Remote Production
Solution paper by Net Insight

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Remote Production
The possibility to offer more live content at a lower cost

The live events industry has grown dramatically in size, and is driven by several factors including demand, changes in viewing behaviour, and new revenue streams. Over-The-Top (OTT) distribution provides a very cost-efficient alternative to dedicated distribution platforms for delivering content to a global audience. This enables new media players to begin competing with traditional broadcasters by providing scalable on-demand services and more content. As a result, traditional broadcasters face a shrinking customer base, and fewer revenues from TV commercials.

To address these challenges, broadcasters are looking to provide more live sports content, as live sports still attracts a large and dedicated TV consumer base. For instance, the 2014 Super Bowl alone accounted for more than $4 Billion in advertisement spot revenues. However, live event production is resource intense. In order to effectively increase income from live event productions, broadcasters must address and eliminate bottlenecks in their live production workflows.

By transitioning to remote production workflow, resources can be utilized much more efficiently, and bottlenecks associated with traditional OB production can be eliminated. Remote production allows broadcasters to produce more content with fewer resources, including more programming in 4K Ultra HD at a lower cost.

Remote production is the ability to produce live broadcasts at a distance from the actual event, by transmitting raw (ISO) feeds, audio, and equipment control over a telecom infrastructure to a central studio facility, from where you have the possibility to remotely control cameras and other equipment at the event site. Production is centralized to the broadcasters studio facilities.
Market trends

Today, new ways of viewing programs via streaming and other media channels compete with traditional TV, at the same time that advertising revenues are decreasing. One exception is broadcasting for live events. This is because it is difficult to skip commercials when programming is delivered in real-time. For this reason, a majority of broadcasters are expanding their offering of live events in sports and entertainment to include niche sports, music concerts, political events and interactive TV shows.

New Viewing Patterns

OTT provides a very cost-efficient content distribution platform to deliver programming to a large global audience. Viewers are now spending less and less time in front of traditional TV sets, and more time consuming streaming content on connected mobile devices. This enables new players such as Netflix, HBO, YouTube, Red Bull, and others to compete with traditional broadcasters and TV channels. With OTT distribution, a large audience can be reached with a very rich portfolio of both premium and niche content. This cannot be matched by traditional broadcasters who rely entirely on conventional distribution platforms. According to research by Morgan Stanley, OTT-only households in the United States alone are expected to climb from 8 million in 2014 to 14 million by 2020.

Increased Demand for Live Sports in 4K UHD

Another marketing trend is the demand for more live content in 4K UHD formats. Compared to standard HD, this new format offers outstanding picture quality with at least four times the pixel density. The price-point for consumer 4K displays are now reaching price levels suitable for mass adoption. Because the consumer market is driving the 4K roll-out faster than the HD roll-out, it is estimated that there will be more than 11 million TVs in the world by 2016. Needless to say, there will be a large demand for more live 4K content. However, these new formats require new production equipment, and the investment of upgrading an OB van fleet to meet 4K production capabilities is cost prohibitive.

Live Means Revenue

It is clear that there is big money in live and interactive broadcasts. For this reason, most broadcasters are expanding their offering of live content from the big events to also provide content from niche sports, music concerts, and political events. The global sports sponsorship market will have an estimated value of $45 billion by 2015; an increase of $5 billion from 2012. Fans are dedicated to their sports. Nearly eight hours per week are spent on viewing sports content and approximately one-third of the viewers are paying for watching sports TV. Among sports viewers, 45% are also using other devices,
such as smart phones for second screen interaction, and 68% of the viewer base consumes sports online. In short, viewers continue to consume more sports every year, using a wider variety of devices.

The challenge is that live production is resource intensive. Availability of production resources, such as production staff, equipment, OB vans, and other factors create a bottleneck that limits the amount of live events a broadcaster can produce. To compensate for lost revenue from advertisements on linear TV, the number of broadcasted live events needs to increase. As a result, these bottlenecks must be addressed.

Remote Production – Produce More Live Events with Less Money

Remote production requires that the cable is extended from the venue to a broadcaster’s main production facility over an unlimited distance. Production of live events and other multi-camera productions can be made from a central control room with full signal and communication control. This makes it possible to run interactive interviews, remotely control arena equipment, as well as direct and edit productions from the control room in the central studio. In order to avoid quality degradation of the live feed and provide fast, effective feedback from the venue to the producer, this new type of workflow requires the support of a high quality, real-time network infrastructure.

Remote production has been a vision for many years. However, the main obstacle has been technology and network capacity between the event location and the central studio. Technology has been limited by the use of many legacy interfaces for audio control, clear channel, TALLY, video, and more. Limitations in network capacity have driven the use of heavy compression, which in turn created longer delays and lower video quality. Long delay times made it difficult to remotely control cameras and the feedback loop was too slow for the producer to work with fast moving content, such as sports. The good news is that newer, low-latency compression techniques, such as JPEG2000, reduce required network capacity without degrading signal quality or increasing delay times. With the current build-out of telecoms infrastructure, the cost for network capacity allows for lightweight compression, or in some cases, no compression or more video feeds to be transported. Therefore, even large multi-camera productions can be made more cost-efficient with remote production.

OB Event Production Concept

In traditional event production, cameras connect to a studio bus or OB van that is located either on-site or near-site. The OB van connects multiple services and protocols to the on-site equipment, such as providing camera control, intercoms, production audio and Tally. The production crew, production mixers, video and audio routers, camera control units and others sit inside the OB van. The production crew is responsible for controlling cameras, mixing video as well as audio, and providing an uplink of the produced feed to the broadcast facility or play-out. This is typically accomplished using a satellite uplink. The production feed is normally a single feed encoded for low- to medium bitrate transport.
Remote Production Concept

With remote production, as many camera feeds as possible are delivered to the central broadcast facility, either as uncompressed ISO feeds or lightly compressed feeds using JPEG2000, for example, to ensure the lowest possible end-to-end delay. Because the actual production and control of on-site equipment is made from the central studio, low delay in remote production is key. A low end-to-end delay provides a fast feedback loop for the producer, as well as for interactive interviews.

Depending on the type of event and the cost of the telecom’s infrastructure available at the venue location, it might be necessary to switch the camera feeds already on site. This can be done using an SDI router located at the event site that is remotely controlled from the studio.

In addition to the raw camera feeds, audio and control data must be handled just as they are in a traditional event production. Control of on-site equipment that was previously handled by the production crew in the OB van, must now be accomplished from the central studio. Production audio must also be brought back from the venue, either embedded in the video feed, or as discrete native audio formats. Audio for intercoms is also critical for ensuring that producers, technicians, camera crew, and reporters can communicate efficiently.
Benefits of Remote production

Reduce Production Costs
As traditional live production becomes increasingly expensive, the dramatic increase in demand for live events presents new challenges for the broadcaster’s organization and processes. Remote Production offers the potential for higher productivity and huge cost savings for live production, in terms of both OPEX (operating expenses) and CAPEX (capital expenses).

With Remote Production, broadcasters do not need to have large technical crews, production talent, and large OB vans on-site. Instead, limited numbers of highly specialised staff can be utilized centrally to accommodate more productions. In the same way, production equipment can be used more efficiently from a central location instead of being tied up during transport between venues.

There is no need to deploy large OB vans to the venue. Only cameras and camera crews need to be sent on-site. As a result, existing production infrastructure at the central studio can be utilized and OB vans that are already owned by the broadcaster can be parked at the broadcast facility to be used to further increase remote production capacity. With Remote Production, there is no cost for truck roll and tied-up resources during transportation between venues. Therefore, travel time and travel expenses are significantly reduced.

Produce More Live Content
The cost savings offered by Remote Production workflows can also be used to deliver more content from the venue. Instead of sending large technical crews on site for OB production, a broadcaster can send more journalists and editorial staff to capture more and better content.

During the 2012 London Olympics, the Swedish broadcaster SVT utilized Remote Production and managed to send more reporters, commentators and talent to the venue. By doing so, the amount of content SVT produced nearly doubled. With the same budget, 1,600 hours of live content was produced versus 850 hours compared to the previous Olympics.

Produce Better Content
By designating the central broadcast facility for production purposes, direct access to central archives and other in-house resources enable broadcasters to produce richer content. Investments in studio equipment can be utilized more efficiently. By implementing uncompressed or lightweight compressed production workflows, the quality of the final production can also be improved. Tier-1 production talent resources are scarce, and by utilizing Remote Production, they can remain in-house to potentially cover multiple events per day. In addition, by having access to raw, unproduced material in the central studio facility, multi-platform production becomes possible.
more efficient. Content can be differentiated to create a better product for second screen, mobile devices and niche audiences.

**4K Production Readiness**

The demand for higher resolution live production formats for live productions is increasingly being driven from the consumer market, and is heavily influenced by consumer display manufacturers.

For broadcasters, 4K Ultra HD live production requires an upgrade of their production equipment. However, the cost for upgrading an OB van or entire fleet to 4K is cost prohibitive. With Remote Production, most of the production equipment resides in the central studio facility. By using lightweight compression, such as JPEG2000, a 4K UHD signal can be transported under 1Gbps. This means the cost for network capacity does not have to be prohibitive for Remote 4K Production. On the contrary, Remote Production is perhaps the most significant enabler for live 4K production, as well as the most significant technology needed to enable cost-efficient 4k Ultra HD on a large scale.
Remote Production makes it possible to produce any event anywhere with both local and global advertiser

Enables production for multi-screen OTT, Mobile and TV

More live content gives more possibility to more ads/revenues

Remote Production enables reduction and removal of on site equipment - cutting CAPEX

Reduced cost for shipment, bus transportation, less personnel on site, reduced cost and time spent on travelling

More time can be spent on production and content creation

Same staff can produce more programs on one day

The more efficient usage of resources allow the broadcaster to extend to niche content production

Less transport and travelling
Challenges with Remote Production

Culture and People
Remote Production can affect personnel in many ways. With less travelling, production staff can spend time at home with family during the events in the evenings, or working with other productions instead of sitting in a truck or hotel room in some distant location. For most people, this is a huge benefit that Remote Production provides. But for others, on-site production has become more than their job. It’s also their way of life.

Technology
Distributing the production workflow over large distances places high demands on the technology used for connecting the remote venue to the central studio. From an application perspective, Remote Production should provide similar characteristics as local production. Existing production equipment and technology must be supported. Otherwise, Remote Production will not be a cost-efficient alternative to traditional production. The main technical challenges to consider are:

- **Reliable telecoms infrastructure and binding agreements (SLAs, etc.)**
  Mission critical productions demand high availability. This in turn could mean path and/or technology diversity, all under-written by sound contracts to ensure adequate risk management. It is important that the cost for the telecoms infrastructure does not prohibit the use of Remote Production. However, network infrastructure in most countries is now capable of handling video production at a reasonable price, and high-quality low-latency compression, such as JPEG2000, can be implemented to lower connectivity costs.

- **End-to-end latency**
  To ensure producers and staff can work and collaborate effectively, end-to-end latency must be kept to a minimum for live broadcasts. The end-to-end delay constitutes of network delay, video processing and coding delay, plus any additional latencies introduced in production switches, video routers and multi-viewers. In most regions, network delays are well within the requirements for remote video production and by using low-latency compression, data rate can be reduced while still maintaining low end-to-end latency.

- **Audio and video Synchronization**
  Synchronization of audio and video is critical for a successful production. In order for the audio production to be successful, a fixed, predictable, and known transmission delay must apply to all audio channels that are brought back to the production suite. To facilitate clean switching, there must be perfect frame alignment between all camera feeds that are brought back to the studio. Efficient video production requires a common synch reference. For example, the studio/house clock must be available for all equipment in the production workflow. Therefore, in order to avoid video or audio impairments in Remote Production, it is vital that the studio clock reference can be extracted at the remote venue.

- **Interoperability with existing production equipment**
  In addition to the live video signals, audio and control data must be exchanged between the remote venue and the studio. This includes production audio, intercoms, and equipment control signalling. This signalling is usually created using legacy and/or proprietary interfaces. Therefore, a successful remote production solution must thus be able to provide multi-service support.
Solution overview

Net Insight delivers solutions for efficient media transport for broadcast contribution, production and distribution. The Nimbra MSR platform is a multi-service networking platform for real-time media transport over standard telecoms infrastructure, with built-in media processing. The Nimbra MSR platform has been used in a number of applications for Remote Production of global sports events and has already helped numerous broadcasters streamline their production workflows to produce more live content.

The multi-service capabilities of the Nimbra MSR enables bi-directional transport of SD-SDI, HD-SDI and 4K Ultra HD video formats, as well as IP data and native audio in a one-box solution. IP connectivity is used for equipment control. Plus, audio production can easily be facilitated in the Nimbra solution regardless of whether the audio production workflow requires discrete or embedded audio. Bi-directional video is required in remote production to backhaul the produced feed to the venue for monitoring. Data links can be set up between the broadcast facility and the remote venue to support remote equipment control, including camera control, audio control, and Tally.

In a remote production environment three factors are very important:

**Low end-to-end delay** – As control of the production is accomplished some distance from the event, delay must be low to allow for a natural interaction and control.

**Bandwidth efficiency** – Multiple camera feeds must be transported off the venue and telecommunication capacity is normally expensive.

**Maintained synchronicity** – To facilitate clean and frame accurate switching, audio and video signals need to be in perfect synch when they enter the production studio.

The technology of the Nimbra MSR ensures low, predictable delay. This enables real-time interactivity both for control signalling, audio, and video.

To offer the best possible trade-off between bandwidth utilization and low latency, the Nimbra MSRs comes with built-in JPEG2000 compression, providing very high quality compression with low latency. An HD-SDI feed can typically be compressed down to 150 Mbps without any visual impairments, while maintaining end-to-end latency within requirements for Remote Production.

By using the built-in JPEG2000 codec, broadcasters can save on bandwidth costs or simply bring more camera feeds from the venue. Because it sustains video quality, even after multiple encoding/decoding iterations, JPEG2000 distinguishes itself from other compression technologies, such as MPEG-4. This makes the technology well-suited for production.

The Nimbra MSR solution is unique because it transports all media services completely synchronized,
even over packet-based infrastructures. The synchronization properties of the Nimbra MSR solution not only guarantee that all audio and video feeds are perfectly in sync, it also allows a number of feeds to traverse different paths over the network. This can be useful for both path redundancy and fault protection.

The Nimbra MSR puts a timestamp in each video frame that leaves the venue. This enables the destination Nimbra to play out each video feed in perfect frame alignment, and facilitates clean switching in the studio facility of both video and embedded audio. In order to avoid frame slips or repeats, as well as maintain the lowest possible end-to-end delay, the Nimbra MSR can also be used to extend the studio clock domain to the equipment at the remote venue. Any of the video interfaces on the remote Nimbra equipment can be used to output a genlock signal that operates off the central studio clock.

Data transport over the Nimbra MSR solution is provided with the same QoS properties as for live video transport. This enables broadcasters to use the Nimbra MSR solution also for extending their office telecoms, VoIP, and other office applications to the remote venue.

With its Nimbra MSR series of media network equipment, Net Insight enables cost efficient Remote Production of events. Not only can our customers benefit from the OPEX and CAPEX savings that Remote Production offers, they can also benefit from operating the world’s most efficient and easy to use media transport solution. This provides further savings of OPEX expenditures on network operations.