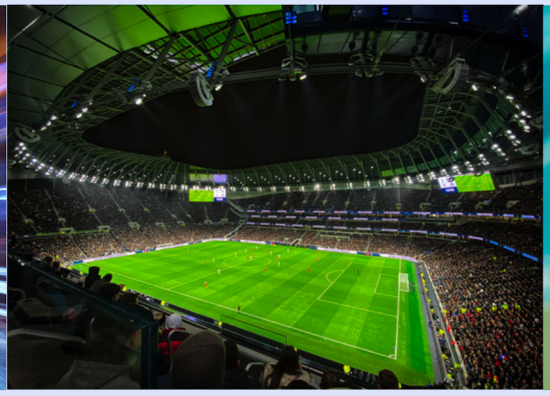
WHITE PAPER

Remote Production/REMI

The pandemic had a major impact on working practices and forced cost-conscious employers to look away from hitherto accepted norms. In broadcasting, it advanced a move to remote production, also referred to as REMI (REMote Integration), as live-event workflows capitalised on opportunities that increased availability of IP connectivity created.

Demand continues to build for live events with immersive content; cash-strapped broadcasters are finding more ways to produce action-packed output whilst minimising costs and maximising resources.



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For the moments that matter

So, how do you do it?

In a traditional OB, all production happens on-site at the event, which typically involves:

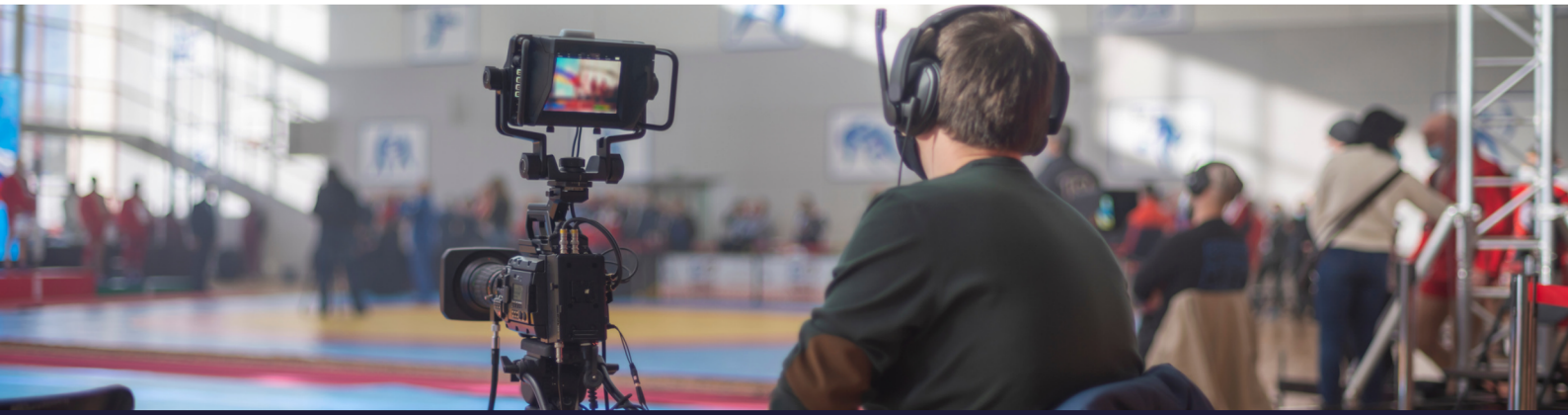
- cabled cameras
- wireless cameras
- vision engineering (camera racking/Paint)
- slo-mo/replay (EVS)
- graphics
- vision mixing
- audio mixing
- direction/production.

The OB team produces the entire programme, transmitting it from the OB site as a single HD/UHD video signal, which can be put straight 'to air'. Until recently, this process was necessary since few venues had on-site video connectivity, and those that did typically had only main and reserve circuits. Most events relied on satellite or microwave links to get signals out, having just enough capacity for the two circuits.

The advent of the internet and increasing requirements for high-capacity data services ushered in a new era of connectivity. It is now possible to book a high-bitrate private network at most event venues. With this setup, the Serial Digital Interface (SDI) from each on-site camera is encoded and transported via IP back to the studio, where the production team produce the programme.

Minimal engineering/production goes to site, whilst the production team work in familiar surroundings having spent the night at home rather than at a budget hotel on location. No need to send an OB truck, crew, equipment — a minimal team of riggers, camera operators, transmission engineers and on-site producers need to be on site. The bulk of resources stay at base and can be used for one event after another on the same day. In addition to the obvious savings on airfares, hotels, etc., huge efficiencies in equipment and staff use are gained, with costly equipment freed-up from travelling to and from sites and staff post-travel rest and recovery periods no longer necessary.

Remote production is an all-round winner: deployment logistics become simpler, cheaper and more environmentally friendly, whilst staff gain a better work/life balance.



Considerations

If the bulk of production activity is transferred back to base, then a major consideration is the signal delay between what is happening at the event site and the studio. Minimising this delay is important in terms of talkback to presenters and camera operators, control of PTZ cameras, and racking/paint of standard cameras, which requires quick reactions from the (now) studio-based operators in response to the incoming images.

A typical HD video signal is 3Gbps, so even a modest 10-camera event would require at least a 30Gbps IP pipe to the studio if no video compression were used. Generally, IP connectivity is priced according to bitrate capacity, so it is desirable to use video compression — also called video encoding — to reduce the bitrate and hence the cost of getting the signals back to the studio.

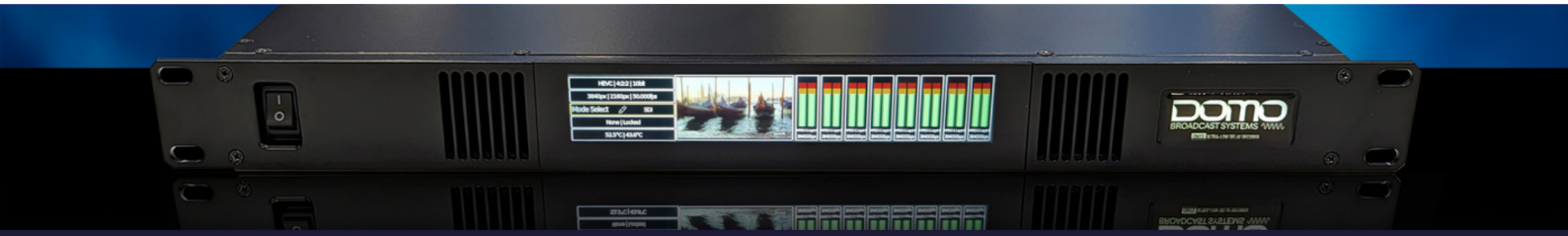
The selection of the video to IP encoders used for each camera is critical

The use of lightweight compression, such as JPEG-XS, is attractive in that typical delay is a few milliseconds at most and picture quality is excellent. However, such systems typically have 10:1 compression ratios, meaning each camera feed is still around 200–300Mbps. On a large, multi-camera event, the cost of this can quickly add up.

HEVC encoding is significantly more efficient and will typically compress 3Gbps HD video down to around 10–20Mbps, reducing the required IP path capacity by a factor of 20 compared to JPEG-XS. Although many makes/models of HEVC encoders are available, few are capable of encoding down to such low bitrates whilst maintaining picture quality and low delay. The encoding delay is important as the IP pipe to the studio can also add significant delay, particularly if the event is overseas.

Of course, this effort means nothing if the feed is lost. So, it is now common practice to use a dual-path data circuit back to the studio, usually sent via completely different routes to eliminate any potential single point of failure. To take full advantage of this technique, it is important that the IP encoders work to the ST2022-7 dual-streaming standard. Basically, ST2022-7 involves dual streaming the same encoded IP signal coming from the encoder, but going over two independent paths and being knitted back together at the receive site. The decoder is constantly and seamlessly comparing the two and ensuring that the output has no dropouts on air through faults in the transmission paths.

The industry's need for ultra-low latency and the ability to transmit simultaneously over dual networks and using a variety of IP formats were at one time considered by many to be wishful thinking. It led the team at Domo to create the Onyx family of encoders and decoders. Close ties with the motor sport broadcast industry was one of the main catalysts behind the development of the Onyx to meet the industry's desire for additional capabilities.

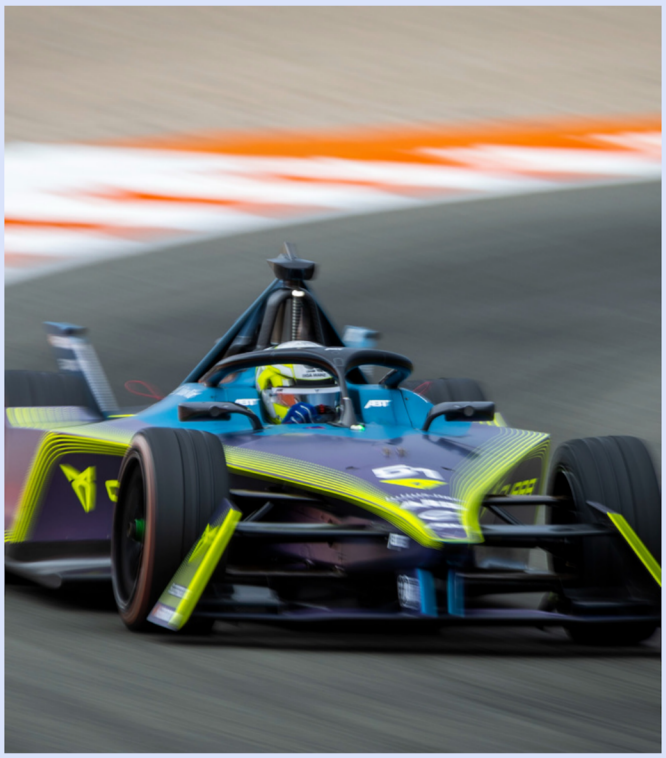


Case study: Formula E Motor Series

In this ambitious project, all 22 cars are equipped with 10 on-board cameras, each with on-board record/replay facilities.

Every car uses on-board ultra-low delay HEVC encoding to transmit four cameras simultaneously, selected by remote control.

The on-site receivers output the feeds as 2x ST2022-7 streams which are fed directly into two diverse IP pipes back to the studio facility in London. Here, they are then decoded to provide 4x low delay on-board camera feeds outputted in the latest ST2110 IP video format.



A gamer-changer for smaller broadcasters

Whilst major broadcasters have been playing with remote production for some time, the advantages are becoming apparent to the smaller, even more cost-conscious players in the market. The introduction of SRT has been a game-changer for those who can't afford (or may not want) a dedicated fibre connection. Available to all manufacturers, SRT can be inserted into a stream to deliver the best quality over the worst network, such as a poor internet connection. This enables multi-camera live coverage of smaller, often niche events, which were previously un-economical to cover.

For example, a lower division soccer match could be covered live using a single 4-input encoder and four cameras:

- Main pitch/match (manned)
- Goal A (PTZ)
- Goal B (PTZ)
- Interview (manned – same operator)

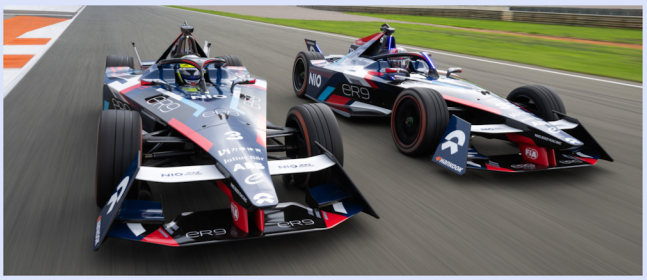
The 4x video feeds are fed into a single quad input HEVC encoder and streamed over the internet using SRT protocol — either using the venue internet connection or a 4G modem.

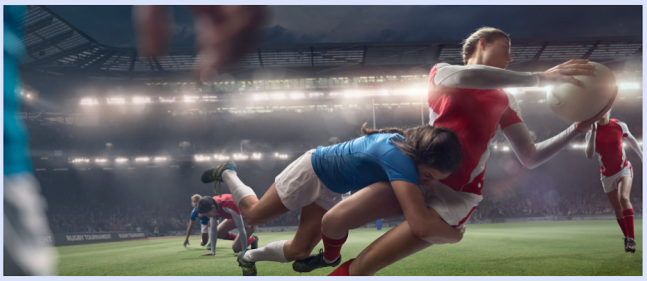
Case study: Managing multiple events simultaneously

In 2021, over one weekend, Timeline TV worked simultaneously to bring coverage of Formula E, Sail GP, Premier League, National League, Women's Super League and the Women's Six Nations coverage.

Timeline split the workload between its Ealing broadcast centre and its Stratford production hub, using a combination of completely remote production, decentralised production, and traditional OB.

"We had three large scale remote productions in our Ealing Broadcast Centre all happening at the same time," says Daniel McDonnell, Managing Director at Timeline TV. "They were all slightly different in their approaches, but it's a clear indication of the way that the industry is moving."





Summary

Remote production is a gamechanger for the broadcasting industry and its potential continues to evolve as new protocols are developed. SMPTE 2110 offers what were previously unachievable degrees of flexibility; video, audio and metadata elements can be separated off and processed by different parts of the production team, who don't need to be in the same physical location yet all elements end up at the same destination. No need for the sound engineer to be in the same building as the vision mixer, nor the director, etc. This true flexibility allows expertise to be based at the most convenient location. With such versatility available more and more ambitious projects can be planned and executed at vastly reduced cost with the viewer able to enjoy a more immersive experience that wouldn't have been viable a few years ago.

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