highlights in its *State of Online Video* report,[5] 58 percent of consumers would be more likely to watch live sports online if there was no delay compared to the TV broadcast.

2 Kaltura. *State of Video in Education 2019: Insights and Trends*. July 2019.

3 Kaltura. *State of Video in Enterprise 2019*. November 2018.

4 Brandlive. *2019 Video Solutions Benchmark Report*. 2019.

5 Limelight. *The State of Online Video 2019*. 2019.

OTT platform providers are always looking for new ways to incentivize viewers to pick and stick with them. This includes producing original content and providing as much content variety as possible. This, however, introduces a new dilemma for consumers: what to watch? It can be hard to decide with so many streaming services to choose from and so much new content being produced daily. AI and machine learning can help here by creating personalized viewer experiences. Using algorithms, platforms can analyze vast amounts of user and video metadata (viewing history and other preferences) and make educated guesses as to what a viewer might be interested in watching, keeping them engaged for longer.

3 Live video is a fixture in marketing plans

Live video is reinventing the way brands think about marketing and e-commerce. It has already proved itself as an essential marketing tool, helping brands grow and better engage their audiences.

Today, we see brands going live regularly on social media and other content delivery networks (CDNs). During these streams, they promote their products, interact with viewers, answer questions, and work on building a strong community around their brand. Live Q&A sessions, tutorials, live product launches, exclusive behind-the-scenes streams – all of these are tools that help build real trust between a company and its customers or clients. Thus, by introducing the element of authentic human interaction, live video helps brands come across as more transparent and approachable.

Knowing this, brands are zeroing in on live video more than ever. A study by Brandlive and IBM reported that about 95 percent of companies consider live video to be an important part of their marketing mix for the upcoming year, and 25 percent agreed that "live content will be a top priority, edging out pre-recorded video."[6] Over 50 percent said their budgets for live content will increase compared to the previous year.

4 Social media is driving live video adoption

We've witnessed the rise of live video journalism on social media, capturing life-changing events in the most polarized parts of the world. We're seeing gaming and eSports live streams constantly break viewership records. Many online creators today are able to make a living going live. Thousands of houses of worship are streaming their services, connecting people together in prayer and in spirit.

Live video apps like Periscope and Snapchat have skyrocketed in popularity, especially among younger audiences. Sending live video clips to communicate with peers feels natural to this generation. Perhaps just a decade ago, users felt awkward going on a video call or even embarrassed watching someone else's poorly produced live video. We are now more forgiving (and much more appreciative) of the more natural, genuine human behavior that comes across in live media.

6 Brandlive & IBM. *2018 Live Video Streaming Benchmark Report*. January 2018.

Top trends (and technologies) of tomorrow

1 360-degree video, VR, and AR will pick up steam

Just a few years back, 360-degree video, virtual reality (VR), and augmented reality (AR) seemed to be off to an explosive start with alluring features like hologram video chat on our phones. In retrospect, these technologies haven't taken off as quickly as initially hoped. Adoption has been slow. Although AR has found a lot of success with mobile social streaming apps like Facebook, Instagram, and Snapchat, live VR still has a long way to go. It's a struggle to provide sufficient frame rate for a high-quality user experience with existing mobile bandwidths and codecs.

That said, we still believe this technology is bound to continue its stride forward. With 5G Internet and efficient codec support just around the corner, it's only a matter of time before AR/VR and 360-degree streaming finds its way into practical applications beyond social streaming. One such example is remote customer support. To assist their customers, companies might ship a VR or 360-degree camera kit that the customer is to set up. Once deployed, this support kit will act as the remote specialist's eyes and ears on the ground. This kind of remote customer support could save companies a lot of time and money on personnel travel.

2 More of the live video experience will be automated

Machine learning (ML) and artificial intelligence (AI) will continue to be top trends in live video streaming. They hold the key to providing outstanding results when it comes to streamlining encoding workflows, managing content production and distribution, and personalizing the viewer experience. In a world where the amount of video content grows exponentially, AI will help create, organize, and distribute more content to more viewers with less human effort (and money). The once manual tasks of metadata tagging, facial recognition, live transcription, and translation will soon be done by ML and AI.

AI will detect specific cues within videos (changes in lighting, facial and speech recognition, etc.) to automate live video production, including switching, recording, and graphic overlays. "Smart" live video can start streaming automatically as soon as it recognizes a specific voice or person in frame. This technology will help track indexed moving objects, keeping them in focus (think presenter moving across a stage). Once the stream is done, the technology can automatically generate and upload highlight reels of the event based on cues like audience applause and lighting. AI will also play an important role in regulating unauthorized content by detecting copyrighted material in real time.

Additionally, AI could be leveraged for more efficient encoding of streaming media. (Case in point: at IBC 2019, the company iSize announced a new codec that uses AI to optimize compression.) AI and ML will continue to play an instrumental role in applications like per-title encoding (i.e., encoding video streams and even individual fragments differently based on aspects like pace of action and subject matter).

3 8K will enter the mainstream

There's been no shortage of 8K products at recent trade shows and exhibitions. At IBC 2019 alone, multiple 8K cameras and TVs were unveiled. Still, some argue that true adoption of 8K is a ways away: 8K TVs are not yet widely affordable, and there isn't much 8K content being produced.

However, at its current growth rate, it's only a matter of a few years until 8K becomes a standard top-tier encoding ladder offering from broadcasting networks and OTT video platforms. Adequate encoding technology is available (i.e., HEVC codec, though some kinks around new codec royalties still need to be worked out) and ready to provide efficient compression and lower bandwidth usage. And with 5G speeds, delivering 8K content to home TVs will be easier than ever. The first true exhibit of the power of 8K streaming will be at the 2020 Olympics in Japan, where 8K screens all around the venue will be streaming high-pace content in the highest quality available today.

High-ranking executives, who may need to appear on live TV often, stand to save a lot of time if they could go live from the comfort of their offices rather than having to travel to each TV network.

4 Remote production will become the norm for live video

Remote production is on a clear path to becoming the prevailing way to produce live video content. The transmission of live audio and video signals over IP is a strong competitor to analogue AV transmission. Using AV over IP to produce live events remotely has the potential to save organizations huge amounts of valuable resources. We see a future where more organizations – including media, live event producers, corporate offices, and even higher education institutions – will choose to transmit and produce all audio and video through a network infrastructure.

Remote video production is cost-effective, scalable, and highly secure. One use case that stands out is remote production video studios for enterprise. High-ranking executives, who may need to appear on live TV often, stand to save a lot of time if they could go live from the comfort of their offices rather than having to travel to each TV network.

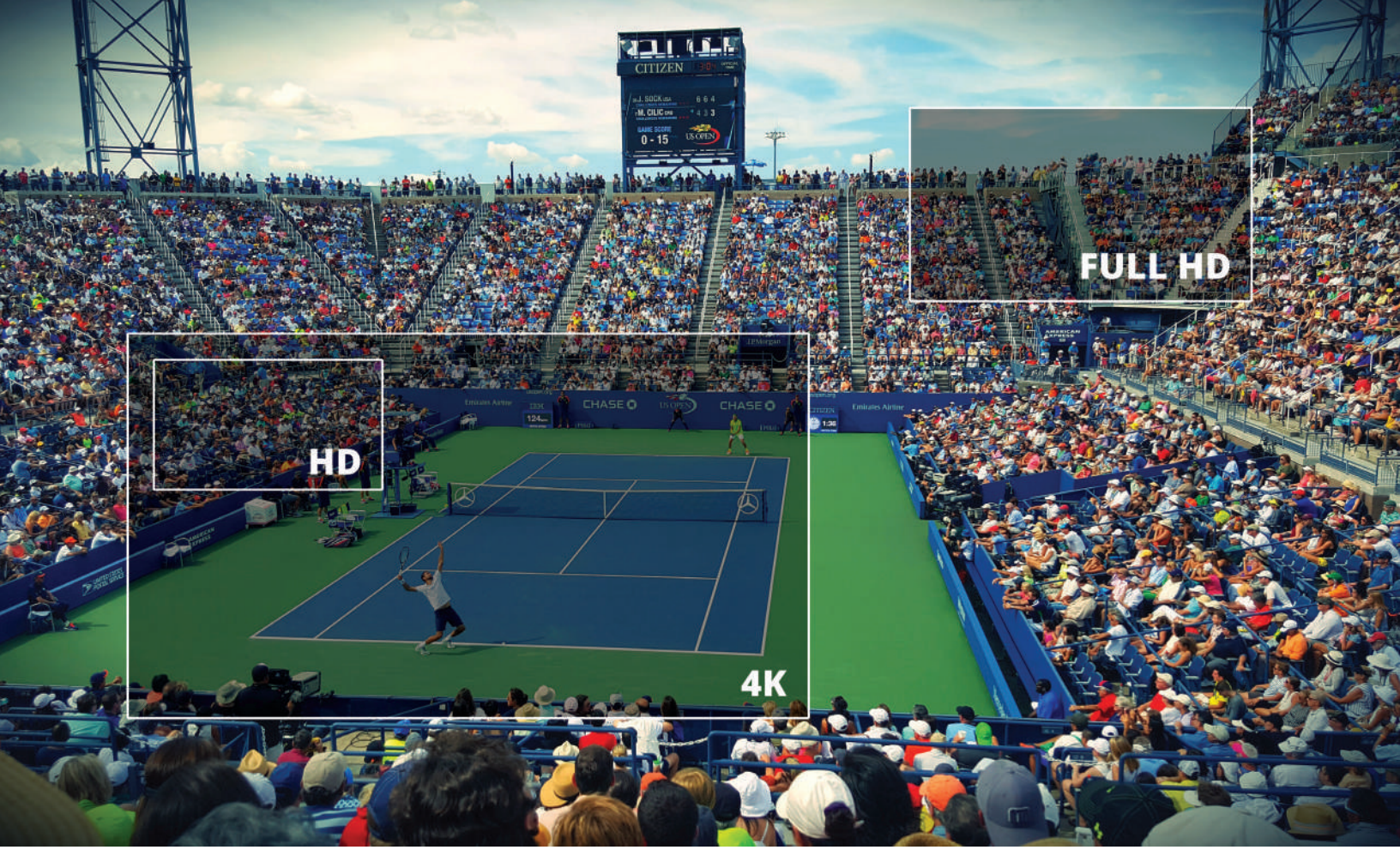
In an effort to optimize and streamline live production workflows, more live broadcasting companies will move to a remote video production model. Instead of bringing an outside broadcast (OB) truck full of production crew to an event venue, companies will send a small team of technicians to set up audio and video equipment. Potentially, this equipment could be set up permanently, especially at larger venues. All signals would travel through a robust IP infrastructure, and live production would be handled remotely from a well-equipped production facility.

Looking ahead

Live video has changed how we learn, collaborate, market products and services, and consume news and entertainment. As new technologies emerge and existing ones develop, the impacts of live video on our lives will only deepen. It will further streamline and improve workflows across numerous industries, change how we access technical support, and make participating in events remotely feel realer than ever.

What are your predictions for the future of live video streaming?

Let us know at **magazine@epiphan.com**



Beyond 4K:

How 8K cameras could revolutionize live event production

It hasn't been all that long since 4K hit the market and already AV companies are carting out 8K computer monitors and television panels. Four times more pixels. What's not to like? The current price point, for one, and the fact that there's precious little 8K content to showcase the benefits of all those extra pixels. Even if there was plenty, it's still unclear if the human eye can perceive the difference between 4K and 8K during normal viewing.[1]

It'll be some time before the average consumer (or business) is ready to board the 8K hype train. But we at Epiphan Video are already excited, and not just because video is kind of our thing. We're excited because we can see practical applications for 8K on the horizon when it comes to live event production.

1 Forbes. *Don't Be Fooled. 8K TVs Are A Waste Of Money For Most Viewers*. October 28, 2018.

To be clear, we're not talking about live streaming in native 8K. Short of a breakthrough in video compression technology, that's still a ways off for the average consumer. Bandwidth requirements alone put 8K live streaming squarely in unfeasible territory for most, and that'll likely remain the case for some time. Local 8K video processing is what we see as the most viable short-term live event production use case (for now, anyway).

8K cameras are already on the market

Big names like Canon, Red Digital Cinema, and Sony have released 8K-ready cameras for professionals who live on the cutting-edge of video production. These cameras carry hefty price tags, but using one can enable video producers to cut costs elsewhere and simplify their setups while capturing a stunning image. How? By cropping pixel-rich 8K footage in post-production or in real time to get an eye-popping, 720p, 1080p, or 4K image.

The power of 8K cropping for live video

The same kind of technique has long been possible with 4K. Videographers can crop a 4K frame to get a great composition or make a single-camera shoot seem like a multi-camera production. 8K makes this approach even more powerful by quadrupling the number of pixels to play with – from 3,840 × 2,160 to 7,680 × 4,320. Essentially, each crop would be a small piece (e.g., 1920 × 1080 or 1280 × 720) of a much larger 8K frame. You'll be left with a shot of excellent quality thanks to the exceptionally high resolution of the native source.

Let's imagine a practical scenario. You're producing a live event: a panel discussion taking place in an auditorium. There are four participants on stage. You're capturing the stage with a single 8K camera set up at the back of the room. With an 8K-capable appliance, you could crop the video into 1920 × 1080 blocks, each framing one panellist. Think of each crop as its own layout. Switch between these layouts and it'll appear as though you're shooting with multiple cameras. Combine this trick with auto-tracking technology coded to switch layouts based on who's speaking and the effect is even more impressive.

Naturally, digital zoom would be far more versatile working from a sprawling 8K source. You'd no longer need PTZ cameras, cumbersome robotic arms – or even in-room camera operators.

What about bandwidth? All the 8K processing would happen locally, as it would if you were to use the same technique with a 4K camera. It's a 4K, 1080p, or 720p signal you're sending to the streaming platform, not an 8K one.

Inching toward an 8K world

The scenario we've imagined here might not be feasible today, but it's where we see live event production going as 8K inches its way to the mainstream. With talk of more efficient video codecs that will make 8K workflows more palpable[2] and companies like Sharp releasing more affordable 8K cameras,[3] it's only a matter of time.

What are your thoughts on 8K live video?

Let us know at **magazine@epiphan.com**

2 DisplayDaily. *8K Live Encoding at IBC 2019*. September 2019.

3 Camera Jabber. *Sharp 8K Micro Four Thirds camera price tag to be under $4,000*. April 17, 2019.

What will 5G mean for live streaming and beyond?

Faster, better cellular Internet is nearly here. All through 2019, 5G was one of the most popular buzzwords at trade shows and exhibitions. The buzz is not entirely unfounded: 5G will bring exciting new telecoms technology that promises faster Internet speeds, greater connection reliability, and lower latency over cellular networks. But the benefits of 5G go far beyond mere bandwidth and latency improvements. In fact, 5G has the potential to change the way we think about live video streaming.

What does “5G” stand for?

“5G” refers to the fifth generation of broadband cellular network technology, succeeding 4G. A set of requirements kicks off each new generation. These requirements, set by the International Telecommunications Union-Radio (ITU-R) communications sector, include parameters like capacity, throughput, and coverage. Once new generation requirements are announced, an organization called 3GPP starts work on a wireless broadband communications standard that meets them. For instance, the prevailing 4G standard is called LTE Advanced, while the 5G global standard is called 5G New Radio or 5G NR.

The promise of 5G

Among the key benefits of 5G is the ability to connect even more devices to the network (expected to support one million devices per square kilometer) along with reduced costs and energy consumption. In terms of speed, 5G technology intends to be 10 times faster than its predecessor. While peak data rate (maximum pipe size) is estimated at 20 gigabits per second (Gbps), the aim for consumer speeds across the coverage area is around 1 Gbps.

For comparison, the 4G LTE Advanced pipe maxes out at 1 Gbps downlink and 500 megabits per second (Mbps) uplink. (Although, according to Opensignal’s *Mobile Network Experience Report*, consumers can count on speeds of about 20 Mbps.[1]) While LTE Advanced lets users live stream from their mobile devices in areas with good coverage, bitrates and streaming quality must be kept relatively low for higher reliability. Clearly, the 5G promise of 1 Gbps on-the-go blows current LTE Advanced data specs out of the water.

How does 5G compare to 4G?

	4G (LTE Advanced)	5G
Peak downlink data rate	1 Gbps	20 Gbps
Peak uplink data rate	500 Mbps	10 Gbps
Latency (theoretical)	~ 5 ms*	1 ms

* According to an Opensignal 2019 report, real-world 4G latency for US cellular consumers ranged from 42.2 to 60.5 ms.

1 Opensignal. *USA Mobile Network Experience Report*. July 2019.

How does 5G work?

As one might expect, 5G is a complex technology. Here is a very brief summary of the most important innovations that make 5G possible:

New radio frequencies

Using what's called super high frequency to transmit signals allows for greater bandwidth, lower latency, and support for a greater number of connections. 5G will be rolling out in phases: In its first phase, 5G networks will primarily transmit in lower, sub-6 GHz frequencies (shared with 4G). The transition to the super high, 24-100 GHz Millimeter Wave (mmWave) will come at a later stage once 5G infrastructure is developed enough to support it.

Smaller cells

The mmWave frequencies that 5G uses have significant limitations when it comes to long-distance signal transmission and physical obstacle penetration. Installing many small, densely packed radio cells would solve this issue, making signals easier to pass between the radio cells and the base station. This is called a small cell network. Operators are spending a lot of time and energy building them out to increase capacity and improve coverage in urban areas.

Beamforming

Beamforming technology creates a direct signal between cells and devices, allowing connections to happen faster and with more precision. Without beamforming, signals flow in all directions, waiting to be picked up by the intended receiver. Eventually these signals will reach their destination – but not without wasting a lot of energy in the process. Beamforming delivers the signal to the receiver much more efficiently.

Multi-user MIMO

Multiple-input and multiple-output (MIMO) is a method for multiplying the capacity of a radio link that increases the overall bitrate by transmitting two or more data streams on multiple antennas. It's like having your own dedicated data exchange channel: your device communicates directly with one antenna instead of competing for signal with other devices.

Carrier aggregation

Carrier aggregation allows you to download data from multiple sources at the same time. Your device will combine multiple signals (including those on different frequencies) to give you the best experience.

The potential of 5G

With so much mobile speed, what changes can we expect?

4K streaming on the go

5G will mean brilliant 4K streaming for media broadcasting, live streaming, and video in general. Basically, we are talking about fiber-like performance on the go. 5G promises to be a true mobile live streaming revolution for streamers and viewers alike. Live footage contributors will be able to use a 5G connection to upload high-resolution video instantly. A more stable connection will make it possible to live stream in 4K and even 8K on the go. And because 5G technology allows more devices to be connected to the same network without congestion, sharing and consuming live content will be easier than ever.

5G promises to be a true mobile live streaming revolution for streamers and viewers alike. Live footage contributors will be able to use a 5G connection to upload high-resolution video instantly.

5G home Internet

Downloading full-length feature films will take just a few seconds, and streaming in 4K on a TV will be seamless. With speeds of 1 Gbps, 5G promises a much better viewer experience across all devices. Instead of a landline, consumers will be offered a 5G wireless connection (through a dedicated router). The only thing that comes close to matching the gigabit-speed offer is fiber, but with good 5G coverage you won't need to spend thousands to install miles of fiber cable.

XR (VR, AR, mixed reality, and more)

XR is a blanket term for virtual reality (VR), augmented reality (AR), mixed reality, and other immersive reality experiences. 5G will be able to provide high enough bandwidth and low enough latency to enable seamless and pleasant XR experiences. No more dizziness or nausea after wearing VR goggles, just a smooth, experience at 120+ frames per second. Additionally, users will no longer be tied to a Wi-Fi connection, making on-the-go XR gaming a possibility.

Internet of Things

5G technology will finally allow Internet of Things (IoT) devices (i.e., all devices that are connected to the network and require real-time communication) to efficiently communicate among themselves. Super low latency will allow autonomous vehicles, smart city and smart home technology, robots, and other devices to communicate with each other and the network fast enough to provide consumers with smooth and efficient experiences.

Remote video production

Producing video remotely minimizes costs, saves time, and reduces the carbon footprint of video production. With the low latency and high bandwidth offerings of 5G, broadcasting and live production companies are extremely likely to take advantage of the technology. Transmitting AV files and collaborating on projects in the cloud will greatly simplify video production. We will also likely see the same companies switching their outside broadcasting solutions from satellite to designated 5G network slices for more reliable connectivity.

Full potential still ahead

It's important to understand that multi-gigabit 5G speeds are still a ways away. There is a lot of work ahead for service providers and technology specialists alike. Carriers are still building out 5G networks while continuing to resolve issues related to the limitations of high-frequency signal transmission.

Today, operators are investing heavily in building out these networks. They understand the enormous potential of 5G and predict significant revenue streams down the line. Importantly, 5G goes far beyond improved cell service for the average consumer. In fact, the majority of interest lies in corporate and enterprise sectors because of the wide range of potential applications – from IoT connectivity to VR gaming.

Ericsson predicts that 5G coverage will reach 45 percent of the world population by the end of 2024. Between now and then, carriers will continue to roll out 5G coverage as 5G-compatible devices populate the market. Regardless of the wait time, we're excited to see how 5G will affect streaming media and the art of live streaming.

LIVE **EVENT** PRODUCTION

Corporations, governments, and entertainers all want more eyes on their events – and recognize video streaming and recording as the means to make that happen. What are the best practices in live event production? How can live event producers cover all their bases? This section investigates these questions and many more.

Maximum redundancy:
Best practices for fail-proof live streaming

"Don't put all your eggs in one basket" has endured for a reason. It's sound advice whether you're farming, investing – or live streaming. Building multi-level path redundancy into your production workflow is the best way to make your live streaming setup more resilient. By eliminating single points of failure, you can minimize the impacts of technological hiccups – and maybe even avert disaster.

There are a few ways to build backup paths into your workflow, including:

1 Program feed output

HDMI and SDI cables are prone to failure. To ensure your feed reaches its respective encoder, use redundancy switch boxes or re-clocking devices to diversify and amplify one program feed into multiple synced outputs. Two cables are always better than one.

2 Hardware encoder

Set up multiple hardware encoders to protect against single device failure. Choose the same encoder model and use identical encoding configuration presets for easy setup and consistent video quality. Ensure all your encoders are timecode aligned and genlocked.

3 Network connection

For your wired connection, use disparate local area network (LAN) switches for each encoder. Make sure you have enough bandwidth across all paths – for each encoder and for each stream. Add an in-line cellular-bonded modem with automatic switchover for an extra layer of resilience.

4 CDNs and streaming servers

Look for CDNs that offer automatic stream failover options. Set up each encoder to send 2 streams: one to the primary CDN and one to the backup CDN. This way, in case of primary encoder and/or primary CDN failure, the backup encoder and CDN will pick up the slack, continuing to send a healthy stream to the destination.

More tips for fail-proofing your streaming setup

Always test your setup beforehand

Be sure to test your setup in advance to confirm the switchover happens smoothly. Run the stream using primary paths and then deliberately bring them down, testing one level at a time. Remember that there will be more stress on the CDN side during a real event as more people access the stream.

Configure both automatic and manual switchover

Having options for both manual and automatic switchover is beneficial. In some critical situations, it's difficult to pinpoint right away what the problem is. Automatic failover architecture can be a lifesaver here. On the other hand, manual control is important because sometimes quick (human) decision making is critical.

Choose robust components

Backing up every aspect of your production workflow will greatly reduce the likelihood of stream disruptions and failures. To increase overall robustness, each hardware and software element must be of the highest quality. For example when choosing a hardware encoder, pay special attention to its multistreaming performance, firmware update regularity, and overall physical robustness.

Best practices in action

MSAVi Pro provides live streaming services for high-level events. Recognizing the importance of reputation, MSAVi Pro strives to maximize the reliability of its services.

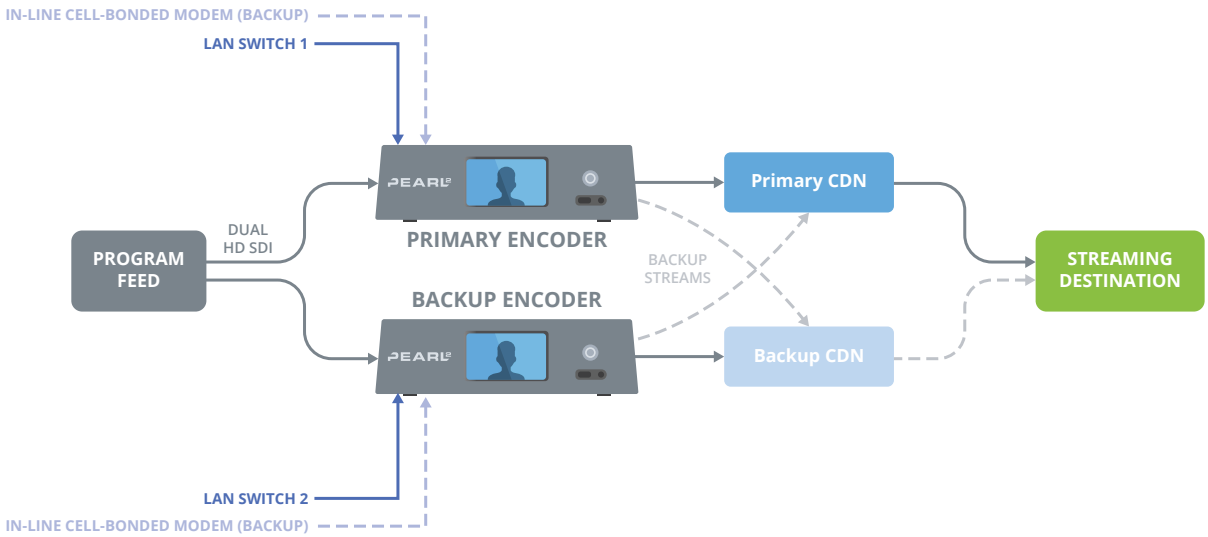
Let's look at how MSAVi Pro built redundancy into its streaming setup. It's a stellar example of a highly resilient streaming stack architecture.

MSAVi Pro teamed up with another live event production company called NEP Sweetwater to produce and live stream a huge music performance by the band Imagine Dragons. NEP Sweetwater was responsible for the AV production side, while MSAVi Pro took care of streaming and recording.

The streaming setup had backup paths on four levels. The team implemented automatic failover mechanisms at each potential point of failure, including program feed, network connection, encoder, and CDN/streaming server. Two Pearl-2 hardware encoders ran simultaneously to stream and record the event; each device was connected to its own unique network access point. MSAVi Pro used disparate wired networks with switch diversity, a backup in-line cell-bonded modem, and automatic switching in the event of network failure. Additionally, each Pearl-2 unit had its own HD-SDI program feed with embedded audio going in, guaranteeing switcher redundancy.

Both encoders sent dual RTMP streams (a primary and a backup) to Akamai and Wowza streaming server entry points.[1] In case of a server failure, the system would automatically switch over to the backup stream. Essentially, the stream had triple redundancy at server level. The team also needed to stream to Facebook, YouTube, and Periscope, so they set up an additional Wowza target to stream to these APIs.

The stream was a huge success. Over 200,000 people viewed the stream live, including more than 100,000 in China.



MSAVi Pro, LLC, is based in California and supports global events. The company is known for providing world-class live streaming services and audiovisual (AV) production support. Clients include companies like Disney, Pixar, Marvel, Lucas Films, ABC Television, ESPN, and Amgen.

1 Akamai discontinued RTMP support and its stream source feature starting January 16, 2020.

The technology behind Markey's Rental & Staging's world-class live event production

Markey's Rental & Staging is a provider of rental and staging equipment for meetings, conventions, and trade shows. They create defining experiences by providing creative solutions for corporate theater, live event production and management, and audiovisual presentation support. Essentially, Markey's handles all things audio and video for any type of event, including huge shows with thousands of attendees.

In addition to providing services like event lighting, digital signage, and presentation management, Markey's also takes care of video recording and streaming. For this, the company uses a fleet of Pearl-2 and Pearl Mini all-in-one streaming and recording devices.

Much more than just gear and labor

Live event production is a highly demanding job, especially when it comes to covering large events. Every event requires a lot of careful planning. Once the event gets going there is no room for error. Fortunately, customers know they can rely on Markey's to get the job done right. The company takes special pride in their excellent service and lasting customer relationships.

"People come to Markey's for our excellence and our problem solving skills. If an issue arises, they know we can take care of it."

Matthew Okerson,
Event Network Technician for Markey's Rental & Staging

Markey's Rental & Staging continues to stay ahead of the competition by listening and adapting to their clients' needs, keeping up with the leading technologies in the industry, and using only the most reliable equipment.

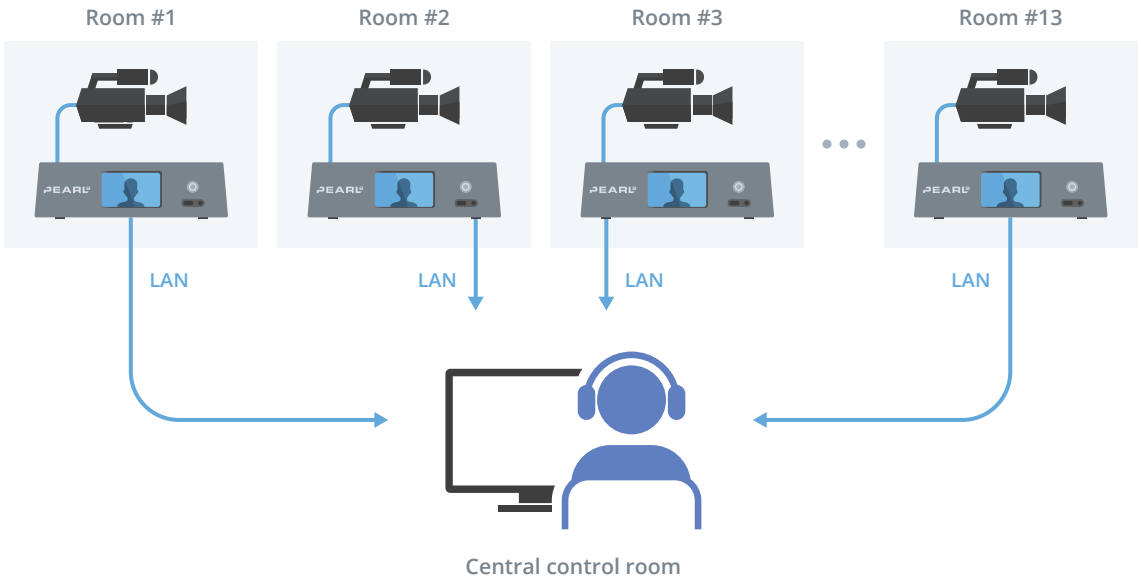
Events big and small, Markey's covers them all

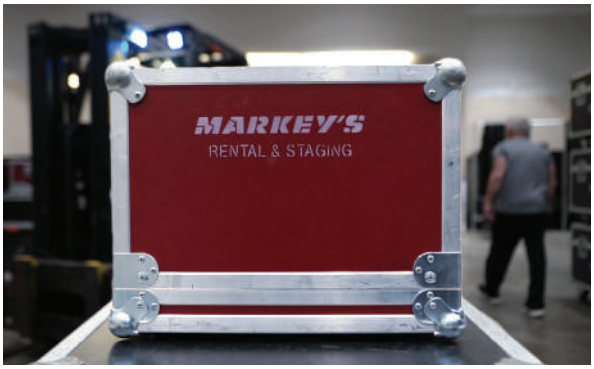
Markey's Rental & Staging covers events ranging from high school graduations to large trade shows and conventions. A great example is the Annual Meeting of the American Orthopaedic Society for Sports Medicine (AOSSM). The 2019 event took place at the Hynes Convention Center in Boston, gathering over 2,500 attendees. Among other things, Markey's was responsible for running and recording 13 concurrent sessions, including three large halls and 10 smaller breakout rooms. To capture the video, Markey's had a Pearl all-in-one system installed in each room, with all audio and video sources connected directly to them.

Networking + integration = efficiency

Naturally, managing 13 recording sessions simultaneously is no small task. To stay efficient, the team relied heavily on Pearl's networking ability to monitor the recordings remotely from a central "headquarters" location. The devices had also been configured remotely through the Pearl web UI. This meant that a single technician was able to monitor the feeds from a dozen rooms through the network, saving the company a lot of manpower.

As with all other events, Markey's was using their own content management system (CMS) to manage AV at the AOSSM Annual Meeting. They've tailored this CMS to their specific needs in order to run large shows more efficiently. They've also integrated Pearl encoders directly with the CMS to simplify the workflow. This made it easy to instantly archive the recorded video, sending that content directly to Markey's internal server. In this scenario, there is no need to transfer the files from cards to drives, saving time and eliminating potential points of failure.





Versatile design to fit the need

Markey's Rental & Staging technicians were able to connect HDMI, SDI, and XLR sources directly to Pearl – without having to worry about video scaling issues. Additionally, Pearl-2 and Pearl Mini were set up to record all sources separately, which gave the team a lot of creative freedom during post-production.

Intuitive and easy to use

The team at Markey's finds Pearls easy to operate. The web UI makes it easy to access all of Pearl's features remotely, while the touch screen on the front of the device is very useful for quick tweaks. Teaching new staff members how to use Pearls is a breeze. If there are ever any questions about how to use Pearl systems, the team is always able to reach Epiphan support and get answers – fast.

Consistent, reliable results

In Markey's experience, Pearl all-in-one recorders have proved reliable in high-stress situations time and time again. The staff feels confident about shipping Pearls all over the world because of their durability. Once configured, Pearl-2 and Pearl Mini just run and continue to do their job. During the five-day event, the Pearls captured over 80 hours of footage without skipping a beat.

"Working with the Epiphan support team has always been very easy and straightforward."

John Charlebois,
Director of Technical Services at Markey's

In closing

Epiphan Video was very happy to learn that Markey's technical team enjoys working with Pearl-2 and Pearl Mini all-in-one video production systems. We also want to thank Markey's Rental & Staging for the opportunity to join them at the 2019 AOSSM Annual Meeting and catch a behind-the-scenes look at their craft.

Markey's Rental & Staging is a comprehensive audiovisual communications company for event rental and staging, in-house support services for convention centers and hotels, on-site corporate services, production services, computer rental, video production, and basic equipment rental.

Automatic transcription is ready for prime time – and could save your next event

A lot can limit what audience members take away from your live event. Maybe in some sections it's tough to hear what's being said on stage due to audio issues or chatty table neighbors. And for people who are deaf or hard of hearing, your event might be totally inaccessible. Happily, there's a solution to these challenges: live transcription. In some cases it's even a legal requirement. Question is, do you enlist human help, or machine?

Machine-driven transcription, or automatic transcription, isn't a new invention. It's one of many applications for automatic speech recognition (ASR) technology, which has been around for over half a century. ASR has come a long way. No, transcriptionist hasn't gone the way of elevator operator or bowling alley pinsetter as a needless human occupation. But with recent advances in artificial intelligence (AI) and machine learning, automatic transcription technology is ready for prime time.

How automatic transcription works

Automatic transcription services link the sounds that make up human speech to words in a digital dictionary. When these sounds have multiple possible matches – homophones, for example, or due to unclear speech or audio – the auto transcription software examines the overall context and assigns each possible word a probability, selecting the word it deems the most likely fit. Deep learning algorithms drive this analysis, informed by a broad range of inputs that vary between solutions.

The same basic process is at work when you interact with Siri, Alexa, Cortana, or Google, only in this case the system outputs its conclusions as text.

Most automatic transcription solutions on the market today are built for post-production. Some work by having you upload an audio recording. Services of this sort will run your audio through automatic transcription software and send you the result. Processing typically takes place in the cloud, but local speech-to-text solutions are also available. Of course, post-production solutions like these aren't suitable for live events, whether it's a conference, a court hearing, a legislative assembly, a corporate town hall, or a sermon.

Most automatic transcription solutions on the market today are built for post-production. Some work by having you upload an audio recording.

Two ways to transcribe live events

If your goal is to deliver subtitles in real time, you have two options:

A. Hire one or more human transcriptionists (to work on site or remotely).

B. Use an auto transcription service capable of analyzing speech and outputting subtitles quickly enough to keep pace with speakers.

Option A is pretty straightforward. Working on site or from home, human transcriptionists capture what presenters are saying in real time. The tricky part is figuring out how to display the text on a monitor, tablet, or other device. Live transcription is a whole different game from working with pre-recorded audio, so you'll want someone who has a degree or certification in court reporting or captioning to ensure they can keep up.

Option B is a bit more complex from a technical standpoint but offers significant advantages over human-based transcription. You can find live transcription solutions from big names like Google, Amazon, and IBM.

On the surface, AI-driven live transcription doesn't look all that different from human-based transcription. Imagine a speaker on stage delivering a keynote address. The microphone they're speaking into is connected to a laptop or other device that's running cloud-based automatic transcription software. Everything the speaker says is projected through the conference hall speaker system but also sent as audio to the cloud. In the cloud, natural language processing technology matches the various sounds with words in a digital dictionary. The software then sends back the text to display on a monitor so anyone can follow along. The data the solution uploads and downloads is tiny, so all of this happens very quickly.

Subtitles and captions: What's the difference?

It's important to note that many automatic transcription solutions generate subtitles rather than captions. A lot of people use these terms interchangeably, but they do refer to slightly different things. Subtitles provide a text alternative for speech or dialogue, whether it's a translation or in the same language. Closed captions convert speech and dialogue into text but also background music and sound effects (e.g., a phone or a doorbell ringing).

Why does this matter? It could factor in if your live event must adhere to a set of accessibility standards. For instance, in the United States there's the Web Content Accessibility Guidelines (WCAG), Americans with Disabilities Act (ADA), and Section 508 of the Rehabilitation Act. Some standards distinguish between subtitles and closed captions, requiring the latter to give people who are deaf or hard of hearing a fuller experience. This might not be an issue for a conference, sermon, or any other event where there's a single person delivering a presentation or speaking. But it's something to investigate if a mandate is driving your interest in live transcription.

Automatic transcription versus human transcription

Like many things, there's a bit of give and take when deciding between human and AI-driven transcription. Yes, humans are still better at some things. We've all dealt with self-checkout machines that insist there's an item in the bagging area when there's no item in sight, only to be rescued by a dutiful (and very human) self-checkout attendant. But machines often win out when it comes to core business concerns like cost and convenience.

We'll compare human and auto transcription on five key criteria:

- Accuracy
- Cost
- Convenience
- Consistency
- Privacy

1. Accuracy

Research suggests human transcription accuracy is around 95 percent.[1] That's one mistake in every 20 words transcribed. Speech recognition researchers are aiming for an error rate that's on par.

Both Microsoft and IBM claim to have met a level of accuracy nearing this with their own speech-to-text solutions. But AI-based transcription doesn't always fare so well outside the ideal conditions of a corporate laboratory. Background noise, poor acoustics, heavy accents and dialects, specialized vocabulary, and subpar recording equipment can all hamper the accuracy of automatic transcription. In truly unfavorable conditions you may end up with "word salad", puzzling (or drawing laughter from) anyone in the audience following along.

1 Breakstone, Micha. *Automatic Speech Recognition: Artificial Intelligence, Big Data, and the race for Human Parity*. June 26, 2017.

Humans tend to do better at transcription particularly when multiple speakers are involved. Machines struggle with this, which may or may not be an issue depending on the nature of your event. But machines are closing the gap in this regard. See, for example, Google's AI speaker diarization technology, which will make live automatic transcription of panel discussions and other multi-participant formats possible.

Don't discount automatic transcription just yet. Thanks to the deep neural networks that power speech recognition technology, machine-driven transcription is improving by the day. Some solutions you can prime before an event to more accurately interpret a specific speaker, potentially dealing with difficult accents or dialects more effectively than a human transcriptionist. With others, it's possible to add words and terms to the solution's dictionary to aid recognition. This feature is invaluable for events that include specialized language and jargon, such as a conference for engineers or medical practitioners. It's even possible to improve transcription accuracy of industry-specific terms by identifying North American Industry Classification System (NAICS) code lists.

AI's accuracy edge doesn't end there. Recall that speech recognition solutions analyze context to help resolve word use ambiguity. Machine-driven live transcription software can make corrections on the fly as a speaker finishes a thought (at the same time giving the system more context to work with). Humans certainly aren't immune to mixing up homophones or similar sounding words; we may even be more likely to do so when the pressure is on to keep up with speakers. The difference is that human transcriptionists don't have time to fix these mistakes – unless they're willing to risk falling behind.

2. Cost

Live events can be expensive affairs. The costs of venue rental, catering, and travel and accommodations for guest speakers can leave little in the budget for much else. This can present problems if you'd like to (or must) provide live subtitles for audience members.

Human transcriptionist pay rates and pay models vary. Some transcription services charge by the minute, others by the hour. Transcriptionists who can keep up with live speakers may command a higher price than those who work with audio files or videos. You might also have to cover travel expenses if the transcriptionist isn't local and needs to be on site. Fees can also be tied to on-site time rather than transcription time, which may mean you're paying the transcriptionist even when the show isn't on (e.g., during lunch and networking breaks).

Whatever the case, transcription fees can really climb when you're relying on human help, especially when your event takes place over multiple days or includes sessions that run in parallel. When budgets are tight, an organization might have to limit subtitles to select speeches or sessions. This can put event planners in an uncomfortable position, as guest speakers may wonder why their talk isn't important enough to ensure it's accessible to everyone.

An automatic transcription solution can help you avoid issues like these. AI-driven services still charge transcription fees, but these are significantly lower than the average pay rate for a human. You can run the service only when there's transcribing to do. And with the lower cost of AI-based transcription, it's less likely you'll have to pick and choose which sessions will feature subtitling. The potential savings are even more impressive if your organization holds or produces multiple events a year.

3. Convenience

It's not always possible to bring in a human help for live captioning or subtitling. Maybe you've scheduled a meeting with short notice and you'd really like to send away participants with a transcript for review, or it's Sunday and the volunteer who usually subtitles your sermons is swaddled in bed with a nasty head cold. Maybe there are other conferences happening at the same time as yours and no transcriptionist with the right skill set is available. And what happens if the transcriptionist you hired can't make your event because they're sick, or their flight was delayed until the next day?

No need to worry about any of this with AI-based transcription. Machines don't have busy professional lives like people do. At a moment's notice, you can set up your automatic transcription service and it'll do its thing. You can test it before the event to gauge its accuracy (which is difficult to do with humans, and potentially costly). You can even customize it to recognize industry-specific words. Automatic transcription services are more flexible as well. Many support multiple languages, eliminating the need to search for a transcriptionist with the right knowledge.

4. Consistency

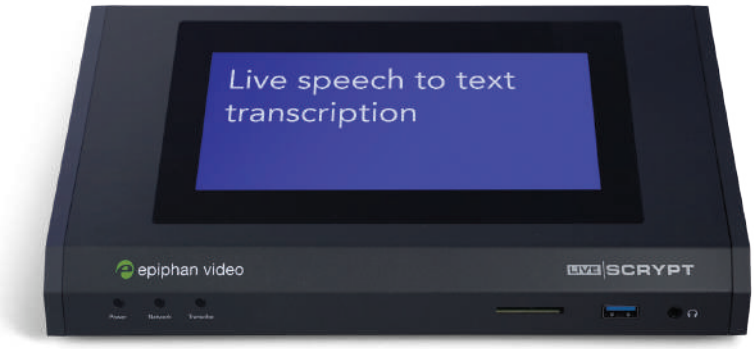
Transcription ability varies widely between people (a matter of experience, most often). Performance can vary in the same individual, too – for example, if the person you hired slept poorly the night before your event.

This variability is cause for concern. Will the person you hired (or their replacement) be up for the task? Will they be at their best on event day? Are they familiar enough with the subject matter? No such trouble with automatic transcription services. Of course, environmental factors like background noise and the AV equipment you're using will affect the software's ability to transcribe speech. But with these things controlled, you'll get consistent transcription from one event to the next.

5. Privacy

Transcripts are great for anyone who missed the big meeting and a convenient reference for those who were there. But what if that meeting included discussions about unpatented technology or other company secrets? No business wants outsiders privy to such things, but it can't be avoided if you bring in an external transcriptionist to caption or subtitle the event. Non-disclosure agreements are a thing, though you can never be too careful. Leaks happen all the time.

Opting for an automatic transcription service will reduce such privacy risks. It won't eliminate privacy risks necessarily, since many send audio to the cloud for processing. The risk of a breach is much lower, in any case, which makes AI-driven transcription the way to go for subtitling private events.



Epiphan LiveScrypt: AI-powered live event transcription

Get the best of automatic transcription today

Automatic transcription is a feasible alternative for live subtitling conferences, meetings, and other events – under the right conditions. Epiphan LiveScrypt makes it easier than ever to get those conditions just right. Powered by Google's advanced speech recognition technology, LiveScrypt features professional audio inputs (XLR, TRS) so you can capture crystal-clear audio conducive to accurate AI transcription. Our transcription solution also includes HDMI and SDI inputs, a built-in screen for configuration, and a QR code system for easy streaming. These simplify setup for auto transcription and make for fewer points of failure.

Visit epiphan.com/products/livescrypt to learn more about how Epiphan LiveScrypt can help you maximize the benefits of today's automatic transcription technology.

VIDEO IN **EDUCATION**

Colleges and universities are leveraging the power of video in classrooms and lecture halls but also in athletics facilities, libraries, and other campus spaces. This section of *EVolution* is for schools just entering the world of video production and those that have long embraced video as a valuable, versatile tool for students, faculty, and staff.

The lecture capture conundrum:
Software encoding or hardware encoding?

More than two thirds of educational institutions use video for lecture capture, remote education, and student assignments.[1] But it's a mystery just how many colleges and universities are aware of the important choice to be made when equipping campus spaces with AV technology.

If you're in the AV business, you probably have a solid grasp on what hardware encoding and software encoding are and the relative advantages of each. Outside the industry, though, these concepts may be a little murky. This is problematic because which schools choose has implications for video production reliability, performance, flexibility, even affordability.

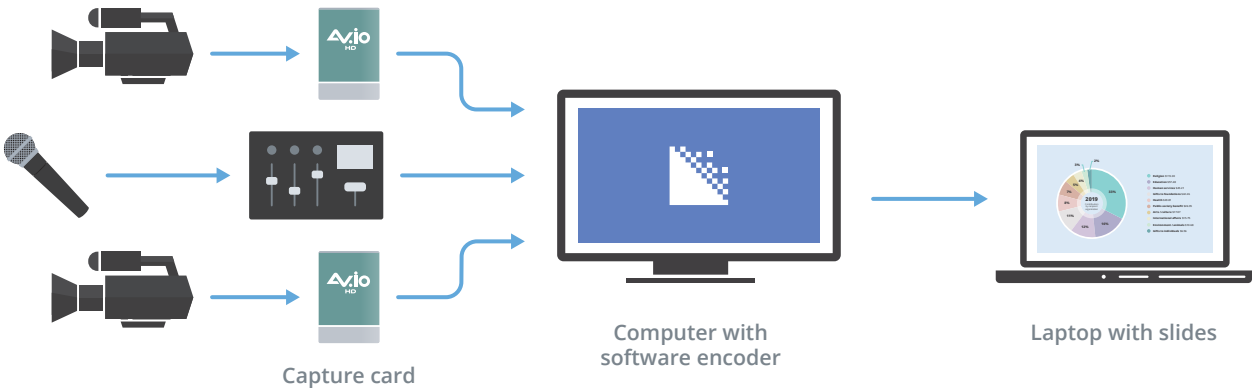
Both methods of encoding video have their pluses. Schools need to know what these are to properly weigh their options and make the best investment.

1 Kaltura. *The State of Video in Education 2019*. 2019.

Option 1: Software encoding

A software encoder is an application for video recording or streaming that runs on a computer. Open Broadcaster Software (OBS), Panopto Recorder, and Kaltura CaptureSpace Recorder are a few examples. The main job of a software encoders is to convert video and audio signals into a format suitable for playback on consumer devices.

One of the major benefits of this approach is that it relies on equipment schools probably already have on hand – namely, laptops and webcams. Staff and instructors are likely familiar with these technologies, and provision and replacement are simple matters with standard computer hardware. Upfront, software encoding is also the less expensive of the two options.



When is software encoding the better choice?

A software-based setup may be best for anyone leveraging video outside an institutional AV infrastructure. Maybe a professor wants to record their lectures but the classroom lacks the technology for this. Software encoding would likely do the trick if lessons consist mostly of presentations with the professor narrating the material.

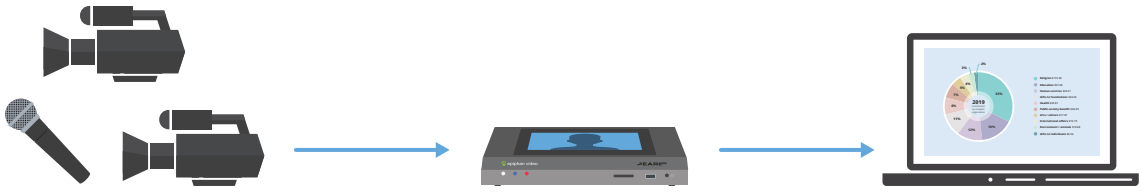
Ultimately, software-based lecture capture can be as simple as setting a laptop on a podium, running a slide deck, and recording the instructor through a webcam. If video quality is a concern, one option is to augment this setup with a capture card or two. These devices can bring in non-USB video signals (e.g., HDMI, SDI) for use with a software encoder. It's then possible to connect and record from a broader range of sources, including DSLR cameras, document cameras, and even microscopes.

Capture cards are simple to use. Just plug the card into a free USB port and connect your non-USB device to the input on the card. The capture card should then appear in the list of available video devices within your video recording or live streaming application of choice. One important caveat: dropped frames and other errors can occur if the computer running the software is older or low on processing power.

Option 2: Hardware encoding

A hardware encoder is an appliance purpose-built for video streaming, capturing, recording – or all three. All the components in a hardware encoder were handpicked or designed for this purpose and the underlying software specially engineered for it. Many hardware encoders include inputs for non-USB video devices (e.g., HDMI, SDI) and for professional audio equipment (e.g., XLR, TRS).

Hardware encoders are the key to optimal video production. Because hardware encoders are designed from the ground up for video streaming and recording, they're able to dedicate more computing power to video encoding than software encoders.



Audio & video sources

Hardware encoder

Laptop with slides

When is hardware encoding the better choice?

Hardware encoding is ideal for institutions that want to reap the full benefits of video. Though they might have a higher sticker price, hardware encoders offer important advantages over software encoder setups – especially for campus-wide deployments.

Greater reliability

Maintaining a bunch of PCs or laptops across a sweeping campus (or multiple campuses) can be an operational nightmare. OS and driver updates introduce bugs and compatibility issues. Applications stop working. Components fail. And when there's no easy solution, it's often unclear who to turn to. Should you reach out to the hardware manufacturer? The OS developer? The software vendor?

Challenges like these make reliability paramount. Here hardware encoders have the edge. Every component and every line of code is attuned to the job of video encoding. There's no hardware or software modularity to account for, so all the parts in the appliance were tested to work together and the software written for that exact configuration. This makes it easier for encoder hardware manufacturers to develop stable updates.

Hardware encoders also need fewer cables and components to record and stream from high-end cameras and audio equipment, making for fewer points of failure. And if something does go wrong with any aspect of the appliance, there's a single point of contact for troubleshooting and repair.

More flexibility

Software encoders can't work with non-USB video signals without a USB capture card, and recording or streaming video from multiple sources can be a tall order without cutting-edge (and pricey) components. Software encoders are also limited to USB-based or 3.5-mm microphones unless you invest in a separate audio interface, and can typically only capture audio from a single source.

In contrast, most hardware encoders include multiple inputs for video (e.g., USB, HDMI, SDI) and professional audio (e.g., XLR, TRS). This lets users connect high-end cameras, projectors, document cameras, computers, tablets, and other devices directly to the appliance. And because hardware encoders are optimized for video production, many can handle several encoded programs at once.

Increased cost-efficiency

It's true that producing video through PCs and laptops can be less expensive at the start. But consider the cost of the cutting-edge hardware, multiple capture cards, and other add-ons you'd need to turn a Windows-based system into a full-fledged lecture capture solution – i.e., the equivalent of what a hardware encoder can do out of the box. At that point, the initial cost differences are negligible.

In any case, operational costs over the lifetime of PCs and laptops often eclipse what you save initially. Hardware encoders win out when it comes to total cost of ownership, in other words. Lower maintenance costs are one big reason why. Compared to generic computer systems, less capital and fewer IT hours will go toward maintaining hardware encoders because they're so much more reliable.

Schools that opt for hardware encoding also won't need to purchase OS and software licences broad enough to cover all their AV workstations. Dedicated appliances come bundled with an OS of their own.

Easier operation

Integration with video content management systems can turn some hardware encoders into hands-off lecture capture solutions. Take for example Epiphan Pearl Mini and Pearl-2 hardware encoders, which feature full integration with the popular Panopto and Kaltura video platforms. With software encoders, users must launch and interact with software encoders to start or stop recording or streaming, whereas Pearl can trigger these events automatically based on a defined schedule.

Bottom line

Today's students consume a lot of media,[2] which has given them high expectations for professional video.[3] These expectations factor in whether what they're watching is published by a news agency, a media production firm – or their school.

Schools can rely on software encoders and webcams for lecture capture and other applications for video in education. But hardware encoders are most often the superior choice. Colleges and universities that use them reap the advantages of greater video production performance, versatility, reliability, cost-efficiency, and ease of use. And with competition for enrolment as fierce as it is,[4] any advantage is a big advantage.

Watch Live @ Epiphan hosts explore the differences between software encoders and hardware encoders.

2 UCAS Media. *UCAS Media student lifestyle report 2018*.

3 Grabyo. *Global Video Trends Report 2019*.

4 Christine Musselin. *New forms of competition in higher education*. August 7, 2018.

Best-in-class lecture recording at the Harvard Division of Continuing Education

At Ivy League schools like Harvard, excellence is more than a reputation – it's a way of life. With 10 years of experience in lecture capture and live streaming, the Harvard Division of Continuing Education (DCE) was searching for a way to enhance how they make their distinctive on-campus experience available outside the classroom.

The DCE wanted simultaneous high-definition capture of both the lecturer and their presentation for use in continuing education projects such as:

- Live streaming to students across the globe
- Video on-demand content (VOD)
- After-class review by students in hybrid courses

The institution met these goals by making an Epiphan Pearl all-in-one recording and streaming solution a key component in their next-generation Opencast lecture capture system.

Pearl was a perfect fit for Harvard DCE

Pearl's small footprint made it a perfect fit for the DCE's already crowded AV closet. It's nearly silent operation meant there was no added noise pollution to worry about. Setup was simple. Installing and testing Pearl took the AV team less than an hour per classroom. Only a few more minutes were needed to configure a video layout combining the picture from the diverse classroom equipment. In no time, they were ready to capture and record!

Like most educational facilities, the school already had a lot of equipment installed. Some classrooms were already very high-tech with four robotic cameras (SDI and HDMI outputs) and more than 40 on-desk microphones connected to an audio mixer. Other classrooms had a single camera on a tripod and several ceiling-based microphones. For classrooms with lots of existing AV hardware, Pearl's multiple video and professional audio inputs gave the AV team all the flexibility they needed. Pearl also offered the school lots of capacity to support future equipment upgrades to less high-tech classes.

"After evaluating many different solutions for lecture capture, we found Pearl's flexibility, reliability, and open model made it the right choice for our program. I'm very happy with our decision to use Pearl; it's now our lecture capture standard."

Gabe Russell
Harvard Division of Continuing Education

Ready for world-class lecture capture

The institution had deployed Opencast in the Amazon Web Services (AWS) cloud as its video management system. The lecture capture and recording solution needed to integrate with this existing system. Here, too, Pearl was a great fit.

As a result of the integration, Opencast is able to control recording start and stop times on Pearl according to the timetable loaded into the system. After each lecture, Pearl is configured to automatically transfer recordings to the Opencast server via the campus network. After an editing and transcoding workflow, the recorded lectures are available for students within 24 hours of the lecture.

Learn more about how Pearl lecture capture encoders can help your school succeed.

CORPORATE VIDEO

Enterprises are leveraging video to a greater extent than ever before. Why is no mystery: video is a powerful tool for reaching and engaging customers, clients, employees, and partners alike. How are companies doing video production? What's the next big thing in corporate video? This section of *EVolution* will dive into these and other questions.

Remote video production holds the key to meeting demand for high-quality video

Expectations of live and on-demand video content are ever-growing, and not just for AV and video production industry insiders. With advanced video equipment becoming more affordable than ever, customers in enterprise, education, and beyond expect well-produced, high-quality video – delivered fast.

At the same time, today's standalone AV hardware and software are still much too complex for the average user to master quickly. Current solutions require the expertise of highly skilled professionals, along with intricate knowledge of the systems involved. Dependence on such professionals can be costly and inefficient, yet high-quality video productions are often out of reach without them.

Happily, the delivery of this expertise can be streamlined and, in the process, made more accessible and affordable. How? By building centralized infrastructures and integrating AV-over-IP-based remote production studios into the video production process.

Cloud-based service delivery could enable a remote video production service capable of efficiently producing high-volume, high-quality live and on-demand video content with fast turnarounds. Providing remote video production as a service this way would also decrease capital expenditures.

Still a need for skilled professionals

In this model, highly skilled AV professionals remain one of the most (if not the most) important factors in producing high-quality video. The main difference is that because they do not need to be onsite at all times, AV professionals would work remotely. This approach values AV professionals' time and eliminates many of the day-to-day distractions they face by relocating them from the chaos of the production floor to the comfort of a well-equipped remote studio. Within this remote studio, all state-of-the-art tools would be at hand for the delivery of edited VOD assets, low-latency live broadcasts, and more.

AV-over-IP technology makes it possible to control even the most complex AV equipment remotely. The high flexibility of this model also allows easy scaling of infrastructure to virtually any size and level of complexity, all while keeping workflows elegant and efficient.

A better approach to video production

Naturally, developing a unified infrastructure is crucial to deploying a viable remote production solution, but there is also a bigger opportunity at hand. The AV industry as we know it is a disparate ecosystem of products and services. There is considerable complexity and multiple points of failure within this model. We see a future where infrastructure as a service (IaaS) empowers individuals and companies to build their own autonomous video ecosystems under one umbrella.

This IaaS approach would offer key advantages over the status quo. By minimizing local hardware and balancing CPU/GPU/TPU processing between edge hardware and the cloud, companies could lower the costs of capital expenditures, cloud processing, and energy usage. But the main advantage would be a much more convenient, centralized, and efficient AV production workflow.

Updating the approach to video production workflows to include IaaS and software as a service (SaaS) is necessary to keep up with market demand today. Both services are on a clear path to becoming industry standards when it comes to high-quality video production. With lower costs and higher efficiency, high-quality live and on-demand video production would be within reach for everyone.

Guide to building a corporate video production studio

Is your company thinking about building an in-house video production studio? Find out how to create a professional corporate video studio and what video production equipment you'll need.

Companies of all shapes and sizes are creating more video content than ever, for both internal and external use. Kaltura's *State of Video in the Enterprise*[1] asked employees of various large companies whether the amount of video used for any purpose at their organization changed in the last three years. More than half of respondents said that the amount of video used has increased over the time period.

A studio environment is ideal for creating professional, high-quality videos. In addition to pre-recorded content, live video is also becoming a key tool for companies. For example, CEOs and guest experts are often invited to go live on national television.

Problem is, studio spaces aren't always readily accessible: you need to find one, book time and a film crew, travel to the location, etc. The solution is to build a studio on your own premises. That may sound daunting, but we'll walk you through the process and tell you what equipment you need.

1 Kaltura. *State of Video in Enterprise 2019*. November 2019.

Benefits of building an in-house corporate video production studio

Lower production costs

By building an in-house video studio, corporations can minimize their employees' travel time and save on expenses. Executive time is really expensive. If a CEO needs to appear on five different live TV programs in one day, then having an on-prem studio set up and ready to go will save them the trouble of visiting every studio individually. Additionally, with frequent studio use corporations can save money on studio rent over time.

Reduce turnaround time

There is no need to go through the hassle of scheduling a shoot, booking a studio, and traveling to the location. Your own on-site studio means no setup and teardown time; the space is always ready to use at your convenience. This provides great peace of mind for executives, who often have to go live at a moment's notice. For the marketing team, this provides a whole new level of creative control.

Allow video creation for all departments

Various departments can make use of a dedicated video studio to record and stream product demos, training and onboarding videos, webinars, employee addresses, and much more. Employees with access to the space can simply book it just like they would a conference room. In fact, you can convert a conference room into a video studio without losing the room's conferencing functionality. In other words, you can still use it as a conference room and choose whether or not you want to live stream or record.

Top corporate video studio use cases

External

Executive TV appearances
Product reveals and demos
Conferences and events
Seminars and product training
Investor updates
Marketing videos

Internal

Training videos and tutorials
Executive messages to employees
Town hall/all-hands meetings
Company event recordings and streams
Internal webcasts and conferences

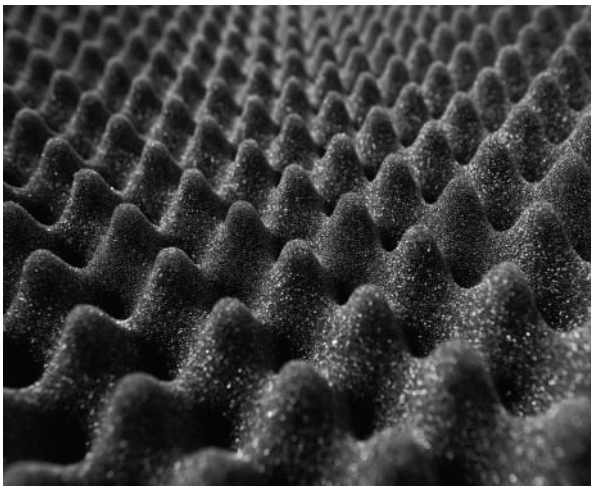
Key considerations for your corporate video studio

Choosing the right space

While having dedicated video studio space is ideal, combining it with a meeting room is also possible. A permanent studio setup will save a lot of prep time and motivate employees to record. Studio time should be distraction-free for production staff. Setting up a booking system for the video studio room (similar to meeting room booking) will help ensure an uninterrupted workflow.

Room size

Generally, room dimensions should be no smaller than 12 feet by 18 feet. There should be at least four feet between the camera and the subject, and another four feet between the subject and the background. Shooting very close to a wall isn't optimal because doing so can cast harsh shadows. That beautiful bokeh effect (heavily blurred background with perfect focus on the subject) always looks great on camera, but you need to get the spacing just right to create it.



Soundproofing

Finding a quiet space is often one of the most challenging aspects of setting up a corporate video studio, but it is also among the most important. After all, nobody wants air conditioning, construction, wailing sirens, and other background noises to end up in the final video. Additionally, sound will bounce off walls and create echoes if the space is too large and sparsely furnished. A space enclosed by four walls is a good start, but for best results, add acoustic foam panels or even hang up blankets to "dampen" echoes and outside sounds.

Essential production equipment

Your corporate video production studio will need reliable, high-end equipment. Expenses can add up quickly, so let's have a look at what is absolutely imperative and what might be overkill.

How many cameras does the studio need?

While just one camera will do, we've found that having at least two camera angles can help create a more dynamic final video. We suggest strategically placing two cameras to create a wide shot and a closeup.

Video

Cameras

To achieve a polished and professional look, the studio will need a high-end camera with great lenses. We recommend looking into HD and 4K cinema cameras first. This includes cameras like the Canon EOS C-series, Blackmagic URSA or Pocket Cinema Camera, and Z CAM E2C. If your budget for a camera is on the lower side, consider looking into DSLRs like the Panasonic Lumix GH5.

Stabilization

To stabilize the shot, it's best to mount cameras on a tripod or something even sturdier like a truss or wall. You could also build your gear into a professional-grade equipment rack or cart to make your studio setup more mobile.

Camera lenses

Generally, there are two types of lenses to choose from:

- **Prime lens –** has a fixed focal length. Adjusting frame composition requires moving the camera back and forth.
- **Zoom lens –** has a variable focal length. Allows you to change the angle of view by zooming in and out.

When picking camera lenses, a lot depends on the size of the room. For corporate video studio production, we recommend zoom lens as they provide more control. As an example, in some of our experiments, we have found that a combination of two Panasonic Lumix G X Vario lenses, the 14-45mm f/2.8 and the 35-100mm f/2.8, works well: the former captures a wider studio angle, whereas the latter creates strong closeups.

Audio

Microphones

Configuring the audio is often the trickiest part of any video production. The most important thing is microphone placement. A poorly placed microphone, no matter how expensive or professional it is, will not yield great results. Avoid using built-in camera microphones as these lack in quality and provide little control.

Microphones should be placed very close to the speaker. For this reason, investing in wireless lapel (aka lavalier or lav) microphones is a good idea. Choose something like the popular and versatile Sennheiser EW 100. Placed correctly, a cardioid condenser boom mic would also work. A boom microphone could either be mounted on the ceiling or a C-stand and hidden above the top edge of the film frame.

It's important to note that, for a live interview, the interviewee would also need an IFB earpiece to be able to hear the questions while avoiding creating an echo.

Audio mixer

Another necessary component is a sound mixer. Why? Each voice is individual in terms of volume, timbre, and enunciation. Therefore, microphone settings need to be adjusted for each speaker on an individual basis. If two people are talking together, their settings must be adjusted in relation to each other. Additionally, mixers are able to determine baseline background noise levels and cancel them out in the final audio.

Getting audio right takes a lot of time and practice, which is why hiring a professional to help with audio will save a lot of time and trouble.

Backdrops

For a polished look, professional studios employ large, seamless infinite white or green screen backgrounds, but these require a lot of space and can be pricey. For leaner budgets, multi-colored backdrop kits available are available for under $100 USD. Another idea is to use a large display as a backdrop. Displays over 80 inches can double as green screens and let you pull up images, such as the company logo.

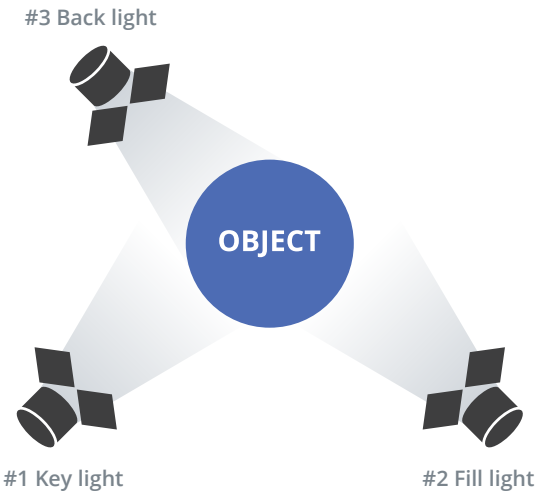
Using a non-solid background is acceptable, too. Something like a bookshelf or neatly arranged plants would make for a nice backdrop. The main tips here are to avoid clutter and make sure there's enough separation between the subject and the background to create a blurry effect for the latter.

Lights

Lighting setups

First off, using artificial lights is generally better than counting on the often inconsistent daylight coming through a window. If there are windows in your studio room, it's best to block out all natural light using thick curtains. Artificial lighting provides a lot more control over the final video image. Lighting the subject (in most cases, a person) correctly makes a huge difference when it comes to producing professional-looking video content.

The methodology behind beautiful studio lighting has long been established: by using the *three-point lighting technique*, you can achieve even, three-dimensional lighting for your subject. As the name suggests, basic three-point lighting involves using three light sources: a *key light*, a *fill light*, and a *backlight* or *rim light*. Generally coming in from the upper side, the key light provides the strongest light hit. The fill light, on the other hand, counters the harsh shadows created by the key light. The rim light, placed behind the subject, produces a little glow to the subject, separating it from the background.



Standard three-point lighting technique

Mounting

Professional light studios generally use a combination of ceiling-mounted lights and lights on C-stands. While convenient, C-stands can create clutter inside the studio space, while ceiling-mounted lights give a cleaner overall appearance. Lights can be mounted onto the ceiling using a system of trusses or rails. For example, a system of rails and scissor lifts facilitates easy movement of light panels in all directions.

Examples of studio lights

Choosing LED lights over incandescent light bulbs is a good idea. LEDs don't radiate much heat, and the color of light (aka white balance) is easier to control. A few examples include Dracast PLUS series ceiling-mounted lighting and Savage RGB-50P Pro LED Panels. Many LED light panels have mobile or web UIs that let you access and control all their settings remotely. All the lighting must be connected to an Ethernet lighting controller interface for this to work.

Recording and streaming

Recording

There are various ways of recording audio and video. Generally, audio is recorded separately on something like a Zoom recorder, and combined with the video track in post-production. Video is recorded onto memory cards. Make sure you choose a memory card with enough space (and speed) to record your footage.

Streaming

If you are planning to stream to Facebook Live, YouTube, or a private content delivery network (CDN), consider adding a hardware encoder to your setup. And with an all-in-one encoder like Pearl-2 or Pearl Mini, you can stream and record video simultaneously. Take advantage of Pearl's professional features like confidence monitoring and adding brand elements to your stream with custom layouts.

To live stream, your facility will need ample dedicated Internet bandwidth. A minimum of a 15 megabits per second (Mbps) uplink is recommended. For mission-critical situations, consider investing in alternative connection options such as cellular bonding.

Live broadcasting

Going live on broadcast TV is a bit trickier than live streaming to a CDN. For one, broadcast stations have their own formats and restrictions regarding transmission feeds. Second, broadcast transmission signal quality must be superb. Third, latency needs to be minimal so that on-screen talent can hear and answer questions right away (and not after a 10-second delay). Consider looking into the services of an IP broadcast transmission provider if you're planning to use your corporate video studio to appear on live television.

Additional equipment

There are many other ways you can enhance your corporate video studio. This can include adding a teleprompter, a confidence monitor, or a clapperboard. Think about the furniture you might need: various filming setups might require different kinds. For example, you might want two comfortable chairs for an interview, whereas for a product demo you might want a sturdy, counter-height table and two variable-height bar stools.

The more you use your studio, the more you will understand your needs. However, nailing down good audio, video, and lighting should be at the top of your list of priorities.

Operating a corporate video studio

Operating a studio without prior experience is not easy by any means. Nailing things like framing a closeup, configuring lighting, and adjusting microphone settings takes knowledge and practice. Things can go wrong, and there might be no one on site with the right expertise to fix it.

Having someone with an AV background or videography experience on site during filming can be hugely beneficial. Hiring an in-house crew or outsourcing a videography contractor is a viable idea, though this can be costly over time. Freelance crews are also an option, but then there's the added hassle of scheduling and arranging the shoot.

Watch the Epiphan webinar *How to build a fail-proof live streaming studio*.

Sample corporate video studio gear list

- **Camera:** Canon EOS C300
- **Lens:** Canon EF 24-70mm f/2.8L II USM
- **Lights:** Dracast LED1000 3200K-5600K Bi-Color Light with DMX Studio Control (minimum 3)
- **Tripod:** Manfrotto 546GB Tripod with 502A Video Head
- **Lavalier mic:** Sennheiser AVX-ME2 SET Digital Camera-Mount Wireless Omni Lavalier Microphone System
- **Audio Mixer:** Bose T8S ToneMatch Mixer
- **Streaming and recording:** Epiphan Pearl-2 all-in-one production studio
- Adjustable height stool
- Network router
- **Backdrop:** Neewer Background Stand Support System with Backdrop OR Large (80") TV display
- ***Optional:*** confidence monitor, teleprompter

Operating a corporate video studio is hard

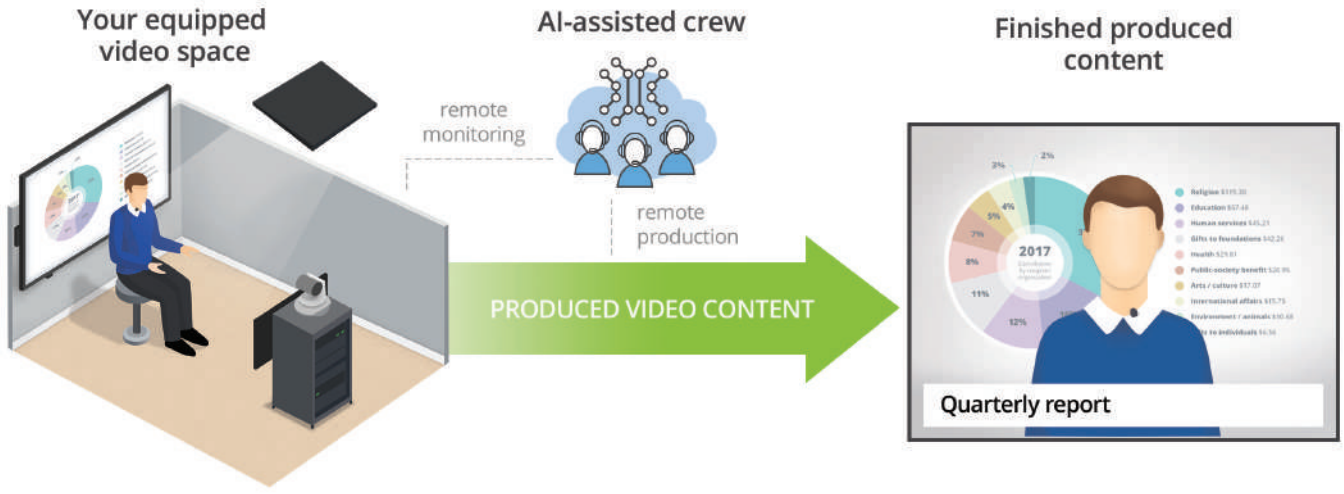
Enter: the remotely operated video studio

While it's feasible for businesses to build their own studio as we've outlined here, it can be a significant time sink. Sourcing equipment, putting everything together, getting the spacing just right – all of this requires both time and experience.

If your company is keen to produce lots of video without the hassle of hiring a production crew every time, remotely operated studios are an excellent and cost-effective option. This way, video production becomes entirely hands off: AV professionals located remotely take care of everything. They can control all studio equipment through a virtual private network (VPN) and help direct the talent if necessary. With staff available 24/7, all you need to do is book time for the shoot, walk into the studio, mic up, and go.

Want to build a hands-off, in-house corporate video studio for your company?

Let us show you how we can help. Contact us at **videogenic@epiphan.com**.



Remote video production

Epiphan Pearl Mini™

Simplify your lecture capture or live event production. Record, stream, and switch multiple HD inputs simultaneously.

See a five-minute Pearl Mini demo.

Epiphan Pearl-2™

Powerful, all-in-one live production system with 4K HDMI, 12G SDI, NDI, and the capacity for 6 simultaneous 1080p channels.

See a five-minute Pearl-2 demo.

Epiphan Pearl-2™ Rackmount

All the same features as Pearl-2 but designed for installation in a rack.

Epiphan Pearl-2™ Rackmount Twin

Two completely independent Pearl-2 systems for a high density rack installation.

Epiphan LiveScrypt™

Powered by advanced speech recognition technology, LiveScrypt makes transcriptions more accessible for your events.

See full product features and specs.

Epiphan Video products

Epiphan AV.io 4K™
Capture 4K over HDMI in perfect fidelity or use hardware scaling to capture any resolution needed for your application.

See full product features and specs.

Epiphan AV.io HD™
The simplest way to capture HDMI, VGA, or DVI video sources at resolutions up to 1080p.

See full product features and specs.

Epiphan AV.io SDI™
Works seamlessly with your SDI video sources, including: SD-SDI, HD-SDI, and 3G-SDI.

See full product features and specs.

Epiphan DVI2USB 3.0™
Get precision video capture control over color space, cropping, resolution, and scaling for any device with HDMI, DVI, or VGA output ports.

See full product features and specs.

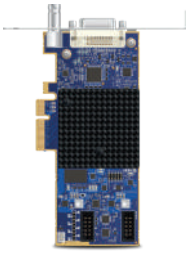
Epiphan SDI2USB 3.0™
Rugged and portable video grabber for AV professionals looking to capture 3G-SDI, HD-SDI, and SD-SDI signals.

See full product features and specs.

Epiphan Webcaster X2™

Webcaster X2™ is a dedicated encoder designed from the ground-up for live streaming to your favorite social media platform, making streaming easy.

See full product features and specs.



Epiphan DVI2PCIe Duo™

Internal PCIe capture card captures lossless video from dual-link and single-link DVI video sources, as well as VGA, HDMI, and SDI video sources with audio from SDI and HDMI sources.

See full product features and specs.

Epiphan KVM2USB 3.0™

Manage local servers and headless computers using KVM over USB 3.0 with HDMI, DVI, or VGA connectors.

See full product features and specs.

Epiphan VGADVI Broadcaster™

Capture, combine, and stream audio plus full HD and SD video. A quiet and portable video recorder for DVI, HDMI, VGA, DisplayPort, S-Video, and composite sources.

See full product features and specs.

AVSTUDIO

Cloud video production

Automate your video production.
Deliver content faster with minimal setup for recording, streaming, and editing video.

INSIDE EPIPHAN

Read on for a message to our customers and *EVolution* readers. Each issue, we'll put an Epiphan Video team member "in the spotlight" and tell you a bit about them.

A message from the people behind the products

Like any big group, we at Epiphan Video are a diverse bunch. We include PC diehards, Mac fanatics, and Linux evangelists. Some swear it's possible to tell the difference between *Coke* and *Pepsi*, others beg to differ. There are those of us who value Canada's rugged winters; the rest live in Palo Alto. We're tech whizzes, coding gurus, data nerds, architects, artists, educators, strategists, and storytellers.

But there are a few things that are true for all of us.

We all believe in the power of video to spread ideas, engage others, and bring people together across great distances. We're committed to developing world-class AV solutions that meet the needs of customers in corporations, educational institutions, live event production, courtrooms, healthcare facilities, government offices, places of worship, and other spaces. We're excited about what's to come for the thriving audiovisual industry.

And we're always delighted to meet with our customers and make new connections – to hear how people are using our products and what they'd like to see from us in the future. If you ever run into us at a trade show or industry event, we'd love to chat. We're also active on social media, and our sales and support team is always ready to answer questions about our solutions. Have something to say about this issue of *EVolution*? Share your thoughts at magazine@epiphan.com.

From all of us at our offices in Ottawa, Ontario, and Palo Alto, California, thanks for reading.

Don't be a stranger!

– Team Epiphan

In the spotlight

George Herbert
Manager, Support and Training

We often joke around the office that George Herbert is the face (and voice) of Epiphan Video. There's a lot of truth to it. George appears in many of our marketing videos and frequently demos Epiphan solutions for customers. He regularly co-hosts our weekly Live @ Epiphan webcast and often mans the Epiphan booth at trade shows. As our technical support lead, he's one of the voices you'll hear if you call into our customer helpline.

While the Face of Epiphan is a title George doesn't shy away from, he's quick to point out the team that makes it all possible.

"Our engineers and developers make great products I'm proud to present," he says. "Our marketing team drafts scripts, designs presentations, and figures out the best way to share our solutions with customers. All of this makes the job of being the face very easy."

George joined Epiphan a decade ago, back when frame grabbers were the company's main focus. He came aboard as a technical support specialist with a broad background in high tech. Today he's Manager of Support and Training, making him integral to Epiphan's track record of customer support excellence.

"Customers tell us all the time that our support team is a cut above," George says. "My philosophy has always been one of treating customers the way I'd like to be treated. Good customer service comes from being knowledgeable about a wide range of subjects but also from being empathetic and sympathetic, from understanding the customer's position and treating them with respect."

What does George get up to when he's not representing Epiphan or delivering outstanding customer support?

"I play a fair number of video games," he says. "I'm passionate about cars and motorcycles. I also spend a good deal of time outdoors, camping and so on. When I'm not buried under technology, I like to be as far away from it as possible."

Where we'll be in 2020

FEB 11 - 14
ISE Europe
RAI Amsterdam, Amsterdam, Netherlands | Hall 11, Stand B110

APR 19 - 22
NAB Show
Las Vegas Convention Center, Las Vegas, Nevada | South Hall (Upper), Stand SU7922

JUNE 13 - 19
Infocomm
Las Vegas Convention Center, Las Vegas, Nevada | Central Hall, Stand C6224

SEPT 11 - 15
IBC
RAI Amsterdam, Amsterdam, Netherlands | Hall 14, Stand H26

OCT 21 - 22
NAB Show New York
Javits Center, New York, New York | Stand N364

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The pro's choice for live video production

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