Core Insights

From the experts at The Broadcast Bridge.

Making Remote Mainstream

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Introduction by Tony Orme - Editor at The Broadcast Bridge.

High profile sports events are renowned for demanding cutting-edge technology for broadcast television. Whether its new video and audio formats or improved working practices, the real-time dynamic of sporting events drives broadcasting to new levels of technical need.

Remote Production (also referred to as REMI and At-Home) is one of the drivers for video and audio over IP distribution. The flexibility IP offers delivers greater scalability and flexibility and provides more options for solving complex workflows. However, this is not just confined to existing working practices, IP empowers broadcasters to rethink and optimize working practices to deliver unprecedented efficiencies.

Moving production crews back to a central studio helps broadcasters make better use of their resources to deliver more programming for ever demanding audiences giving them greater choice. However, this model of operation creates many new challenges. Although they've already been solved by vendors, understanding the intricacies of these solutions is key for any broadcaster looking to adopt the remote production model.

Remote Production isn't just about moving crews to a centralized location but instead is about giving broadcasters much more choice. The flexibility this system offers is unprecedented and many factors influence the best operational solution.

Throughout this Core Insight, we discuss the many solutions available with their respective advantages and look at how broadcasters can leverage the flexibility to deliver the best system possible to facilitate live events from all over the world.

1. **Understanding the Benefits**
Discussion of how Remote Production can be used to leverage flexibility and scalability for modern broadcasters and international events.

2. **Core Infrastructure**
Description of the components, networks, and systems employed to give broadcasters unprecedented choice.

3. **Connecting Seamlessly Together**
Discussion of how systems are connected together to deliver pictures and sound with the minimum of latency and at the same time keeping presenters happy.

Part 1 - Understanding the Benefits

Remote Production is gathering pace as it continues to add more benefits to the production value chain. As a solution, Remote encompasses many different disciplines and workflows to deliver the best productions possible. In the first part of this three-part series we take a deeper look into Remote Production to further understand its benefits.

Traditional Outside Broadcast units are hugely expensive, both in terms of capital outlay and operational costs. The time taken to design and build them also has direct implications for cost. Not only does the electronic equipment within the unit have to be serviced and maintained, but the actual vehicle must be kept on the road. Although the maintenance schedules are improving, the vehicle is still a mass of moving parts that can fail and quite often all your eggs are in one basket.

Brand Implications

The costs of the truck and fuel may seem insignificant compared to the cost of the hundreds of thousands of dollars' worth of broadcast kit, but many industries are realizing the effect global warming may potentially have on their brand. That is, if you're not doing something to reduce your carbon footprint, then your brand may be affected.

As we move to IP, one of the major advantages of using IP as a delivery mechanism is that we can take advantage of circuits used in other industries. For example, IP managed circuits are used throughout the IT industry for connecting different sites together.

Transport Stream Agnostic

Telco's adopted IP due to its flexibility and that it is transport stream agnostic, that is, an IP datagram has no knowledge of what type of data circuit it is being transported on. It is equally happy to work on Ethernet, optical, DSL and 4G, to name a few. This has huge advantages for the Telco's as they can move IP packets around their networks much more easily, and also exchange IP datagrams with Telco's. However, this also introduces some interesting challenges which we will address in a later article.

Although IP as a concept is helping to facilitate Remote Production, it is not the only reason we are seeing a massive increase in its adoption. As IP compliant circuits are ubiquitous in wider industries and are heavily used all over the world, the cost of the circuit is decreasing, and the data capacity is increasing.

Broadcasting was once considered to be at the cutting edge of technology, and in some respects, this is still true, especially when we look at the advances made with wide color gamut and high frame rate cameras. However, industries such as finance and banking have had the buying power to persuade vendors to invest in building faster networks capable of distributing IP with breathtaking data rates.

More Choice

These massive data rate increases have had a significant influence on the adoption of Remote Production.

The fundamental advantage Remote Production offers is that broadcasters now have a choice of where they place their kit. Like all things in

engineering, a compromise has to be struck, but in essence, broadcasters have much more choice now than they ever have.

Traditional OB's demonstrate one extreme, that is, all the kit is at the venue resulting in a complete program being produced on site. The program can be streamed back to the studio via an IP link, or satellite feed, or even a bespoke video circuit. Broadcasters, if they wish, can still adopt this model.

Key to understanding the benefits of Remote Production is to appreciate the concept of centralization. Although this may be the current buzzword, centralization has been in IT since the first IBM Mainframe computers that provided computing resource for tens or even hundreds of users.

Centralization is Key

A huge expensive computing resource would be located centrally in a company's office and relatively low computing power terminals would be connected to it, one for each user. The Mainframe, in this instance had succeeded in moving the expensive computing resource from the user to a single centralized unit. This also took advantage of the fact that any one user would only need a small time-slice of processing power and not the whole machine continuously.

Remote Production is quite similar to this as a concept. As an industry, we're caught in a catch-22 situation as live sports and events broadcasting are very bursty. That is, events are not back-to-back throughout the week and continuous. Instead there is a cluster occurring at weekends and probably another cluster during the week. Anybody who has designed a traditional broadcast facility knows that we must always plan for the maximum demand on the system. This often leads to much of the very expensive resource being left idle for large amounts of time. This is one of the reasons cloud computing is so attractive to many broadcasters as we can increase and decrease resource at a few minutes notice to meet the peak demands.

Better Resource Allocation

This catch-22 situation has one of two solutions; reschedule all the sports events throughout the world to match the capacity of the broadcasters skilled operational talent or manage the broadcasters, resources and skilled talented staff to work more efficiently.

Centralizing key members of the crew (A1's) in a centralized production hub means they can now work on more sports events throughout the day. Instead of just working at one location, which may include several days of travel, accommodation and subsistence, a centralized team can work on three and possibly even four events in a single day.

The advantages aren't just about saving money, but more importantly making best use of the resources and people available to a broadcaster to improve the quality and quantity of productions provided. This is a complete win-win outcome; the crew win because they have better certainty of work with more opportunities to demonstrate their talent, and the broadcaster wins as they become significantly more efficient and increase their output. Furthermore, the broadcaster is giving their viewers a much better viewing and potentially immersive experience.

Compromise of Extremes

Taking centralization to the opposite extreme of the classic OB truck, places all the kit except the cameras and microphones back at a central production hub. This is also possible, and a workflow used by some. It has some interesting challenges however, but we will look at these in a later article.

There are many combinations of workflows between the extremes of full OB and fully centralized production. Systems are dynamic in that they can be changed to meet the specific needs of the particular event, or events the broadcaster needs to cover.

Another major advantage of IP-compliant circuits is that they are bi-directional and, in most cases, symmetrical, that is, the data rate and latency is the same in both directions. This allows video, audio, control, tally, and metadata to be sent from both ends of the link. In the next article we'll look at applications where bi-directional connectivity excels.

Remote Production is increasing in popularity in part due to the prevalence of affordable high-speed, low-latency IP-compliant circuits. However, there is also a significant business drive behind its adoption, that is, the ability to make much better use of the broadcasters' resource and talented skilled crew, and at the same time increasing the broadcaster's quality and quantity to satisfy very demanding viewers.

Media Stream Type	Rate	Number of Streams per Port			
50 Hz fps Standards	Mb/s	10 GbE	25 GbE	40 GbE	100 GbE
HD 1080i_50 SDI	1,485				
Uncompressed SMPTE ST 2022	1,559	5	14	23	57
Uncompressed SMPTE ST 2110	1,114	8	20	32	80
HD 1080p-50 SDI	2,970				
Uncompressed SMPTE ST 2022	3,119	2	7	11	28
Uncompressed SMPTE ST 2110	2,202	4	10	16	40

Media Stream Type	Rate	Number of Streams per Port			
59.94 Hz fps Standards	Mb/s	10 GbE	25 GbE	40 GbE	100 GbE
HD 1080i_59.94 SDI	1,484				
Uncompressed SMPTE ST 2022	1,558	5	14	23	57
Uncompressed SMPTE ST 2110	1,330	8	16	27	67
HD 1080p-59.94 SDI	2,970				
Uncompressed SMPTE ST 2022	3,119	2	7	11	28
Uncompressed SMPTE ST 2110	2,635	3	8	13	34

Figure 1 – This table shows the number of uncompressed video feeds that can fit on various types of ethernet connections.

Part 2 - Core Infrastructures

In part-1 of this three-part series we discussed the benefits of Remote Production and some of the advantages it provides over traditional outside broadcasts. In this part, we look at the core infrastructure and uncover the technology behind this revolution.

As discussed in part 1, the major benefit of Remote Production is that it gives program makers and broadcasters more choices to both potentially increase quality and quantity of programs.

Instead of thinking of Remote Operation in the static linear terms of outside broadcast, that is, point-to-point links and peak demand infrastructures, we should begin to think in terms of distributed dynamic systems.

Each of the program essence streams can be processed independently as ST-2110 has very cleverly re-created the underlying sample clock in software and within the stream itself. This further allows the essence streams to be processed on entirely different systems.

ST-2110 Opportunities

As ST-2110 has now freed us of hardware timing constraints, there are many new and interesting options open to the broadcaster. There are many other opportunities where this application model will become relevant freeing broadcasters to ask deep and challenging questions – why does the slo-mo operator need to be at the venue? Or, why can we not perform AI processing in the Cloud to tag live video and audio for ingest?

Another interesting scenario occurs when considering pool feeds. For international events, a host broadcaster will be nominated by the organizers to provide a program feed for their own broadcast and a clean-feed for international broadcasters. The international broadcasters will then in turn add their own graphics and commentary voice overs.

Streaming Flexibility

In the distributed Remote Production example, it's perfectly possible to stream the clean-feed from the production hub. But with Remote Operation, there is also the option of streaming individual cameras and microphones to other broadcasters so they can make their own productions. This is particularly useful as broadcasters start to experiment with virtual reality (VR) and augmented reality (AR).

Broadcasters may also work extensively with 3rd party production facilities as IP enables them to send uncompressed or compressed feeds to production facilities. The feeds can source directly from the venue or the production hub, so they don't have to go through expensive video and audio specific circuits. Most, if not all production facilities will have IP compliant circuits into their buildings making integration to Remote Operation even easier.

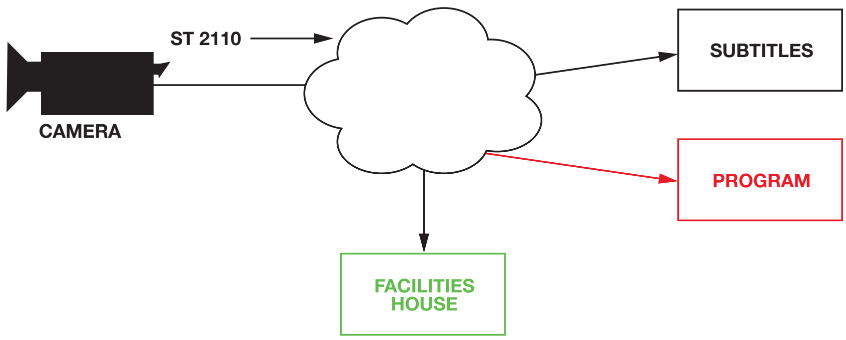


Figure 1 – ST2110 allows us to abstract away the video, audio, and metadata essence from the underlying data link and transport stream. One major advantage of this is that the essence feeds can all be processed independently of each other if required.

Return Feeds

IP-compliant circuits allow the cameras to be backhauled to the production facility and the bi-directional ability of IP circuits allows return

vision, monitor feeds and even teleprompter feeds to be sent back to the cameras.

A similar solution has the potential to occur with audio, that is microphone feeds can be sent to the production hub and return monitoring feeds can be sent back to the venue. However, latency plays a big part of making audio monitoring work reliably and to keep latency as low as possible, monitoring is provided on site.
There are occasions when the broadcaster may decide to place more of the infrastructure equipment at the venue instead of keeping it at the production hub. This might occur when the event is so big, that is there is so much revenue at stake, that the broadcaster may want to record everything on site as well as providing a full production feed, similar to how outside broadcasts work. Or, the Telco's may not be able to provide sufficient capacity for an IP-compliant circuit, so backhauling is not possible

The type and quality of circuit provided by the Telco's has a significant influence on how the remote production will work. Three parameters influence the quality of an IP-compliant circuit, they are; data rate, data loss, and latency. The SLA (service level agreement) agreed with the Telco should specify all these, but it's fair to say that a higher data rate, and lower loss and latency, results in a higher cost.

Latency is Inevitable

All data circuits have a certain amount of latency. The continuous video and audio data streams are packetized leading to the use of memory buffers both in the send and receive equipment, and the network too. This is an inevitable consequence of using IP and one that cannot be avoided. It's not just a case of "if" we have latency, but "how much".

Leased circuits contracted by Telco's will have the latency specified in the contract, so it becomes more predictable. However, if a broadcaster uses the public internet or even a shared service, then latency is not guaranteed or predictable. The good news is there are solutions that overcome this and there are vendors who can supply connectivity over the internet.

Latency also occurs in broadcast workflows, specifically when we compress video and audio or try and synchronize streams. A great deal of research has been conducted into video and audio compression in recent years. This is

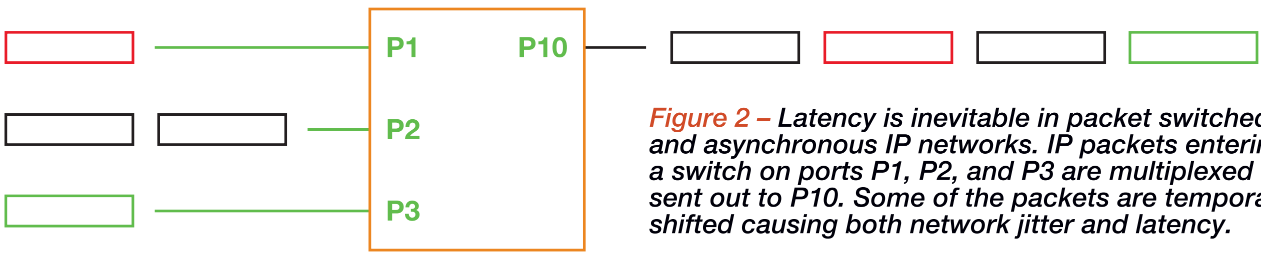
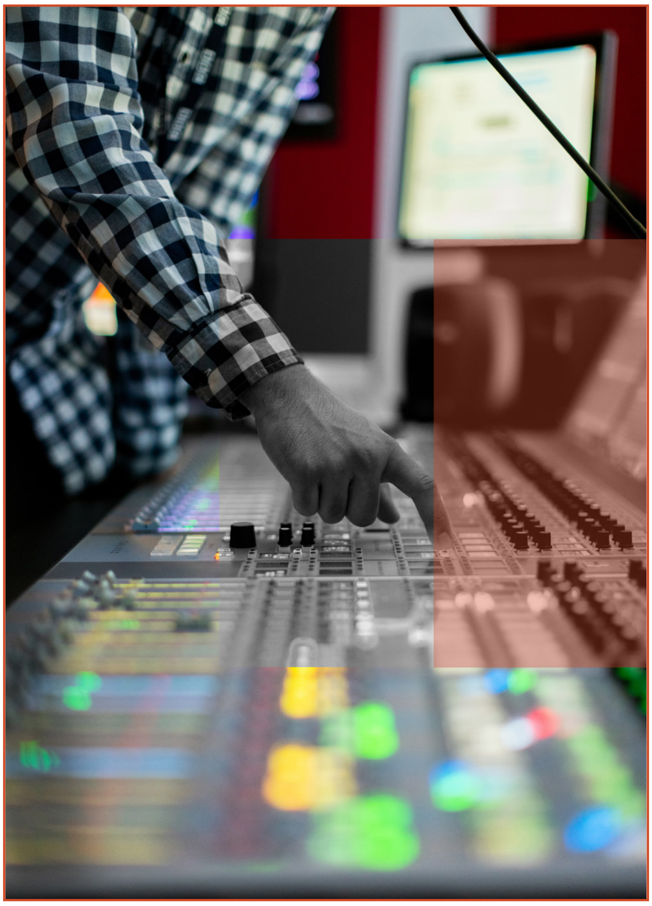


Figure 2 – Latency is inevitable in packet switched and asynchronous IP networks. IP packets entering a switch on ports P1, P2, and P3 are multiplexed and sent out to P10. Some of the packets are temporally shifted causing both network jitter and latency.

another area where broadcasters can benefit from the progress in other industries as much has been done to improve video compression in telecommunications, predominantly to reduce the amount of data needed to deliver a video and audio stream.

As video has a significantly higher data rate than audio, the effects of reducing the data bandwidth are noticed more in video compression. One method is to analyze movement over a period of frames, find the differences between them, and then only send the difference information. The assumption being that most temporally adjacent video frames will be similar. To achieve this form of efficient compression, many frames of video must be buffered, and it's this buffering that significantly adds to the delay, or latency.



Last Mile Costs

Latency is a combination of factors in both the IP-compliant network as well as the broadcast workflow and the two are usually additive. As a general rule of thumb, the lower data rate and higher the data loss, then the longer the latency. Broadcasters don't always have the choice of the data circuits available so have to compromise, but Remote Production still gives them many more choices.

For Telco's, the "last mile" of cabling is often the most expensive for them to provide. Fiber cables will need to be installed in the road or through ducting, resulting in high installation costs. However, these are still relatively low compared to the costs of installing full bandwidth audio and video circuits.

Where the equipment resides is then a compromise between many factors. These are not only technical decisions but production and financial decisions too. For some productions it may be better to have commentators at pitch side. For others, it may not be possible or even desirable, especially if one commentator needs to cover two or three games. Being in a central production hub allows them to cover several games, otherwise they would have to travel from one venue to another, often on the same day.

The beauty of Remote Production is that the broadcaster has many more choices than they do with the traditional outside broadcast method.

Part 3 - Practical Challenges and Costs

by Michael Grotticelli

In parts 1 and 2 of this three part series we discussed the benefits Remote Production has over traditional outside broadcasts, and the core infrastructures needed to make this work. In the third and final part of this series, we look at the challenges and costs associated with making live sports work effectively on Remote Production models to employ less equipment and crew on site, and to logistically cover more events using an IP infrastructure.

Following numerous successes, At Home productions have significantly increased over the past two years, enabling producers to cover multiple venues for the same "Tier-1" event and also many "Tier-2" sporting events that would overwise not be covered to due to cost (and lack of advertiser support). With each new remote project, new lessons are being learned and systems infrastructures tweaked to make the most of available resources.

"It comes down to what your inventory of equipment is and navigating the environment that you have to produce in," said Chris Merrill, Director of Product Marketing at Grass Valley. "These opportunities continue to expand as time goes on. The number of remote productions being done today versus three years ago is significantly higher. I expect that, with the increasing demand for content, that trend will only continue."

Indeed, when it comes to remote production methods, there's no "one size fits all." But the end game is the same for all. Maximizing resources and reducing/minimizing costs.

On its website, Grass Valley has identified three typical remote production workflows that are supported by the company's wide portfolio of live production products (cameras, switchers, servers, replay systems, modular processing products, etc.) and have been successful for different reasons—including geography, budgets, and bandwidth availability. They break it down to an uncompressed model, a compressed model and a distributed workflow. [Of course, there are more than only these three options and a myriad of ways that people split up their resources.]

Uncompressed Production

The uncompressed method is considered the most ideal, due to the higher signal quality, but it does increase the cost of sending signals (that's 12Gbps for 4K) back and forth between a hub facility and the remote site. Camera feeds are sent straight from the camera head over IP to some sort of production hub. In this scenario you send only the camera to the venue and the signals are sent back to a base station at the hub facility via fiber.

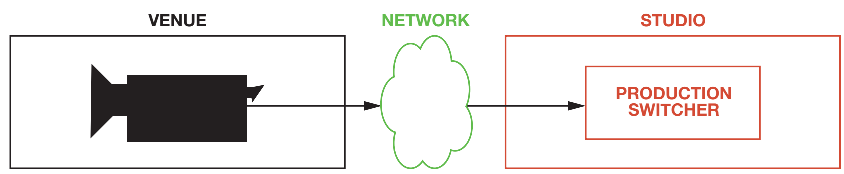


Figure 1 – Uncompressed production – all processing is done at the studio, only the camera heads are at the venue. The bandwidth requirement is high as uncompressed video is streamed directly to the hub giving minimal latency.

This requires consistent 3Gbps and higher bandwidth, which can be tough to get in the last mile (from the "home" production facility to the remote site). So, if you've got 10 cameras, that's a lot of required bandwidth, which is not typically realistic in today's budget-conscious world. Most stadiums don't have those types of connections, anyway, so it's that last mile that is the most challenging. Even with its big budgets, producers of the Olympics are challenged each time with procuring available bandwidth.

Certainly there are places where that type of high-data-rate bandwidth is available, but it's not common—requiring you to secure a satellite or dark fiber connection. However, this uncompressed method has been used in Europe, where there's a lot more public support for higher bandwidth. In the U.S., users tend to hire that bandwidth for the specific time period required. Therefore, due to bandwidth availability, uncompressed remote production is often easier and less expensive to produce in Europe and Asia than it is in the U.S. or South America.

"In general, the infrastructure is good in most of Europe, ok in the U.S, and more difficult in other locations," said Christer Bohm, Business Development and a co-founder of Net Insight. His company makes networking equipment with built in encoding/decoding used to transport video, audio and data (file and transaction types for control). "Reliability is more of an issue outside Europe and the U.S., meaning that back up and redundancy need to be addressed."

A replay server can be located on site and serve as backup in case of lost contact between the remote site and the studio. In general, there always needs to be redundancy and backup to handle problem situations. Normally, there are double uplinks employed, but when that is not available redundancy connections can be managed by other lower bandwidth technologies—such as 5G and the Internet.

Compressed Production

Compressing the signals before they are distributed to the hub facility means lower data rate (and less cost) requirements. Signals are sent into an encoder at the remote site and then decompressed at the hub facility. This method introduces a bit more delay, due to the compression/decompression process, but this can be up to a second depending on the compression used.

To compensate for the delay, Precision Time Protocol (PTP) technology is used to synchronize the signals. Most viewers won't care about the delay. The challenge is for the production people, who are looking at monitors that are not synchronized. The monitors at the venue are often ahead of the hub, but if there's a round trip from the hub facility, then the monitors are behind. So, there's this challenge for production people that they have to learn to get used to.

"For most programming no one really cares," said Merrill. "But it does become a complexity issue for major live events. This compressed method is often used for Tier-2 events only because of the delay problem."

This Remote Production method was used at last year's 2020 FIS Ski World Championships in Sweden. The action was captured with 80 Grass Valley HD cameras and a production switcher on the mountain in Åre and the signals were sent back (and forth) to Stockholm, about 600 km (372 miles) away—with redundant 100Gbps connections—for final processing.

Distributed Production

In the Distributed Production model, producers are taking some of the physical equipment to the venue and performing the processing at the remote site, but are leaving the control elements at home. For example, a production switcher frames lives on site, but the panel is remotely located at home. Replay systems could be set up this way as well.

The advantage is that you are still leaving people at home, but you are able to process more quickly on site. The control signals require much less bandwidth than full video signals. That makes it easier to send signals back and forth. This also reduces lag time in the stream and cost.

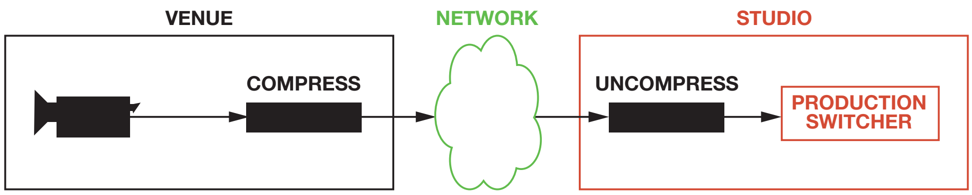


Figure 2 – Compressed production – all processing is done at the studio, only the camera heads are at the venue. The bandwidth requirement is reduced by up to 90% depending on the compression system used, this results in slightly higher latency but is usually acceptable for the operation.

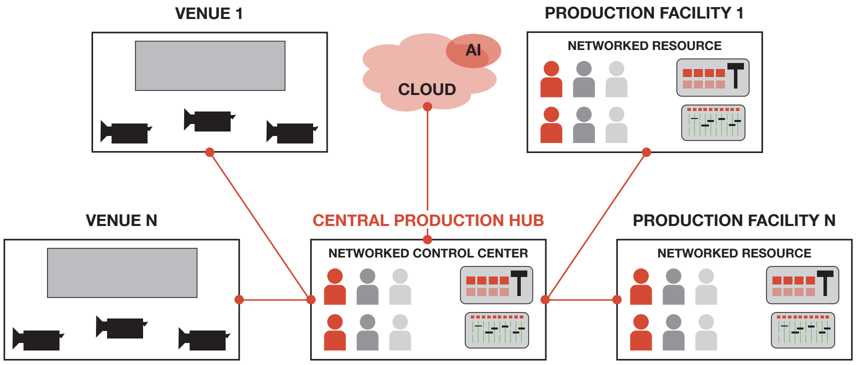


Figure 3 – Distributed Production – venues have the least equipment and staff possible with the crews and main processing equipment residing in the central and distributed production hubs. The production hub can switch between venues to make the best use of resources.

Net Insight's Bohm agrees that getting the right infrastructure to connect to the stadium is among the biggest challenges to remote production. He said they see it as a multi-dimensional problem that includes bandwidth (1, 10 or 100G), latency (which equipment can be centralized and what needs to stay on stadium), type of production (number of cameras, slomo or not, archive, etc.,) and frequency of the event—like producing a related series of events or one major event like Olympics, FIFA, etc.

"Facing these challenges, I can choose the parameters that are most important to the project at hand," said Bohm. "For example, I have 10G access, 25 cameras, and need to operate centrally. I need low latency data and J2K compression (uncompressed cannot handle all cameras and with MPEG4/HEVC delay is too big to centralize some functions). So there is always a trade off in how a setup is done. In our experience there needs to be flexible technology to adapt to various scenarios."

OB Vans Have A Remote Future

Related to series vs. events, Bohm said there are projects that are ideal for Remote Production models and others that are best produced traditionally. Things that affect that decision include infrastructure to location, frequency of events, investment in central location (equipment, manpower, etc.) vs. OB vans.

"We have customers that have changed their production set up so they can only do Remote Production and have thereby saved a lot of money, but there are others with brand new OBs and for them it might not make sense," said Bohm.

It should be noted that remote production does not translate into a future with no OB Vans on site. In fact, they have a place in a remote production and many veteran production companies are all working towards this "hybrid" model. The Distributed model described above requires an OB Van. The truck is sent on site but the equipment on it is controlled remotely.

"There are many mobile production companies that are looking at hybrid models that meet their customers' production demands and yet allow the benefits of less personnel on site, more standardization, etc.," said Grass Valley's Merrill. "There's certainly a place for OB Vans in remote production."

Cost Is THE Issue

Regarding connection costs, standards-based IP connectivity is significantly more accessible and cost effective than satellite links, and much more versatile too, allowing many devices to share the available connectivity regardless of their specific payload type. The best way to reduce it is to look to reduce the overall bandwidth, either through data compression, or by assessing how many feeds really need to be returned to HQ – you don't need to return every camera feed in full HD if you can switch remotely using lower resolution previews.

When looking at the cost of connectivity, it should be offset against the overall saving of Remote Production. With traditional outside broadcast you have millions of dollars' worth of broadcast truck and high value production and engineering staff spending most of their time travelling and setting up rather than producing content. With Remote Production, the expensive equipment and staff are at HQ where they can deliver far more efficiently.

Remote Processing In The Cloud

The cloud is another off-site processing technology that is being experimented with, but there are issues of cost relating to getting content into and out of the cloud.

"The challenge with cloud processing is there's not—today—the ability to process everything for a live event," said Merrill. "I can get stuff into and out of the cloud, which can be expensive, but the whole processing piece is not available. I can't actually switch a production in the cloud. I have to bring it down again to switch, which is expensive. So, it's more of a transport mechanism right now, but we will most likely get there in the future."

Remote audio production is also on the rise, as various radio shows have begun to add cameras to their studios and television productions need stereo— and, increasingly, multi-channel sound—to accompany their images. Dave Letson, VP of Sales at Calrec Audio, said that the challenge of round trip latency for audio monitoring has held back full Remote Production for some time, but products like its RP1 audio mixing core, or engine, that can be controlled as though they are part of a host mixer at the hub facility make it easier. The RP1 core enables staff to mix the audio from the home studio just as they would if on location.

The two main audio challenges for At Home production models are latency for monitoring and IFBs, and control. In fact, audio poses a very specific challenge; announcers need to be able to hear themselves, their co-announcers and guests, and sometimes other ambient sounds in real time. Too much latency in the monitoring signal path makes it very difficult for talent to do their job, as the time it takes a signal to travel to a broadcast facility and back over a long-haul connection is too long.

"The main differences are in relation to latency with specific regard to in-ear monitoring," said Letson. "Control lag of the mixer which is dynamically controlling the remote mix is negligible, although the latency of the network connection will directly affect how responsive the remote mixer is. In general, audio uses much less bandwidth than video and in that respect is less cumbersome, although the challenge of monitoring latency (not control latency) is unique to audio."

Letson said this same challenge does not apply to video because talent rarely need to see themselves in real time, but they often want to hear how they are sounding on air, with EQ and dynamics applied. Neither is it a challenge that applies to other sounds; sounds other than one's own voice can be more forgiving of latency as the sound already incurs some natural delay getting from the source to the ear, which will be offset if that same sound in the monitoring is picked up from a mic much closer to the source.

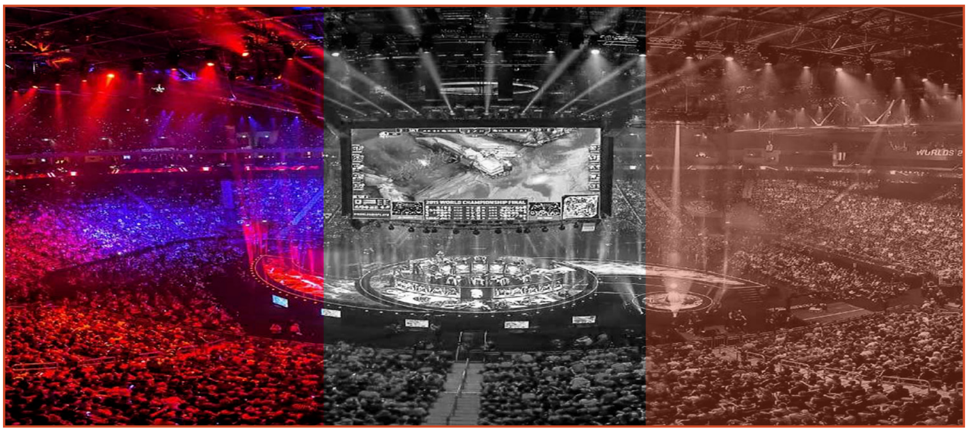
Mix Before Transport

The solution to real-time audio monitoring for At Home Production is to handle the monitor mix locally, at the venue, so that the local sources don't make the long-haul journey at all. Program mix-minus feeds can be returned from the broadcast facility, mixed with the talents' own voices at the venue, and sent to their IFBs, in real-time, avoiding the round-trip delay for the local sources.

The other challenge is more universal; control. The need for a local monitor mix has led to many At Home productions posting an audio operator at the event, but many modern audio mixing products offer remote control via IP which means the monitor mix can be set up and controlled remotely from the broadcast center, as well as on-site via a browser-based interface.

Having the monitor mix as part of the program chain, rather than splitting mics off into a standalone monitor mixer, means one person can control all of the mixes directly from the surface of the main mixer at the facility, in exactly the same way they control their local sources and destinations. They can freely adjust the remote mic gains, fader levels, routing, send and bus output levels from the comfort of their own familiar surface.

The ability to also control audio using a web-based GUI over standard IP means that it can be connected to the mixer whenever it is required. A virtual surface at the venue allows an on-site technician to check local mics and monitors; they can set up the routing for the mic and monitors, and also to and from the IP interface.



The Riot Games' 2019 League of Legends World Championship final in Paris used Calrec's RP1 technology for the English language feed for viewers in North America, Europe and Oceania. The company's European facility in Berlin used At Home technology as part of its design. Calrec came up with a remote production solution for IFB for the on-air talent, which was processed onsite by Calrec's RP1 to avoid the delay that would occur if it had been routed to Berlin and back and networked around the Paris site on a DANTE IP network.

Audio Without Video

Another consideration to factor in is the additional bandwidth required when transporting audio separately to the video (such as when using SMPTE 2110), just as it does for remote-control data connections, although these requirements are negligible compared to that of the video feeds that accompany it. Audio bandwidth is negligible compared with video, but that can be reduced by remotely controlling sub-mixes to return, rather than all the individual audio sources.

"A broadcast audio mixer facilitates broadcasters' choice for output signal by providing I/O options for analogue, AES3, MADI, SDI, AES67 and more, so all signals (mics, monitors, as well as return feeds), can be transported without needing extra boxes and interconnects," said Letson. "Broadcasters can choose between a variety of backhaul transports between the venue and the facility."

In addition, SDI is still popular for many reasons and it can be processed with IP codecs, so passing SDI feeds through the audio mixer and having it embed its audio output at the remote site reduces the connections to the codec (saving cost). It also provides a convenient way to keep audio in sync with video.

"The industry is in a major transition to IP now, so production companies are still becoming familiar with At Home infrastructures and how to use them most efficiently," said Grass Valley's Merrill. "There's this huge demand for content and there's no way you can send everybody out to every site. It just does not work. That's why remote production makes so much sense."

CI
CORE INSIGHTS

EG
ESSENTIAL GUIDES

MEDIA

ARTICLES

This **Core Insights** document was written by the Editorial team at The Broadcast Bridge.

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