Haivision

The Complete Guide to Remote Production Over IP

Enabling flexible and efficient decentralized remote production

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This guide examines the benefits and challenges of adopting a remote production model based on IP networks and explores how the latest technologies innovations are helping broadcasters overcome the challenges of producing live events remotely.

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Introduction

IP ENABLED REMOTE PRODUCTION

Remote production, often known as REMI (REmote Integration Model) or at-home production is an increasingly employed broadcast workflow where content is captured live from a remote location, such as a sporting venue, while production is performed in a main studio and control room. The drive towards IP technology combined with recent events has changed this model further by replacing large studios and control rooms with distributed or decentralized production workflows spread across multiple broadcast facilities and home-based staff.

IP technology, including secure and reliable internet streaming, has also enabled remote event broadcast productions to evolve from traditional approach of using multi-million dollar Outside Broadcast (OB) trucks, costly satellite uplinks, and large crews to more flexible and efficient remote production workflows.

Driven by surging consumer demand for more live coverage whether it be news, sports, or music events, broadcasters are increasingly turning to flexible remote production workflows that rely on the public internet for broadcast contribution, return feeds, and monitoring.

Correctly implemented, IP-enabled remote production can reduce the movement of both people and equipment, increase the utilization of resources, and maximize the efficiency of production teams, providing broadcasters with the flexibility to produce, distribute, and monetize more video content with fewer resources.

In this guide we set out to explore the benefits and challenges of adopting a remote production model based on IP networks and share real world examples of how the latest technological innovations are helping broadcasters and production studios overcome both technical and operational challenges of producing live events remotely.

FOX
20TH SEASON

FOX SPORTS AND NASCAR

After a hiatus lasting almost ten weeks, NASCAR racing returned to screens in May 2020, thanks to live coverage provided by Fox Sports. In order to ensure the health and safety of its employees, Fox Sports deployed a remote production approach to deliver high quality race coverage while putting the smallest crew possible on the track. Fox Sports turned to Haivision for a solution that was low latency, reliable, and extremely bandwidth efficient. With 16 live video feeds leaving the track to Haivision Makito X video decoders located in Fox Sports' network centers in Charlotte, North Carolina, and Los Angeles, California, both the production and broadcast engineering teams were able to work remotely and interact seamlessly with the onsite production crew. This was achieved via a private ethernet network between the track, LA, and Charlotte, and a public network via the Haivision SRT Gateway providing low latency internet streaming for executives and production staff working from home.

CUSTOMER SPOTLIGHT

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Broadcast Reimagined

In an era of increasing competition and evolving business models, television broadcasters and content owners are looking to optimize efficiencies and reduce costs. Employing a remote production model allows broadcasters to do more, with less, by reducing the time, costs, and resources involved in preparing for a live event broadcast. Remote production over IP offers broadcasters the opportunity to produce more revenue-generating content to meet rapidly growing demand while simultaneously creating efficiencies. By routing live video at low latency over IP networks, including the public internet, broadcasters can also consolidate production resources and talent, whether in a centralized broadcast facility or across a decentralized broadcast team.

Consider the task for a second-tier sports broadcaster that needs to cover hundreds of small-scale events each year. These smaller events are not able to be monetized at the same scale as a marquee sporting event. Remote production over IP allows costs to be dramatically lowered by dispensing of the need for satellite equipment and on-site resources while being able to stream low latency contribution video over the near-ubiquitous internet.

CUSTOMER SPOTLIGHT

Leading cable sports broadcaster, **ESPN**, deployed an IP powered remote production solution to 14 collegiate athletic conferences that have been used to produce more than 2,200 events via low-cost internet connections, in place of using traditional satellite uplink services that would have cost upwards of $8 million.

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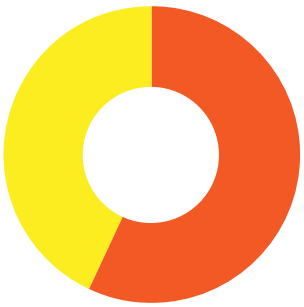
THE REALITY OF A DISTRIBUTED WORKFORCE

According to Haivision polls conducted in September 2020 among broadcast and media professionals during the COVID-19 pandemic, 57% of respondents stated that 50 % or more of their organization's production workforce is currently working from home. In addition, 79% of those polled stated that the pandemic has accelerated the transition to IP in their organization.



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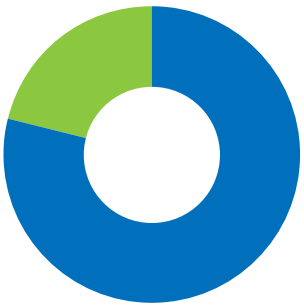

79% of those polled stated that **the pandemic has accelerated** the transition to IP in their organization.

THE BENEFITS OF REMOTE PRODUCTION OVER IP

REDUCE COSTS AND COMPLEXITY

Deploying OB trucks and on-site production equipment is a very expensive proposition requiring massive investment in logistical planning, video hardware, and support personnel. In addition, set up times are long, and there are many moving parts to contend with, allocating, transporting and setting up equipment, securing and provisioning satellite links, as well as coordinating staff schedules, travel, and hotel arrangements.

By eliminating the costly and complex logistics associated with deploying OB trucks full of expensive equipment and on-site production teams there are substantial time and cost-savings to be made.

MAXIMIZE RESOURCES

With fewer people deployed in the field, broadcasters can instead focus on optimizing the use of their existing resources to produce more high-quality content. Remote production allows broadcasters to leverage their best operators, editors, and onscreen talent to work on multiple events with greater attention to consistency and quality. For example, a replay operator on-site at a sporting event might be only utilized for three hours during a four-day period. If the replay operator is at home, however, they could be running replays around the world, all the time.

DECENTRALIZE PRODUCTION

Recent events have driven the need for broadcasters to decentralize their production workflows to include multiple production locations as well as home-based staff. Low latency IP streaming, including over the internet with SRT, provides access to live production streams from anywhere. This can also include bi-directional streams for live interviews with remote subjects and talent. Executives and other staff can also access low-latency streams to monitor live production from a laptop or mobile device using an encrypted connection to a cloud or on-premise stream gateway.

CREATE MORE CONTENT

When it comes to live content, customers want more choice and they're willing to pay for it, particularly live sporting events which remain a huge draw. And this demand is not limited to just high-profile, traditional sports leagues, but niche, minor, and so-called second tier sports such as college sports, volleyball, e-sports and even rodeo which have a rapidly growing fanbase. The challenge with these events has been that deploying resources onsite is simply cost-prohibitive. By harnessing the latest video technologies designed for remote production, broadcasters can expand their coverage to meet demand while keeping production costs in check.

Remote production over the internet not only enables broadcasters to reach audiences with niche content, it allows them to increase coverage of a major event by permitting more feeds from multiple cameras around a venue. Fan-cams in the bleachers to player or bench cams, streams overlaid with real-time stats to video with bespoke commentary give the viewer more personalized viewing options and the video service provider great potential for targeted advertising. With no cost restrictions around broadcasting time, providers have greater flexibility in building programming around an event.

RIOT GAMES

RIOT GAMES: LEAGUE OF LEGENDS WORLD CHAMPIONSHIPS

Esports giant, Riot Games, used a remote production workflow for its League of Legends World Championships, a mammoth undertaking spanning 4 cities over 6 weeks serving a global audience of nearly 100 million viewers. The Championship tournament was broadcast from Korea while being centrally managed and produced from the Riot Games headquarters in Los Angeles. With 18 studios dedicated to 18 different regions/languages, Riot Games delivered an impactful viewing experience to fans rivalling some of the biggest professional sports events. Using Haivision's Makito X video encoders and decoders, Riot Games was able to build a REMI workflow supporting ingest of high-quality 1080p60 HD video for backhauling over their cost-efficient IP network, with an end-to-end latency under 150 milliseconds.

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Key Technology Challenges of Remote Production

For a remote production approach to be both successful and sustainable, broadcasters must be able to capture all the live action without compromising on quality to deliver the best possible experience to viewers. There have been justifiable concerns which have made some video providers reluctant to commit to this path. These concerns include **connectivity and reliability, synchronization, latency, and security**.

CONNECTIVITY AND RELIABILITY

Technologies that transport high bandwidth video streams over unmanaged and often unpredictable networks, such as the public internet, must be able to handle large amounts of packet delay variation (jitter) and be able to recover packets that have been lost in transmission in order to ensure reliability of the video stream.

MULTI-STREAM SYNCHRONIZATION

Keeping live video and audio in sync while streaming over IP networks can be a considerable challenge. Especially when dealing with an unpredictable network like the internet where round trip times and bandwidth availability can continually fluctuate.

In order to ensure that all video and audio streams are in sync with each other, broadcast and network engineers need to spend time to manually adjust the timing of each video decoder output. Typically, this is done using a test pattern device to calibrate audio channels with live video sources. This approach requires coordination between people at both the remote location and at the Master Control Room (MCR) and can be very time consuming. The more cameras and audio channels involved, the more complicated it becomes to synchronize everything, and the more time needed before going on air.

LATENCY

When it comes to bi-directional interviews or live sporting events, every millisecond counts, as viewers will attest, nothing kills the viewing experience like high latency. Perhaps you've watched a soccer game online while your neighbor watches live over the air and you hear them celebrate the winning goal 10 seconds before you see it? Or worse still, imagine watching election results and they appear in your twitter feed before you even get to see it on your TV screen. In these cases, low latency is critical to assure an optimal viewing experience with great viewer interactivity and engagement.

There are several factors which contribute to end-to-end latency including the complexity of the content delivery chain, the number of video processing steps involved, the individual components involved (eg cameras, encoder, decoders and displays), the network type and speed, as well as the streaming protocols and output formats used. While individually these delays might be minimal, cumulatively, they can add a disruptive delay that compromises the viewing experience.

SECURITY

Keeping valuable content secure, protecting intellectual property and preventing unauthorized access to video is a high priority, especially for live events. With online piracy on the rise, broadcasters are looking to protect content throughout its journey, from video contribution feeds through to distribution channels.

Such concerns can now be assuaged thanks to advances in technology designed to solve the problem of reliably and securely transmitting high quality video at low latency over poor quality networks.

Remote Production Streams Explained

In order to support remote production workflows, different types of video streams are needed. In some cases, this could involve streaming over a private network such as an MPLS service, dedicated fiber or a WAN. For increased flexibility and cost savings, the public internet can also be used to send streams from one location to another. Broadcasters may decide to use a mix of both private and public networks to support their video streams. Whatever the case, it's important to be able to distinguish the different types of video streams needed and how they enable remote production.

CONTRIBUTION STREAMS

Video that is sent from the field to a live production facility is typically referred to as a contribution stream. In most cases, especially when covering live events, there are multiple streams sent from the field so that they can be captured and mixed into the final production. Also known as the first mile, broadcast contribution is a critical stage of the overall success of a live broadcast production as the quality, reliability, and latency levels need to be as optimized as possible in order to ensure a great end product. When leveraging the public internet for broadcast contribution it is especially important to be able to keep those streams, both video and audio, in sync with each other so that they can be used by the live production team.

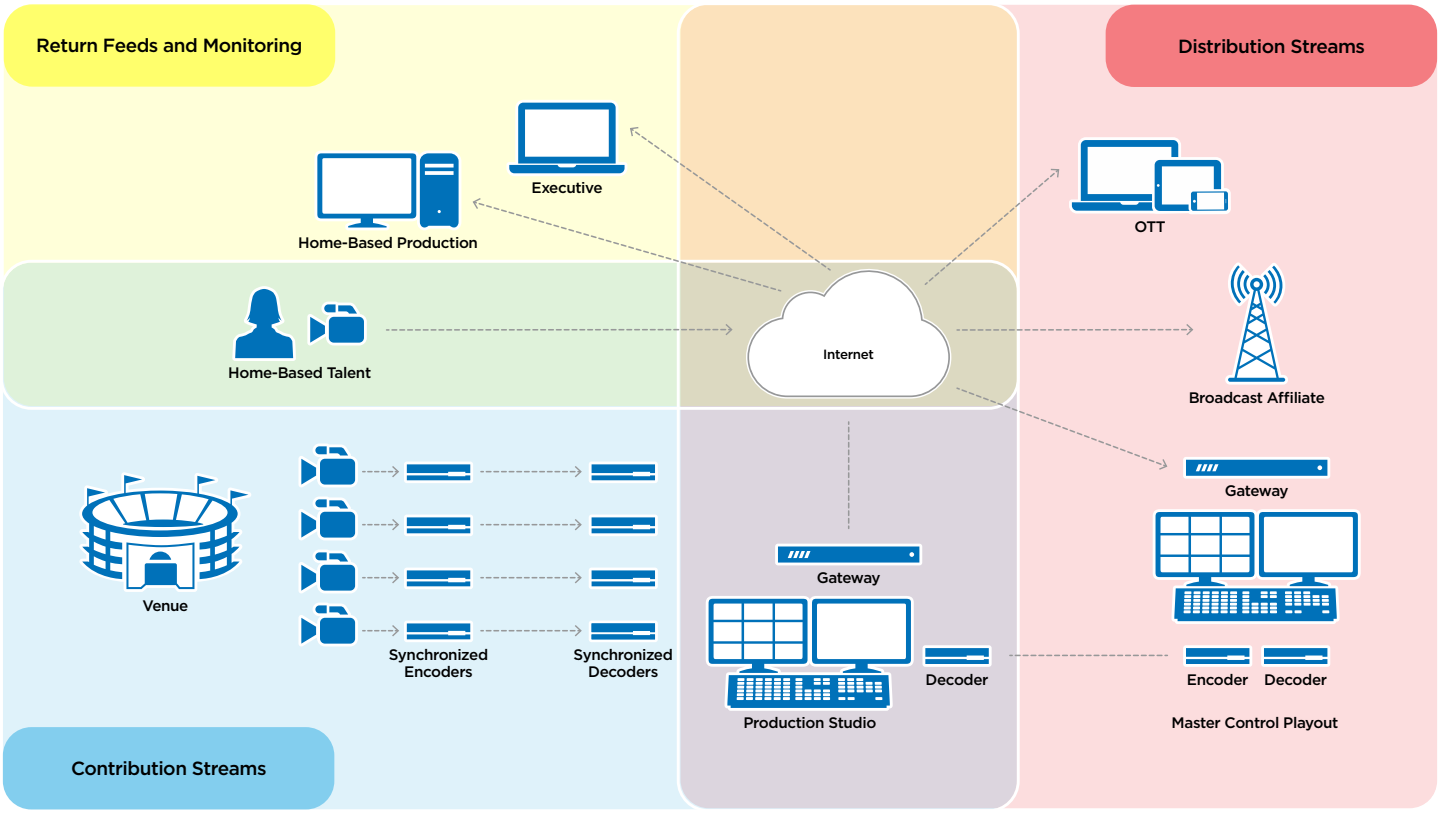
RETURN FEEDS AND MONITORING

In addition to the contribution streams that are used to create the on-air content, there are a number of other types of streams that are critical to the live production process. Return feeds are used by producers stationed across different locations to see live camera shots and to be able to suggest or make quick changes on the fly. Return feeds can be sent to a portable monitor to cue up content for remote talent including live feeds from the field or even of themselves, replay content, or teleprompter information so that they can be better prepared for on-air broadcasts. Broadcast engineers and executives also rely on video streams for monitoring what's happening during a live broadcast, including both on-air and off-air camera shots. Although the picture quality does not always need to be on par with broadcast content, it is critical that they are reliably delivered and shared at very low latency so that producers and talent can work in real-time.

DISTRIBUTION STREAMS

Distribution streams may include sending produced content, based on contribution feeds and on-air talent, from a production facility to a master control room where graphics are added for playout. Distribution streams can also include the playout material shared to various affiliates or send to an OTT streaming service. In some cases, especially for international sporting events, the produced content needs to be distributed to multiple rights holders. Traditionally, broadcast distribution was supported by costly satellite links or dedicated fiber, but increasingly, IP networks and the internet are relied upon as with other remote production streams.

REMORE PRODUCTION LOW LATENCY VIDEO STREAMS



Different types of video streams used for remote production

LIVE X

LIVE X: USGA AMATEUR CHAMPIONSHIPS

New York based full-service production company Live X deployed Haivision technology and the SRT protocol for the remote production of the USGA amateur championships in both 2018 (California) and 2019 (North Carolina). With multi-camera coverage of the commentator and additional wireless cameras covering the golf action at key locations, the team were able to run the production entirely remotely from its MCR in New York at a fraction of the cost of a regular OB production. Live, low latency (sub 500 ms) audio and video feeds were successfully transported from six live synched camera feeds and, from controlling cameras to mixing the audio live, everything was done remotely from as far as 3000 miles away.

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Broadcast With Confidence: Next Gen Technologies for Live Remote Production

ULTRA LOW LATENCY

From live bi-directional interviews, to remote production or at-home contribution, latency is critical in many broadcast applications. Broadcast engineers work to keep overall latency as low as possible from the start, keeping the delay from the camera to the production studio at less than one second (or ideally under 300 milliseconds) which is referred to ultra low latency. Haivision video encoders and decoders have been engineered and designed to keep latency as low as possible, under 55ms in some cases. Haivision's dedicated hardware encoding engine can maintain low levels of latency even with HEVC while delivering high quality video at extremely low bitrates down to under 2 Mbps.

By delivering a combination of bandwidth efficiency, high picture quality, and low latency at the first mile, last-mile viewers can enjoy a great live experience over any network – with no spoilers.

MULTI-CAMERA STREAM SYNC

Keeping live video and audio in sync while streaming over IP networks can be a considerable challenge. Especially when dealing with an unpredictable network like the internet where round trip times and bandwidth availability can continually fluctuate.

In order to ensure that all video and audio streams are in sync with each other, broadcast and network engineers need to spend time to manually adjust the timing of each video decoder output. Typically, this is done using a test pattern device to calibrate audio channels with live video sources. This approach requires coordination between people at both the remote location and at the MCR) and can be very time consuming. The more cameras and audio channels involved, the more complicated it becomes to synchronize everything, and the more time needed before going on air. Although with the right tools, this approach can be made to work, there is a much simpler and faster way.

Haivision's Stream Sync solution automates and simplifies real-time frame alignment. Stream Sync is supported by the Makito X Series of video encoders and decoders, including the new Makito X4 encoder and decoder for 4K or quad-HD video. These Haivision devices are configured to stream multiple channels of live event video which are kept in sync – accurate to within a single frame.

Stream Sync continuously monitors the characteristics of the streams and the network and applies the exact amount of buffering required to ensure smooth and synchronized playout across multiple feeds. This is done in real time based on timestamps embedded in each stream from the remote Makito X or X4 encoders. For live production, this means that any camera can be used with any audio track, with no noticeable video hits or loss of lip-sync.

HIGH EFFICIENCY VIDEO ENCODING (HEVC)

Efficient compression to maximize bandwidth (and offer significant bitrate savings) is integral to remote production over IP. And in recent years, the move towards 4K resolutions has necessitated higher levels of compression efficiency than before. Enter H.265, a video compression codec more commonly referred to as HEVC (High Efficiency Video Encoding).

Its predecessor, H.264 (or AVC) was the most widely used codec for a long time, but since its release in 2003, resolutions have increased considerably, so it is now generally considered to be an aging compression scheme. HEVC has built on the concepts behind H.264 and is quickly becoming ubiquitous. At an identical level of visual quality, HEVC enables massively improved compression allowing video to be compressed at half the bitrate of H.264, making it twice as efficient making it the obvious choice for remote production over the internet. When compressed to the same bitrate as H.264, HEVC delivers significantly better visual quality.

NETWORK ADAPTIVE ENCODING (NAE)

Haivision's Makito X series of video encoders features Network Adaptive Encoding which enables encoders to automatically adjust compression levels based on real-time network bandwidth information. For applications where latency is critical such as video surveillance and defense applications, picture quality can often be traded off in favor of minimizing latency. However, for use cases where pristine broadcast quality video matters, latency can be increased slightly in order to support advanced video processing and error correction. By delivering the optimal combination of bandwidth efficiency, high picture quality, and low latency, viewers can enjoy a great live experience over any network.

SECURE RELIABLE TRANSPORT

Originally developed and pioneered by Haivision, the Secure Reliable Transport (SRT) streaming protocol provides end-to-end security, resiliency, and dynamic endpoint adjustment based on real-time network conditions to deliver the best video quality at all times. Even using HEVC, unreliable networks can increase video latency and cause jitter and packet loss which lowers the quality of the video at the receiving end. Leveraging the SRT protocol, video can be optimized across unpredictable networks, like the internet, to ensure the delivery of low latency, pristine quality video, no matter what the network.

SRT also utilizes AES128/256 encryption to keep streams safe and secure. Trusted by governments, financial institutions, major corporations, and some military intelligence agencies, AES encryption has a proven record of reliability and security. AES encryption is only one part of a larger security strategy. SRT also ensures that firewall traversal is easy by using a caller/listener handshake concept. This allows for the passage of real-time video streams within secured networks.

Another important security aspect of SRT is its output listener statistics. This feature allows you to monitor who is "calling into" (accessing) your stream, as they are accessing it. This serves a dual role. You can ensure that you are not crowding your stream with too many callers watching at once, while simultaneously monitoring that only those authorized to access your stream are watching.

SRT offers significant operational flexibility and cost savings over (or compared to) satellite or custom network infrastructures.

HUNAN TV AND SINGER 2020

Throughout the eighth season of China's most popular talent show, Singer 2020, Hunan TV, one of China's biggest broadcasters, was forced to rethink the entire production of the show because of the restrictions brought about by the coronavirus pandemic. Up against tight deadlines, limited resources, and logistical constraints, Hunan TV landed on an ambitious plan to ensure the success of the live grand finale. Leveraging the combination of innovative Haivision technology and the SRT protocol, Hunan TV was able to deliver its first ever live remote production of a TV show in China across three locations: Changsha, Taipei, and Tokyo to a record-breaking audience.

CUSTOMER SPOTLIGHT

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REMOTE PRODUCTION AT THE RODEO

Rural Media Group, the leading provider of multimedia content dedicated to rural American news, culture, and the western lifestyle relies on the latest technologies to cover more events remotely. Using Haivision Makito encoders and decoders, along with the SRT protocol has resulted in considerable cost savings allowing the network to operate more efficiently and with very low latency. For the remote production of its flagship event, the Cheyenne Frontier Days, in Wyoming, Rural Media Group benefited from a robust and reliable solution that delivered low latency, frame accurate, pristine quality video.

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Haivision Remote Production Solutions

Haivision offers a range of cost-effective, reliable, and secure video solutions for flexible IP and cloud-enabled broadcast workflows. From video encoders and decoders, to gateways and video transport, broadcasters around the globe rely on Haivision solutions to deliver low latency, flawless video with rock solid reliability.

MAKITO X VIDEO ENCODER/DECODER SERIES

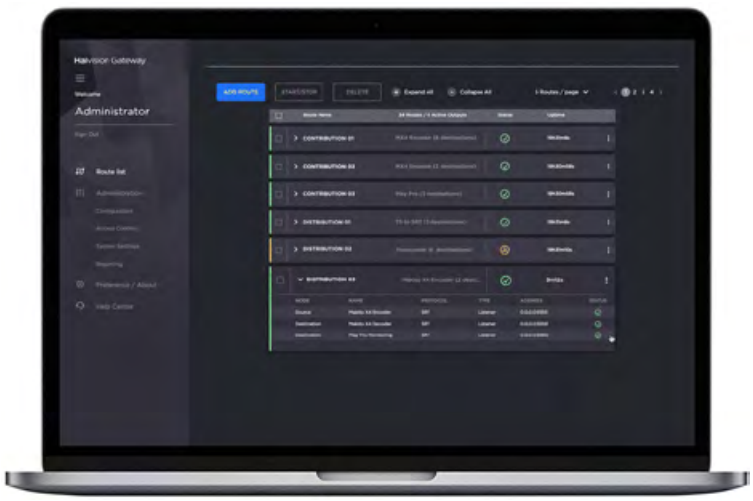
Haivision's award-winning H.264 and HEVC video encoders and decoders enable ultra-low latency end-to-end transport of secure, high-quality HD and UHD/4K video. Haivision's Makito X Series includes Network Adaptive Encoding which can adjust video bitrate based on your network conditions, ensuring your stream never fails.

The series also features Haivision's unique Stream Sync technology which makes it easy to synchronize incoming encoded video sources for remote production workflows. The flagship Makito X4 video encoder can encode and stream 4K/UHD video with 4:2:2 and 10-bit color depths for live production of premium content.

Haivision Makito X4 Video Encoder and Decoder

SRT GATEWAY

A flexible and scalable solution for secure routing of live video streams across different types of IP networks. The Haivision SRT Gateway serves as a network bridge for converting non-SRT streams to SRT and traversing firewalls. The SRT Gateway can also duplicate live streams to provide broadcasters with a cost-effective solution for delivering live content to one or multiple destinations for remote production and broadcast distribution.



Haivision SRT Gateway

Alibaba Cloud

Microsoft Azure

aws

HAIVISION HUB

Haivision Hub is a cloud-based service for routing live media for broadcast contribution, production, and distribution workflows, with built-in support for the open source SRT transport protocol, Haivision Hub is a great solution for broadcasters seeking alternatives to costly satellite links, fiber networks, and proprietary transport technologies.

Haivision Hub

PLAY PRO

This mobile app enables direct viewing of SRT streams encoded in H.264 and HEVC, including password protected channel lists for broadcast monitoring and encrypted low latency return feeds.

Best of all, it's completely free to download!

Haivision Play Pro App

SECURE RELIABLE TRANSPORT

Haivision's Secure Reliable Transport (SRT) technology provides end-to-end security, resiliency, and dynamic endpoint adjustment based on real-time network conditions to deliver the best video quality at all times.

With SRT, you can optimize video streaming across unpredictable networks, like the internet, by assuring quality-of-service when faced with packet loss, jitter, latency, and fluctuating bandwidth.

Looking to the Future

The benefits of decentralized remote production over IP networks have been greatly amplified by recent events. The advantages of IP and internet video streaming for remote production include more than just cost efficiencies, but also the potential for broadcasters to innovate with new ways to create and consume content.

More employees are working from home than ever before and this trend is likely to continue as broadcasters realize the benefits of reducing the need for travel, improving work-life balance, and being able to hire the very best talent no matter where they are located. Decentralized production offers the flexibility for broadcast engineers and producers to work together in real-time to create and deliver more high-quality events.

With the near ubiquity of high bandwidth internet and the ongoing rollout of 5G networks, live video streams for remote production can be shared in real-time from anywhere to anywhere. As in-house broadcast facilities deploy SMPTE 2110, entire broadcast workflows will be IP enabled over both public and private networks. Furthermore, remote production workflows are encompassing a mix of on-premise, at-home, and cloud-based elements for encoding, decoding, and video processing, all accessible via IP networks. To ensure that internet streaming does not become a bottleneck, technologies such as SRT can ensure low latency streaming, reliability, and security for decentralized remote production workflows. The potential for remote production over IP is limitless.

READY TO GET STARTED?

Contact us to speak with a video streaming expert.

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