LiveU SPORTS

5G

The Technical Breakdown

How will 5G technology impact Sports broadcasting?

The Impact of 5G

One of the most impactful new technologies, across many industries and cases, is Fifth Generation cellular networks (“5G”).

5G is a broad term for a set of technologies and standards that leverage new forms of encoding data into radio transmissions, new frequencies to carry that encoding, and new network architectures to bind it all together. The results are wireless networks capable of linking a huge number of devices at high bandwidth – in some cases **100x better than 4th generation LTE networks.**

This transformative technology is having an impact on the world of sports production, which we will explore in this paper.

5G: What Is It? How Does It Work?

Covering all the technologies that make up 5G would take many similar papers, but a brief tour of the key components of 5G are worth reviewing before looking at its impact on video production.

New Radio ("NR")

One big change in 5G is a new protocol for the radio access network ("RAN"). NR, short for **New Radio**, replaces LTE as the in-air protocol in 5G. It uses a combination of more flexible and advanced options, in key areas such as modulation schemes, subcarrier spacing, carrier bandwidth and aggregation. All basically adding up to more efficient use of all parts of the spectrum, to support many more devices connected to the network at higher bandwidth for each device. Even in the same spectrum, NR provides roughly **20% more bandwidth through just efficiency,** compared to LTE.

Non-Stand Alone ("NSA") and Stand-Alone ("SA")

Another form of flexibility provided in 5G, SA vs NSA networks refer to the network control layer, or "control plane". In a NSA network, the control plane is still provided by LTE. In an SA network, it is provided by the 5G network itself. While SA networks have more features and flexibility, NSA deployment allowed the **quicker and less costly launch** of some of 5G benefits to users. As of this writing, there are still a mix of NSA and SA networks around the world and in the United States, with NSA networks still more common.

Sub-6 and Millimeter Wave

Next to 5G NR, the other biggest change in 5G, is the support of more frequencies for use in cellular networks. In fact, 5G adds a whole new section of the spectrum called millimeter wave ("MMW"). This new section of spectrum is exciting because it is higher frequencies, specifically **24,250 MHz to 71,000 MHz** (the full MMW spectrum extends up to 300,000 MHz). However, MMWs impact on the real-world is still limited. It is challenging to deploy, requiring microcells, new antennas and new techniques such as beam forming. These factors mean MMW remains part of 5G's still evolving future, and will have a bigger impact on networks in years to come.

Meanwhile, 5G also adds new bands for use in the Sub-6 spectrum, meaning those bands in 6 GHz and below. While LTE always used these bands, 5G adds specific bands not previously used, including across the low and mid bands of this space, allowing for the prioritization of distance or bandwidth, respectively.

How 5G Is Impacting Video Production

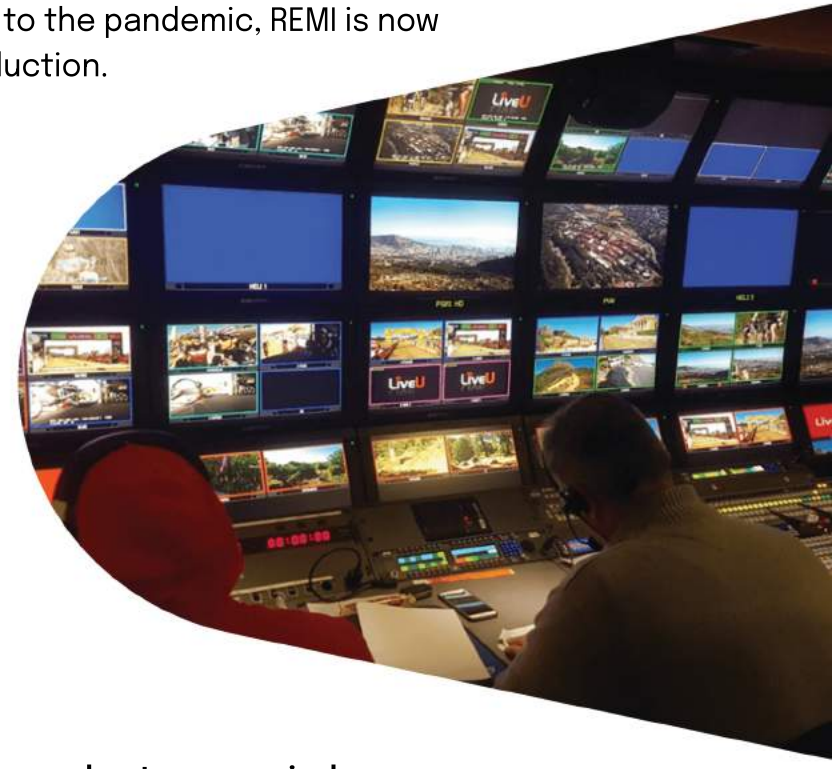
So how are all these technologies impacting video production, specifically sports production? The impact is all about **ubiquitous, reliable bandwidth**, usable from small and portable transmitters, without deploying your own network gear *(unless you want to, more on that later)*.

Here are just some of the use cases for 5G in production.

The LiveU LU300S paired with 5G modems used for the Trans Am Race Series.

5G As Contribution for REMI

Maybe it feels a bit backward to talk about the **remote integration model** of multi-camera production first, since up until a few years ago, local production (or "OB Van" production) was still more common. But as REMI has grown, driven by many factors from the financial benefits to the pandemic, REMI is now arguably the more common method of production.



It is also an obvious fit for 5G technology. REMI relies on backhaul not just for a few produced feeds, but for many source feeds - ramping up the demands on contribution. 5G, particularly when combined with techniques such as reliable protocols and cellular-bonding, becomes a very reliable, low latency and low-cost form of contribution for REMI.

5G As Short-Range Wireless

An interesting application of 5G bandwidth is as **short-range wireless transmission** technique. This can be architected a few ways, including using some of the newer technologies outlined next. While at first this might seem like just re-building an existing technique with slightly different tech, 5G can **lower the cost, complexity and barrier** to deployment. It can also allow connectivity from devices much smaller and lighter than previous short-range wireless, and from "off the shelf" devices such as smartphones.

These new capabilities make point-to-point use of 5G technology an upgrade from previous short-range wireless.

Emerging Techniques

In addition to all the benefits already outlined as part of 5G, there is even more beginning to impact production now, at the cutting edge.

1 Network Slicing

Network slicing is a technique that made big headlines in the early days of 5G, but has been slow to be deployed, like MMW. Slicing is the ability of the software-defined 5G network to dedicate resources at each part of the network to specific devices. This means partitioned bandwidth on the backhaul network but also partitioned bandwidth on the radio-access network – something not available previously.

The complexity of making these slices available to customers have made this technique slow to deploy. So, while slicing gained a lot of early attention, it is still not generally available – another technology that will help 5G's future.

2 Non-Public Networks

Many of the same benefits of slicing are available via another technique, **non-public networks** (NPN), aka private networks or private 5G. This technique is the convergence of several parts of 5G: the ability to build a network from software, access new bands, and connect devices via widely available hardware. The idea is just as the name implies: a network not used by general, "public" users. This can be deployed temporarily, on "pop up" antennas or via mobile units, or permanently in specific areas. One enabler for this technology has been the Citizen Broadband Radio Service (CBRS) spectrum.

These are bands that in the USA have been designated by the FCC for use for private deployments. You can reserve bands in CBRS for specific geographic areas and times, and then use that spectrum privately. The ease of these reservations and the large size of the CBRS block (150 MHz) has been a huge advantage for NPN. Some other bands can be reserved via other means, and in other countries similar options exist, but CBRS is a notable enabler for the surge in this technique.

3 Multi-Access Edge Computing

Multi-Access Edge Computing (MEC), aka Edge Computing, is a feature of 5G where computing resources can be located at the "network edge". This provides **extreme low latency and high reliability**, in some cases, as low as 5 milliseconds. If you move some of your video processing, routing, or even full video production to these new edge zones, they can be leveraged in architectures that are a hybrid of the REMI production model and the short-range wireless model.

5G In the Real World

Field of Dreams

The MLB at Field of Dreams Game broadcast, produced by FOX Sports, in collaboration with MLB, was a homage to the renowned movie from Universal Pictures as well as a live sports production event. Watched by nearly six million viewers, the FOX Sports production team utilized two aerial production drones to output High Dynamic Range (HDR) over **T-Mobile's 5G network** using a single 5G SIM card in LiveU's LU800 production-level field unit and a LiveU 5G modem. The production used a number of the new technologies outlined in this paper including 5G bands, NPN, and 5G in both short-range and REMI scenarios.

> ***"For the MLB at Field of Dreams Game, we collaborated with T-Mobile and LiveU to provide HDR drone coverage, which was integral to the special live production. The robustness we received from the T-Mobile 5G network using a single 5G SIM card in the LU800 exceeded our expectations and was a solid part of our broadcast. Great imagery comes from aerial and moving cameras, which lent itself to the special live program we were able to deliver."***
>
> Brad Cheney, VP of Field Operations & Engineering, FOX Sports

Sky Germany

Sky Germany has always been at the forefront of professional 5G deployment, leveraging LiveU's broadcasting solutions for their first 5G-powered sports transmission already back in 2020. After a successful Bundesliga trial broadcast that utilized the network slicing technology, Sky challenged itself to take 5G to a whole new level and produce a handball match fully in the cloud. By mixing multiple broadcast and smartphone camera feeds in a streamlined cloud-production workflow, they brought sports fans even closer to the action.

> ***"After our successful first 5G live broadcast in 2020, we were once again demonstrating the potential of using 5G in live sports with another end-to-end production. With the integrated LiveU and Vizrt technology, we were able to bring the handball action very close to the TV viewer in unprecedented 5G transmission quality."***
>
> Alessandro Reitano, SVP Sport Production at Sky Germany

In Conclusion

5G has only begun to reshape live video production as we know it, enabling lower cost production, higher production volume with fewer crew, new types of shots and content, and faster time to get content to air and to viewers. Some benefits of 5G have only just begun to be deployed or not yet publicly available, leaving a long roadmap of future improvements. 5G will change the game for live video production for years to come!

LiveU's 5G Solutions

LiveU's 5G field units ensure top-quality live video transmission for global newsgathering and live productions. Designed with embedded 5G connectivity, our live video solutions provide unparalleled quality of service and reliability in any network condition.

Scan to learn more