MEDIA AND BROADCAST

Wireless IP and low-Earth orbit satellite

TV Production Demonstration

Whitepaper

BT Media and Broadcast, BBC R&D, Neutral Wireless.

At IBC 2023, BT Media and Broadcast, BBC R&D, Neutral Wireless and Zixi have collaborated to demonstrate the future of live broadcast production.

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What's this all about?

Traditionally, a live broadcast needed cabling between camera and production truck, and fixed connectivity onwards to the broadcast centre. To make the camera wireless required several radio links to carry video, return, camera control and comms. To make the truck wireless required a large satellite antenna and expensive satellite capacity to carry the signal to the broadcast centre.

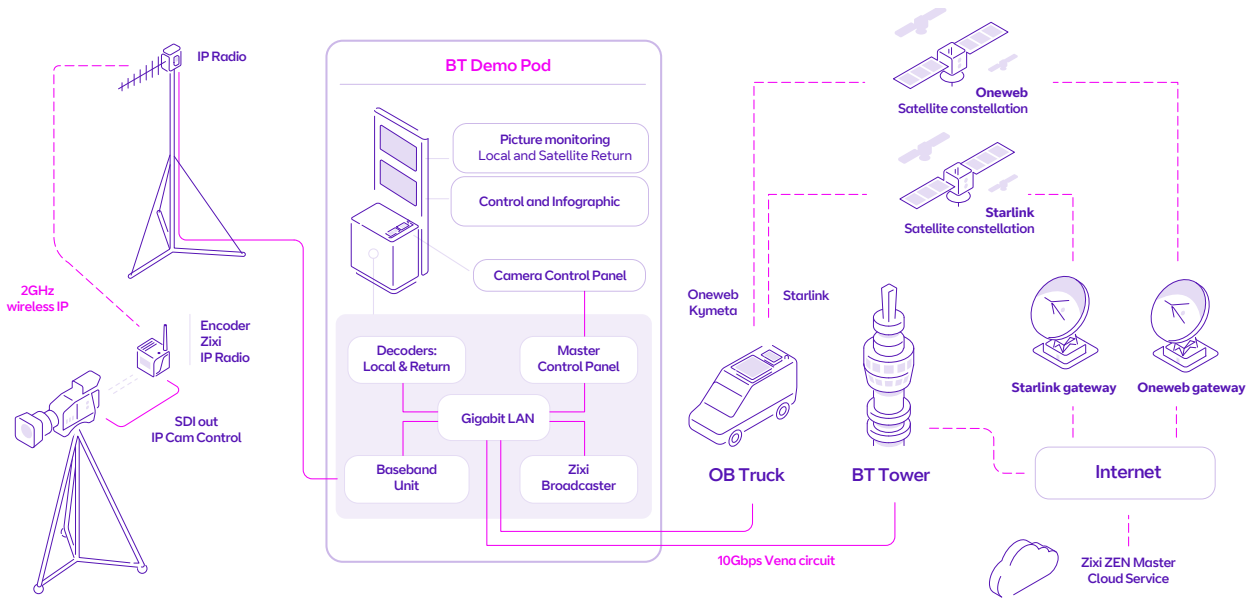
In this demonstration we show an entirely wireless IP end to end system, which simplifies the camera connection to one radio link, shrinks the satellite equipment into something that can be mounted onto the roof of a small car, and can be operated without the assistance of an engineer.

So what's the workflow?

Pictures from a TV camera are carried over a wireless IP link within the BT marquee to the demo pod, where we can see the camera pictures and remote-control the camera. The pictures are then sent onwards over bonded OneWeb and Starlink low-Earth orbit satellites to a cloud ingest, then returned to the marquee in Amsterdam via BT's internet gateway in London and over BT's Vena network. These returned pictures can also be seen on screen as they might appear for a viewer.

We're grateful to Sony for loaning us the broadcast camera and camera-control panel for this IBC demonstration.

Wireless IP and low-Earth Orbit Satellite
TV Production Demonstration



How does it all work?

A professional broadcast camera is fitted with an encoder developed by BBC R&D and a radio unit provided by Neutral Wireless, operating in the 2GHz radio band. The encoder uses a low-latency HEVC codec to compress the 1080p50 video to 10 Mbps (4:2:2 10-bit) and Zixi to protect and monitor the video transmission. An antenna and radio receiver are mounted on a tall stand in the corner of the BT marquee. The bi-directional IP link over this wireless system enables the camera operator to roam around within the marquee while maintaining full remote camera control.

The radio receiver is connected over optical fibre to the demonstration pod. Inside the pod, a baseband unit provides the Neutral Wireless network core and software-defined radio stack, handing off the IP signals to a Gigabit Ethernet switch. The video signal from the camera is decoded for local viewing and displayed on the pod multiviewer. A camera control panel and associated master control panel are used to control the camera remotely over the wireless IP link.

A PC running Zixi Broadcaster manages Zixi over the IP wireless link and integrates with Zixi ZEN Master, and is used to split the video path in the IP domain, sending one copy to the local decoder and one onwards for satellite transmission. Zixi is then used to manage the transport of the video signal over dual bonded low-Earth orbit satellite paths to ZEN Master, load-balancing the IP packets across both links.

Ethernet cables connect the pod to a OneWeb Kymeta terminal and a Starlink standard terminal, both mounted on the roof of the BT Outside Broadcast truck. Note this mounting location was chosen for the IBC demo simply as a way of ensuring a clear view of the sky in a constrained space. The terminals are small enough to fit on the roof of a car or to be placed on the ground in a newsgathering or production situation.

Bi-directional IP paths are carried over both satellite systems, providing routes to the internet. The IP packets are routed to Zixi ZEN Master, where they are recombined. The return feed is then pulled back to the Zixi Broadcaster in the BT marquee in Amsterdam via BT's internet gateway at BT Tower in London, routed over a 10 Gbps Vena network path, and redirected to the local video decoder. The decoded picture is then also displayed on the pod multiviewer.

The OneWeb system uses a Kymeta flat panel antenna, and has been configured with a data channel providing peak speeds of 75 Mbps down and 15 Mbps up. The Starlink system uses a Starlink standard terminal, and has been configured with a data channel providing peak speeds of approximately 100 Mps down and 20 Mbps up.

Why use two satellite systems?

Each low-earth orbit system is made up of a constellation of satellites moving overhead rapidly. The ground terminal switches between satellites frequently, and this results in short-duration signal degradation as the flat-panel antenna hops from one satellite to the next. For normal data streams this is not a problem, but for live video the only way to cover it up is to use a large protection buffer.

Using two satellite antennas on the same constellation is a good solution, but even better is to use two different constellations. Dual paths managed by Zixi or a similar FEC/ARQ transport protocol can be used to reduce the buffer size required and therefore the overall system latency.

This is just the start of an exciting journey. Significant performance improvements are expected over the coming months as we continue to test and optimise, and over the coming years as the satellite systems mature, in particular the launch of the 'v2' constellations with in-space satellite-to-satellite communications. There is plenty to look forward to.

Explore the possibilities

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