

Enabling Broadcast Quality Live Production and Distribution from Remote Locations

Live backhaul, contribution and distribution feeds delivered with private 5G networks, Starlink satellite and Zixi-as-a-Service (ZaaS) infrastructure.

OVERVIEW

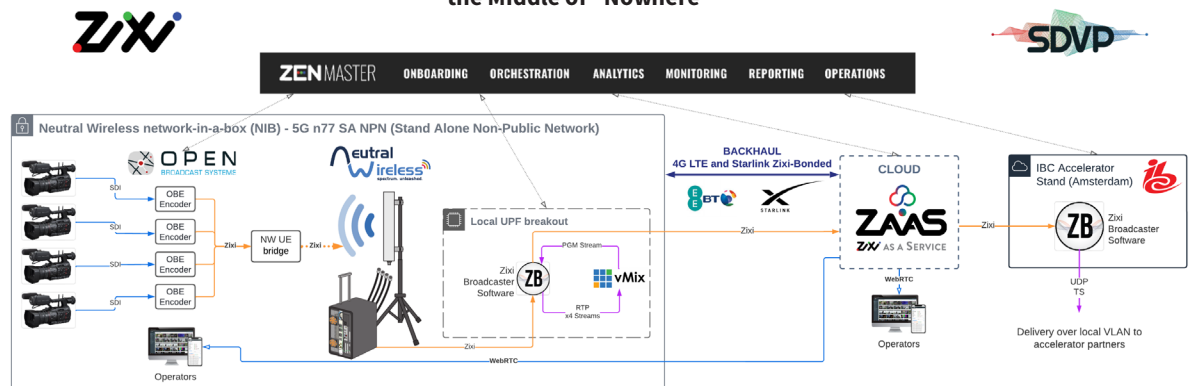
This breakthrough project demonstrates just how portable and flexible a private 5G ‘Network in a Box’ can be for live broadcast production use cases, taking it to some truly remote global locations, as well as to the IBC show itself. In addition to showcasing untethered camera feed backhaul over private 5G networks, this project provided early trial testing of emerging low earth orbit (LEO) satellite constellations leveraged for live video backhaul to cloud/remote processing centers.

For this project, Zixi was selected to support four key aspects of the overall distribution:

- Ultra-Low latency source backhaul to vision mixer
- Bonded 5G/Starlink contribution to cloud production facilities
- WebRTC cloud to on-prem live confidence monitoring
- Primary distribution to delivery and playout partners

Each aspect included specific challenges that Zixi and the partner ecosystem worked through to deliver a truly untethered live video production, from the middle of nowhere.

IBC Accelerator 2022 - Remote Production from the Middle of “Nowhere”



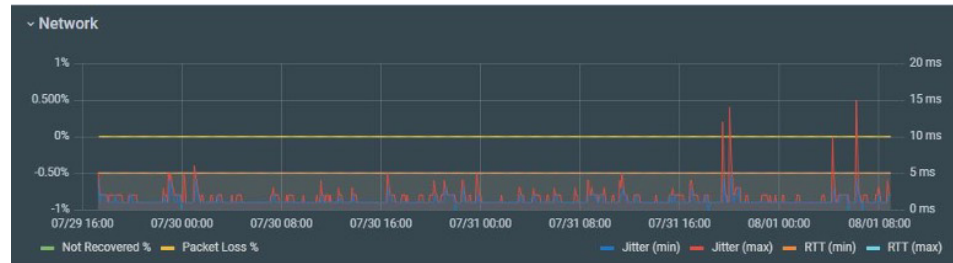


APPROACH

Ultra-Low Latency Backhaul

Source signals from camera feeds are backhauled to a central vision mixer, where a produced program feed is created. This is achieved using a 5G non-private network (NPN) leveraging network-in-a-box from Neutral Wireless. To maximize the bandwidth available on the 5G NPN, camera feeds are compressed on OBE encoders and delivered to the production LAN using Zixi. OBE has integrated Zixi and the combined solution achieves extremely low latency backhaul, with 5G NPN latency at less than 50ms and live video backhaul glass-to-glass latency under 160ms. The combination of flexibility and performance enables completely untethered live camera work and backhaul.

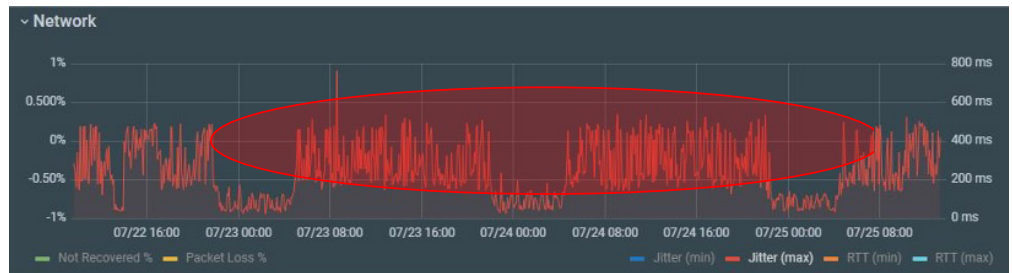
Ultra-Low Latency and Full Packet Recovery over 5G NPN



Bonded Egress to Cloud with Zixi-as-a-Service (ZaaS)

The produced program feeds were then delivered over a Zixi bonded network to the cloud based ZaaS. Zixi seamlessly bonded 4G LTE and Starlink LEO satellite networks to support a high throughput, highly resilient wireless contribution feed. The 4G LTE link was stable, but constrained the available bandwidth for contribution. The Starlink network provides very low latency uplink from almost anywhere on Earth, though it is still being built and can periodically experience degraded performance and delayed connection response as the signal transitions between satellites. Zixi creates a sequenced bonded stream, continuously optimizing delivery to maximize the capabilities of the bonded network. With dynamic ARQ and FEC, Zixi automatically corrects any delivery issues while continuously driving down latency to the minimum necessary to guarantee QoS.

Excessive Frequent Jitter Spikes on Starlink Connection





Confidence Monitoring

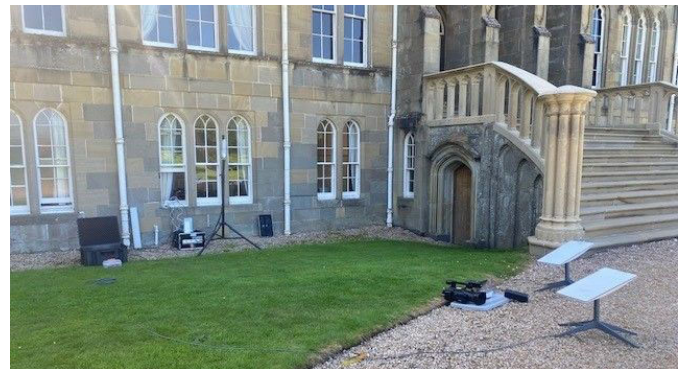
Producers wanted to validate that the completely untethered program feed was successfully being transmitted error-free to the cloud. To support this, Zixi ZEN Master provided live operations dashboard views, confirming receipt and validating overall performance at each stage in the production backhaul, contribution and distribution of the live event. In addition to the operations dashboards, Zixi produced a live WebRTC feed of what was being received in the cloud, enabling on-prem producers a real-time view of what was being delivered. This tangible and ultra-low latency confidence monitoring showed that the 5G NPN backhaul and 4G LTE/Starlink bonded contribution feeds were delivering broadcast quality feeds to the cloud.

Live Video Delivery to Distribution Partners

Now available in the cloud-based ZaaS environment, the resultant program feed was then routed to multiple discreet target destinations. Each destination had unique requirements on format, packaging and delivery protocol used. ZaaS made the live feeds available as compliant streams, leveraging a combination of integrated low latency transcoding, program mapping and protocol conversion to establish, monitor and secure live video distribution to all program takers. Delivering once to the ZaaS ingress point, and then from there out to each target destination, conserved bandwidth at the venue while providing the flexibility to ensure a compliant feed was delivered to all distribution partners.

As with the contribution feed, the primary distribution is well monitored, providing receipt confirmation, audio/video quality analysis and connection performance details for each recipient. If any problems in the distribution were to arise, real-time alerts and automated RCA reports are generated, pinpointing root cause and rapid incident resolution in ZEN Master.

5G NPN and Starlink Antennae



RESULTS



Lower Latency

Ultra-low latency production backhaul of compressed camera feeds over 5G NPN network. Advanced features such as OBE's 'Periodic Intra Refresh Stream' encode option and Zixi's intelligent dynamic error correction deliver bandwidth efficient and highly resilient feeds with less than 160ms 'glass-to-glass' latency



Simplified Deployment

Untethered production systems, the 5G NPN 'Network-in-a-Box' solution and SDVP enabled operations teams to easily, confidently and rapidly setup for live event production. Wireless bandwidth from a single antenna can extend over a kilometer and performance is continuously monitored and optimized.



Lower Bandwidth Costs

Leveraging unmanaged internet over the Zixi bonded 4G LTE and Starlink networks to reliably egress live contribution to cloud offers significant savings over traditional satellite or leased line access. Produced feeds are processed and normalized in the cloud to the target destination requirements.



Reduced GHG Emissions

Remote cloud production infrastructure deployed in Zixi as a Service (ZaaS) can be spun up and down on-demand, greatly reducing the carbon footprint associated with fixed infrastructure and on-prem deployment. Remote producers and editors collaborate in real-time with full access to all feeds.



CONCLUSION

New Models for Flexible Live Event Production

Live remote production and offsite contribution is becoming increasingly popular, but it can be expensive and difficult to set up. Traditional RF networks are often prone to public interference and require multiple dedicated networks for video backhaul, comms, control, and operations per connected device. Wired SDI or IP networks can mitigate this problem, but they present staging and deployment issues and reduce production flexibility. Venue egress bandwidth also requires long lead times to provision and can be prohibitively expensive for remote productions.

Leveraging a 5G NPN radio network for live camera feed backhaul greatly simplifies operations. 5G NPN networks can be tuned to prioritize uplink bandwidth for video backhaul while providing an ultra-low latency two-way connection, consolidating the ancillary communications and control paths to a single network. For these projects, the [Neutral Wireless Network-in-a-Box](#) solution was providing up to 350Mbps of dedicated bandwidth on a single uplink, providing the throughput to host many concurrent broadcast-quality live camera feeds.

[OBE encoder](#) performance optimizations in the video backhaul path provided pristine quality live audio/video backhaul while significantly reducing the inherent latency of video compression. [Zixi Broadcaster](#) is able to dial in ultra-low latency reliable transmission that is continuously optimized to ensure the lowest possible connection latency while preserving uninterrupted throughput from the camera to the live video production systems.

Live production backhaul over unmanaged internet can be reliably delivered by bonding diverse network paths. Combining 5G, 4G LTE and now [Starlink internet](#) connections into a coherent high throughput bonded Zixi enabled network supports live contribution from even the most remote locations. Zixi was able to tune the bonded networks to maximize the performance characteristics of the available networks. Once received in [ZaaS](#), the feeds were conditioned and normalized for the unique delivery requirements of many concurrent target destinations. ZaaS includes [ZEN Master](#), which provided global live monitoring dashboard views of the end-to-end distribution, including presenting on-prem operations teams an ultra-low latency live video confidence monitor WebRTC connection.

The flexibility of untethered operations, simplified production workflows and ubiquitous availability of video optimized network egress should unlock new live event production capabilities and novel audience experiences that traditionally would have been too costly or complex to produce. Zixi is very excited to participate in these cutting-edge projects that are reshaping how live programming is captured, produced and delivered!



ABOUT ZIXI

Zixi provides a cloud based and on-premise Software-Defined Video Platform enabling the management, orchestration, monitoring, and delivery of broadcast-quality live and live linear video over any IP network, protocol, cloud provider or edge devices to broadcasters, enterprises, over-the-top video providers, and mobile service providers around the world. Over 15+ years, the Zixi Enabled Network (ZEN) of partners has grown to over 350 OEM and service providers with whom Zixi serves well over 700 customers representing most of the top media brands around the world with 20,000+ channels delivered daily. www.zixi.com | sales@zixi.com