

Scale Up/Scale Out for Private 5G Networks



By Steve Crouch, President SUSO

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TV coverage of live sports is big business. Live sports have traditionally been one of the biggest money-makers in television with more than 30 percent of ad revenues coming from live sports, even though sports programming accounts for just 8 percent of total viewing time.

Sports content is the last bastion of the linear TV ecosystem, with live events like NFL games and the Super Bowl and the NCAA's March Madness accounting for over 95% of the most-watched programs in 2023. Also, a shift to streaming is underway as direct-to-consumer services increasingly edge into live sports broadcasting.

The production systems (OB vans) that provide the physical infrastructure to cover all the action are increasingly complex. The Super Bowl is perhaps the pinnacle of this complexity – 19 mobile units fielding 165 total cameras including 24 main and 24 robotic cameras, 20 embedded inside endzone pylons, 5 skycams/flycams, 3 drones, and more.

While larger stadiums are fully wired, many (most) sports take place in smaller venues, on city streets and parks, or even remote locations like beaches and jungles. It can be difficult and expensive to use standard-fare production vehicles in these places – cable runs for cameras can be hundreds of meters requiring a lot of manual labor to lay them out.

This is where a Private 5G Network comes in. Plus, it's not just for wireless broadcast camera contribution – a P5GN can run all features like return video and intercom, connect vendors and ticketing at events/festivals, and provide discreet networks for coaching staff and even consumers for VR experiences.

A Private 5G Network is a real game-changer for live production systems.



HOW IT'S DONE NOW

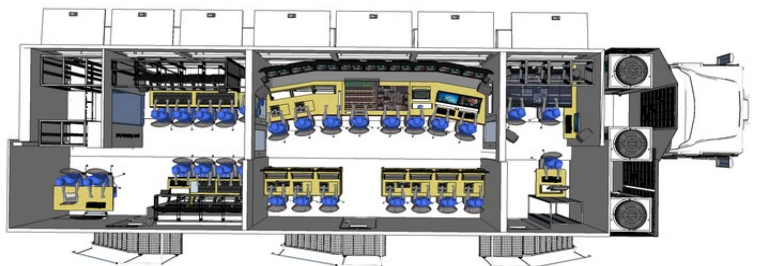
A multi-camera OB (Outside Broadcast) vehicle can be the size of a Sprinter van up to a 50' expandable trailer towed by a semi-truck. Everything needed for a production is crammed inside and wired together. The cameras are placed in position and cables are run. Some of the cameras can be connected with RF wireless systems or line-of-sight microwave for cameras further away.

There can be anywhere from four to 50 cameras used for live productions. Each is usually connected with triax cable and those need to be stored on reels, transported, and laid out. This takes a small army of laborers hours/days to run before a show. If the cables can't be stored in reels on the vehicle, another truck accompanies the main unit to the location.



Large OB production trucks have reached critical mass in terms of weight and space inside the vehicle; they can't make them any bigger. It's getting harder to find space in the belly bays and weight on the truck to carry all the gear. A truck going down the road can't weigh an ounce more than 80,000 lb.

Production companies have to figure out a way to pack in all the technology but also maintain that weight limit. They're looking at ways to slim down and one of the ways is converting into an IP infrastructure.





WIRELESS CAMERAS ARE THE FUTURE

Reliable and performative wireless video has been around for only a short time. The main system in use for a couple of years is called “bonded cellular”. With any wireless system, the keys are bandwidth, throughput, and latency.

Cellular bonding is a process whereby multiple carriers are all used simultaneously to send and receive data to maintain sufficient bandwidth. The camera signal is compressed into data and then sliced into numbered packets. Each packet is distributed to each connected service which then flies through the air to the receiving (de-bonding) server. Because each route they take is different, the packets don’t arrive in order.

A de-bonding server receives the packets and puts them back in order. Then it sends this single stream of data to the destination – a local recorder, a switcher input, or an internet destination. Bonded cellular video is not appropriate for multi-camera productions because the cameras cannot be synchronized properly and each has a different latency.

A better solution came along in 2023 – Private 5G Networks.

These can be set up in a couple of ways. Cell companies have deployed 5G across their networks for general public use, but the network is subject to overloading if too many people connect at the same time and start sharing video (like at a stadium or concert). In this case, the provider can establish a “slice” with a different address that can be used by a private group with a dedicated SIM card. 5G has better performance than LTE/4G so bandwidth-gobbling tasks like video sharing or encoded cameras can be used effectively. This kind of ad hoc network needs to be set up by the cell company and usually requires an FCC license.

The better way to set up a Private 5G Network is to put up your own antennas and use your own SIM cards on the devices you want to connect. Now you are in control of the entire network bandwidth, which is important because HD/UHD/4K camera signals are huge. CBRS bands can be used which do not require an FCC license. The video signal gets turned into a compressed video stream and can now be sent over the 5G network or any internet connection.

IP-based video took the sports industry by storm once a standard for interoperability was established by SMPTE with their ST2110 protocol. It specifies the carriage, synchronization, and description of separate essence streams over IP for real-time production, playout, and other media applications. Each stream is individually timed and can take different routes over the networked fabric to arrive via unicast or multicast at one or more receivers. A PTP clock ensures the accurate synchronization of all streams regardless of how the packets were routed.



THE ACROMOVE PRIVATE 5G NETWORK-IN-A-BOX

The essential elements in a 5G network that must come together seamlessly –

- **Radio Access Network (RAN):** This includes antennas and base stations that connect your devices to the 5G network.
- **Core Network:** The core network manages data traffic, routing, and security.
- **Backhaul and Transport:** Ensure reliable data transfer between RAN and core network components.
- **Edge Computing:** For processing data locally, reducing latency.

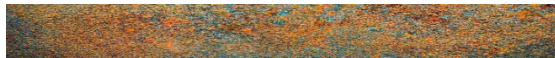


Acromove's system is a complete turn-key configuration in a portable package that is extremely easy to deploy on location. It runs on AC, internal batteries that act like a UPS, external sources like car batteries, and even solar panels. It can also be rackmounted.

It combines the entire 5G network with a powerful edge cloud server that can run additional software like editing, transcoding, logging, asset management, instant replay, and remote video/audio switching systems like Grass Vally AMPP and Ross Video Graphite CPC. Built-in 10G networking can connect the device to a local network where other servers can be added for more storage or compute power.

It has four ports to connect 5G small cells with hybrid cables that supply power and signal. These ports can be expanded to handle upwards of 16 antennas for the largest and most difficult installations. Various backhaul solutions are supported such as Starlink satellite uplink, high-gain 5G antennas, mmWireless transmitter, or fiber/Ethernet.

The system can be remotely controlled due to an integral LTE modem or local WiFi with a specially-developed WebApp that runs on a cell phone, iPad, or laptop. It's easy to operate with minimal training and does not require a specialist to be with the unit.



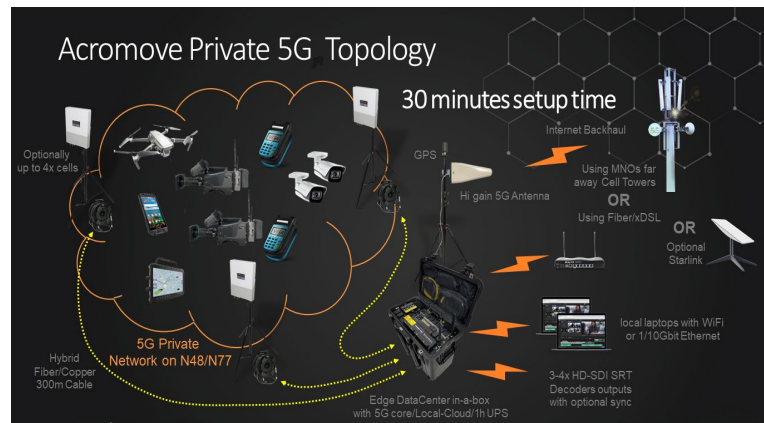
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What Devices Can Connect?

- **HD/UHD/4K Camera encoders:** Haivision Pro460, BSI Mini TX 5G, TVU systems, Vislink, LiveU, Peplink/Vitek.
- **Smartphones and tablets:** Apple iPhone with IOS14+, Apple tablet with iPadOS 17+, iPad Pro (6th generation) and later, many Samsung smartphones like Galaxy S23, any other modern 5G compatible device.
- **Point-of-Sale systems:** Through 5G SA N77/N48 and any WiFi access point that supports 5G connectivity like Mikrotik Chateau 5G, Netgear Nighthawk M6 pro, Peplink with 5G like MAX BR1 Mini 5G.
- **Supports up to 30 devices per small cell:** When used with more than one small cell we can calculate 20-25 SIMs per cell to allow a headroom for handovers when devices are moving from Cell to Cell, so 125 devices in a four-small cell system.

The encoders that mount on the back of the cameras also enable ancillary services like intercom, return video and audio, camera shading, and even remote pan/tilt/zoom (PTZ) control. Integrating all these features really simplifies a production setup requiring fewer personnel on location.

Another interesting feature of the Acromove Private 5G Network is the ability to create sub-networks for multiple “tenants” to simultaneously provide discrete services over the network. For example, an outdoor music festival can connect all the ticketing booths and on-site vendors to web-based payment processing, surveillance cameras can have their own network monitored by security teams, all while providing a broadcast multi-camera HD camera contribution system for recording.





SUMMING UP

The effects of the COVID-19 pandemic in 2020 forced the broadcast and streaming industries to double down on remote production workflows and technologies. With studios shuttered, empty broadcast operations centers, and parked OB vans, video technology companies and producers turned to IP-based production like never before, embracing its efficiency, flexibility, and ability to cost-effectively meet rapidly changing requirements.

Many broadcasters and mobile TV production companies still operate in fragmented environments that have evolved to their current state over decades. Essential elements of the production process are often executed in siloed environments and managed in islands of automation that are not well integrated. As a result, disconnected processes are cobbled together to capture images, process and edit content, and then prepare programming for distribution to audiences.

Industry leaders are accelerating efforts to modernize investments in production and information technology to support new workflows and operations that will enhance their market positions. Companies face challenges from other broadcasters and increasingly from streaming providers with lower operational costs and simpler distribution mechanisms through the strategic application of internet protocol-based (IP) infrastructures.

Wireless Private 5G Networks will play an increasingly important role in the months and years to come.

About SUSO – www.SUSO.Pro is a consulting organization headed by Steve Crouch. It provides business development and representation services to companies seeking to establish alternative sales channels mainly in the US market. SUSO also offers system and product design services.

About Acromove – <https://acromove.com/> provides Private 5G and Edge Cloud Data Center Infrastructure solutions. Our novel solutions enable enterprises to transfer massive amounts of data effortlessly and to bring a true cloud computing experience to the Edge.