

# A LOOK BEHIND LEVELS:

The first live XR music production powered by  
Verizon 5G and 5G Edge with AWS Wavelength



# Table of contents

## Introduction

P.03

## A Perfect Partnership: How Verizon 5G and AWS Wavelength work in tandem

P.12

- Why 5G?
- Why Verizon 5G Edge?
- Why Edge computing with AWS?
- The Power of the MEC
- What it all means

## LEVELS: A brand new live experience to drive tech validation

P.27

- The Journey
- The Look

## Behind the Scenes: The tech that powered LEVELS

P.35

- The Production Workflow
- The Partners

## The Evolution of Entertainment: What the future of production looks like

P.45

- The Business Case
- The Future of Entertainment

## Conclusion

P.53



**The game is beginning. The concert is starting. The live performance has begun.**

An infinite stage comprising floating hexagons and interactive, evolving graphics looks like a concept thought up in a dream. The performers take their places in a space that looks like a recording studio, which soon transforms into a bright and airy apartment filled with plants, then a galaxy.

Audience interaction to the music floats around the space, and people call in, their faces projected into this built universe with perfect clarity.

This is an entertainment event that's never been achieved before.

This is a space where anything you can imagine can become a reality.



# LEVELS

**A 5G interactive experience**

# Introduction





“Levels is unique as a new show format because it brings game engine technology, LED walls, real time interactivity, and a remote audience into a completely new form of live entertainment,” says Andrew Zarick, head of partnership activations for Verizon. “None of this could happen without the power of Verizon 5G Edge with AWS Wavelength, and our ecosystem of ISV partners who all rallied around this completely new pilot to make it possible.”

The combination of these technologies enabled a first of its kind interactive performance streamed live on Twitch. Staying true to the “venue” of the performance, LEVELS is a gamified show, where audience interactivity plays a key role in the production, meaning the people who are engaging with the show format are actually affecting the storyline as it’s unfolding.

“We’re doing virtual production live and there’s a lot of risk associated with that,” says Scott Connolly, Technical Lead at Verizon 5G Labs. “But I think that’s one of the most unique things about the Labs – we’re able to push the boundaries because if we don’t push them, then no one will.”

Low latency, enabled by the technology, makes for a seamless experience between the live performance and an audience watching from anywhere. And high quality makes all the difference. “Forget 4k, this is like 10k” said one viewer in the live chat. When latency is diminished, the veil between on-screen talent and at-home viewer is lifted, and interaction between artist and fan becomes meaningful.



### CHAT



lanihehe: MY MIIIND

EazyMagic: She killing this song ngl

19 RurouniShogun: 🍌🍌🍌🍌🍌

LoverJ5DaLegend: 🗨️🗨️🗨️🗨️🗨️🗨️🗨️🗨️  
🗨️🗨️🗨️🗨️🗨️🗨️

anitasvv: 🗨️🗨️🗨️🗨️🗨️🗨️🗨️🗨️

LoverJ5DaLegend: 🗨️🗨️🗨️🗨️🗨️🗨️🗨️🗨️

mostrokes: 🗨️🗨️🗨️🗨️🗨️🗨️🗨️🗨️  
🗨️🗨️🗨️🗨️

crawftone78westent: 🗨️🗨️🗨️🗨️

**LEVELS is a gamified show, where audience interactivity plays a key role in the production and leveling up**

**Real-time audience interactivity from Twitch chat to influence a live music entertainment experience**



**Real-time interactions with stage talent via low latency call-ins, fan wall, and audience triggered VFX from chat wasn't previously possible**

**As Verizon 5G reduces latency between live broadcast and the viewer, there are more opportunities for audience engagement**



**“I think with music it’s important to be innovative and what I really loved about it was getting to engage with fans,”**

says LEVELS’ first artist, singer-songwriter Nija. “I think it’s extremely important to connect with fans because those are the people that are supporting you – it’s the most important part to me.”





1:14

Main Stage - Stage Left





A love of music and its power to connect people is built into the DNA of this project. Verizon and AWS Wavelength teamed up with Capitol Records, who joined on the project to see just how far this kind of technology can push performance and what it means for the future of music. The studio graphics are, in fact, based on Capitol's famed Studio B, where the likes of Frank Sinatra and The Beach Boys recorded iconic work.

This pilot project was the result of years of innovation and collaboration from Verizon 5G Labs, and with one show under their belts, the team is ready to continue driving forward tech validation and democratizing the means to high-quality, low-latency entertainment experiences.

**“With this kind of technology the opportunities for how a remote audience can engage with a live show format are really endless.” –Zarick**



# A Perfect Partnership:

How Verizon 5G with AWS Wavelength work in tandem

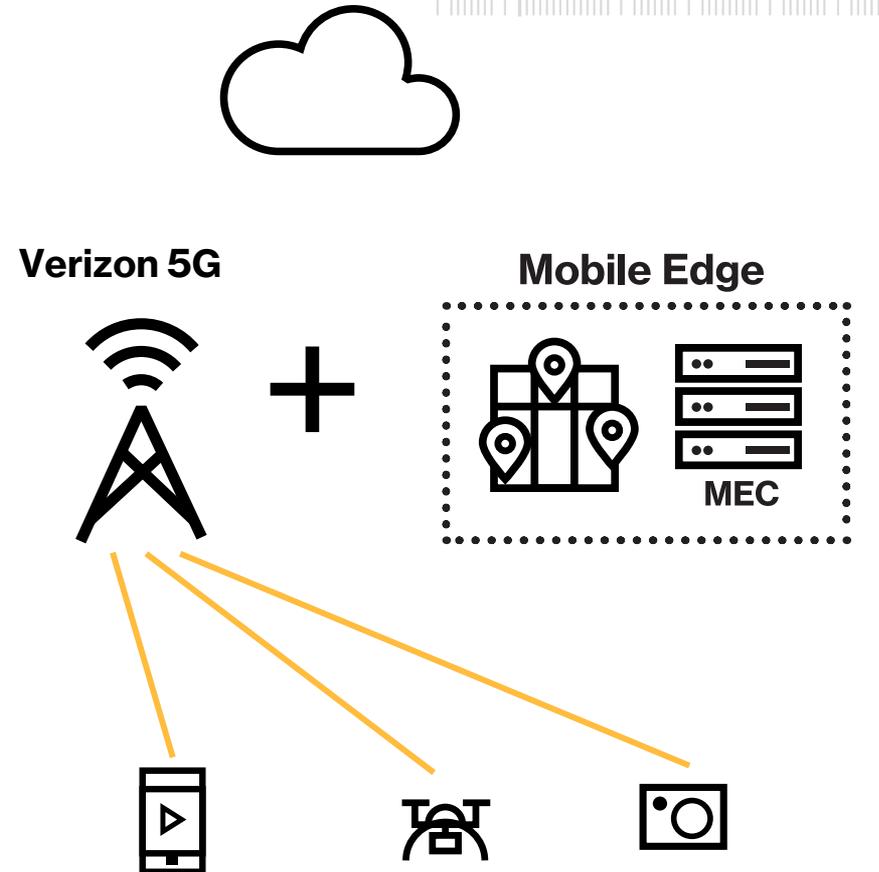


a perfect partnership

**A project like LEVELS can only happen with a solid foundation of technology behind it – one that’s innovative, reliable, and provides a high-quality experience.**

The basis of this digital event was the combination of Verizon 5G Edge with AWS Wavelength, which turned out to be a perfect partnership.

When combined, this real-time cloud computing platform brings applications to the very edge of the wireless network, resulting in the lowest possible latency, no matter your device. That’s just one of the benefits of this dynamic duo.



A woman with long braids lies on a patterned rug in a room. Several rotary telephones are scattered around her, some on the floor and some on a table. The scene is dimly lit with warm, orange tones.

**Let's dig deeper into the  
elements and what they can  
achieve when combined.**

verizon

aws

# Why 5G?

In a world where speed and quality are everything, 5G is the connection consumers and tech innovators have been waiting for. The modern consumer has become accustomed to experiencing content and connectivity no matter where they are – what 5G offers is confidence in that connection. In fact, Verizon's 5G Ultra Wideband network is Verizon's highest performing 5G, delivering speeds up to 10 times faster than the average connection.



a perfect partnership



## The core tenets of what Verizon 5G delivers

a perfect partnership



- > **MOBILITY**
- > **RELIABILITY**
- > **LOW LATENCY**
- > **EFFICIENCY**

# The core tenets of what Verizon 5G delivers

a perfect partnership



**MOBILITY**



“With 5G, last mile connectivity is no longer part of the conversation,” says Josh Arensberg, Global head of business development of media and entertainment for Verizon. Traditionally a limiting factor with regards to performance and latency, the last mile crumbles in the face of 5G. “When it comes to portability you can expect that the end device is going to have the reliable connectivity and speed it needs to create a world class experience no matter where you are.”

> **RELIABILITY**

> **LOW LATENCY**

> **EFFICIENCY**



# The core tenets of what Verizon 5G delivers

a perfect partnership



> **MOBILITY**

**RELIABILITY**



Verizon made a commitment in support of reliability in the form of a billion dollar investment in fiber, the gold standard of connectivity. With fiber at the core of your network, you can grow and scale and be assured that when you get to the edge, you're on an all-optical network.

> **LOW LATENCY**

> **EFFICIENCY**



# The core tenets of what Verizon 5G delivers

a perfect partnership



> **MOBILITY**

> **RELIABILITY**

**LOW LATENCY** >

5G's ultra low latency will be one of the drivers of true technological change; so much more becomes possible when you all-but evaporate the end-to-end response time. Data transit speed with this technology is many times less than the blink of an eye – from the network, to the central processor, and back again.

> **EFFICIENCY**

# The core tenets of what Verizon 5G delivers

a perfect partnership



- > **MOBILITY**
- > **RELIABILITY**
- > **LOW LATENCY**

**EFFICIENCY**



5G supports layers of efficiency – from a battery life standpoint all the way to the efficient delivery of video. That level of efficiency allows for more traffic, more content, and better user experiences for the consumer.

# Why Verizon 5G

For media and entertainment companies, or those putting on live events, the power of 5G really resonates. The network's ability to connect a greater number of different devices also makes this tech particularly good for large crowds, with unified servers producing higher-quality internet services for all devices. In fact, Verizon 5G supports a million devices per square mile, says Arensberg.

From a security perspective, when using a network for business-critical functions, Verizon 5G has the ability to secure and upgrade the connection, and is a trusted provider for your services.

a perfect partnership



# Why Verizon 5G Edge

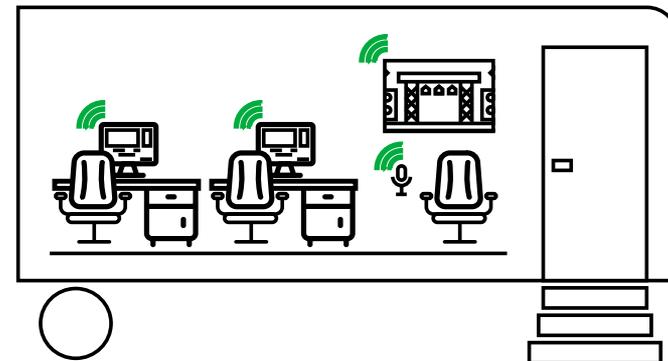
a perfect partnership



Consumers and enterprises expect highly responsive experiences, especially when using new 5G networks. Edge Computing essentially brings the cloud experience to where data is consumed or generated – closer than ever to users or devices.

Because most of today's consumer and enterprise applications are accessed on mobile devices, which are, in turn, hosted on application servers outside the provider's network, being closer to end users means providing a more responsive experience. In short, running applications in edge computing infrastructure is an essential component of providing what consumers expect.

When coupled with the 5G network, edge computing will enable new classes of cloud applications across industries including industrial robotic and drone automation, connected vehicles, and AR/VR infotainment. Many emerging applications require local processing of information in order to reduce the volume of traffic transported to data centers. By enabling compute capabilities closer to end users, developers and enterprises can provide new innovative 5G applications and deliver immersive experiences to a wide audience.



# Why Edge computing with AWS?

a perfect partnership



AWS edge computing services provide infrastructure and software that move data processing and analysis closer to the end point. These include deploying AWS-managed hardware and software in locations outside AWS data centers, and even onto customer-owned devices themselves. AWS gives you more edge specific capabilities than any other cloud provider.

Combining edge computing with AWS means accessing the most extensive global cloud infrastructure footprint of any provider, with the highest network availability, designed to meet the most stringent security requirements in the world. With over 200 cloud and device services, AWS has the deepest range of capabilities.

It moves the cloud closer to the endpoint, extending beyond regions to the very edge, all with the same network, control plane, APIs, and AWS services in each deployment. Using managed hardware at edge locations also enables you to securely connect and manage devices at scale, with support for more security standards and compliance certifications than any other offering.

Being able to build faster with reduced costs is another benefit: by using a single programming mode for the cloud and local devices you're able to build once and deploy on the cloud or at the edge with consistent performance, shortening the development lifecycle and reducing costs





# The power of the MEC

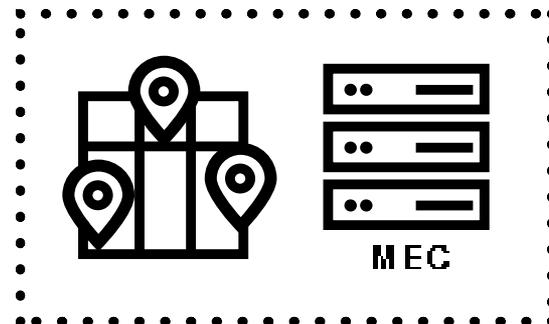
a perfect partnership



Mobile Edge Computing is all about extending the cloud experience as close to the consumer as possible, and AWS Wavelength brings its services to the edge of the Verizon 5G network. Wavelength Zones are AWS infrastructure deployments that embed AWS compute and storage services within communications service providers' data centers at the edge of the 5G network. This is so application traffic can reach application servers running in Wavelength Zones without leaving the telecommunications network, which avoids the latency that would result from application traffic having to traverse multiple hops across the Internet to reach their destination. All of these elements come together to enable customers to take full advantage of modern 5G networks.

For live entertainment events this is a game changer. The buffering and jitter that results from latency is a killer when it comes to interactive media and live streaming, and it doesn't need to be this way. Building applications in a public MEC platform allows you to deliver those applications in ultra low latency for 5G devices.

Leveraging powerful compute, storage, and GPU hardware in AWS Wavelength Zones, live events can be enhanced by giving audiences a front row experience regardless of their location inside the stadium. A fan could be choosing which camera they want to view on their mobile device, and could have other live content inserted into their video feed, such as lyrics or text commentary, statistics, or other fan-facing content. It would also allow for augmented reality overlays to the live feed, and the capture and processing of multiple camera views to create a remote 3D viewing experience.



# What it all means

a perfect partnership



Being able to deliver this level of experience without a huge upfront investment or highly skilled technical team means a high school football team can replicate what the NFL currently spends millions of dollars on. What 5G and MEC can do combined is democratize high-quality streaming by making this technology accessible to everyone. This is a positive for consumers and businesses alike.

“A lot of people hear 5G and MEC and somewhere in the back of their mind they think it’s all hype, that it’s not real, but you’re only limited by your imagination – the software will not limit you” says Nem Kashanian, founder and CIO of Multicasting.io. “The first time we turned on AWS Wavelength I thought in my head there was no way it reduced latency by 50%. But it doesn’t just make you believe, it proves the belief.”

“Latency is a very critical part in this era because everything is very interactive, and it’s increasing,” says Ant Media co-founder Yalim Eristeiren. “And for us the edge is about quality of service – there’s nothing between us and the user.”

5G MEC is the future of computing, and creatives are just beginning to discover what’s possible with this technology supporting their work. Verizon 5G Lab saw the limitless potential in this combination of factors and from that vision, LEVELS was born.

What follows is a case study of how an ultra wideband network, with ultra low latency, and a powerful edge computing infrastructure with the fastest processing speeds can enable a never-before seen live virtual performance.



# LEVELS: A brand new live experience to drive tech validation

**When an audience member experiences LEVELS, they're not just tuning in to passively view a traditional concert—the audience is part of the story.**

The event itself is the gamification of a virtual concert, which seeks to find new ways for audience members to engage directly and meaningfully with artists.

The production is a combination of physical and virtual elements – the content is captured in person, presented in a virtual environment, and broadcast to a digital audience. If LEVELS had a venue, it would be Twitch. The broadcast streaming service is where concert-goers virtually gather to interact with each other and the artist.



verizon<sup>v</sup>

aws



The show is a marriage of innovative technologies – from the Extended Reality (XR) technology on stage displaying powerful graphics, to people calling in with video displayed in real time, to the backbone of it all – the 5G MEC providing an ultra low latency experience. “LEVELS is a sandbox for innovation,” says owner of Image Flux and creative director for LEVELS, Aaron Kaminar.

The result is a show unlike anything ever done live. “The tech at the core of this is actually freeing creatives up to do things they couldn’t do before,” says Evan Pesses, co-founder of Wild Capture and the executive producer of LEVELS. With a couple of devices and a huge bandwidth capability, it can reach everybody.”





# THE JOURNEY

Because the performance itself is gamified, there are six distinct levels to the show. Each level brings the audience closer to the story of an artist. The stage transforms to suit the level, displaying childhood photos, taking on the look of a recording studio, and enhancing the musical portions of the show, which occur between each level.



# The Six Levels

The communal interaction enables the audience to have a direct effect on what happens during the show. At the urging of host @storymodebae, viewers become judges, voting with their fingers if they want to see the story progress to the next level. One emote – Twitch’s version of emoji – equals one vote.

During the performance, a heads-up display appears on screen to indicate the level, a picture of the emote, and a progress bar. As the progress bar moves, it triggers the emotes to float in the space. This is the XR component that turns the concert-going experience into an enhanced one – music notes or hearts move around you, visually representing audience engagement. As the artist progresses through the levels, callers related to their story call in remote, their videos appearing on the wall of the set for the artist to interact with.

The finished product is an event that creates intimacy between artist and fan, and builds an entire world for viewers to lose themselves in.



# The Six Levels

LEVELS



- 1. The Spark**
- 2. Back in the Day**
- 3. The Hardest Moment**
- 4. The Turning Point**
- 5. Gaining Ground**
- 6. Where I am Today**

Each level brings the audience deeper into the story of the artist – but it all depends on what the audience wants to see. Any member of the audience can feel responsible for changing the rudder of the show, and artists have the experience of playing a game with their audience. It results in an unparalleled level of engagement.





# THE LOOK

The set where all of this takes place is designed to be modular, a direct reflection of the boundless potential of the virtual space. The set is one big transformer – a physical stage with a million possibilities. The LED wall that serves as a backdrop can extend virtually and infinitely. The artist and host are present there, combining traditional broadcast with advanced tech 3D workflows that concert-goers will see in all their glory in real time.

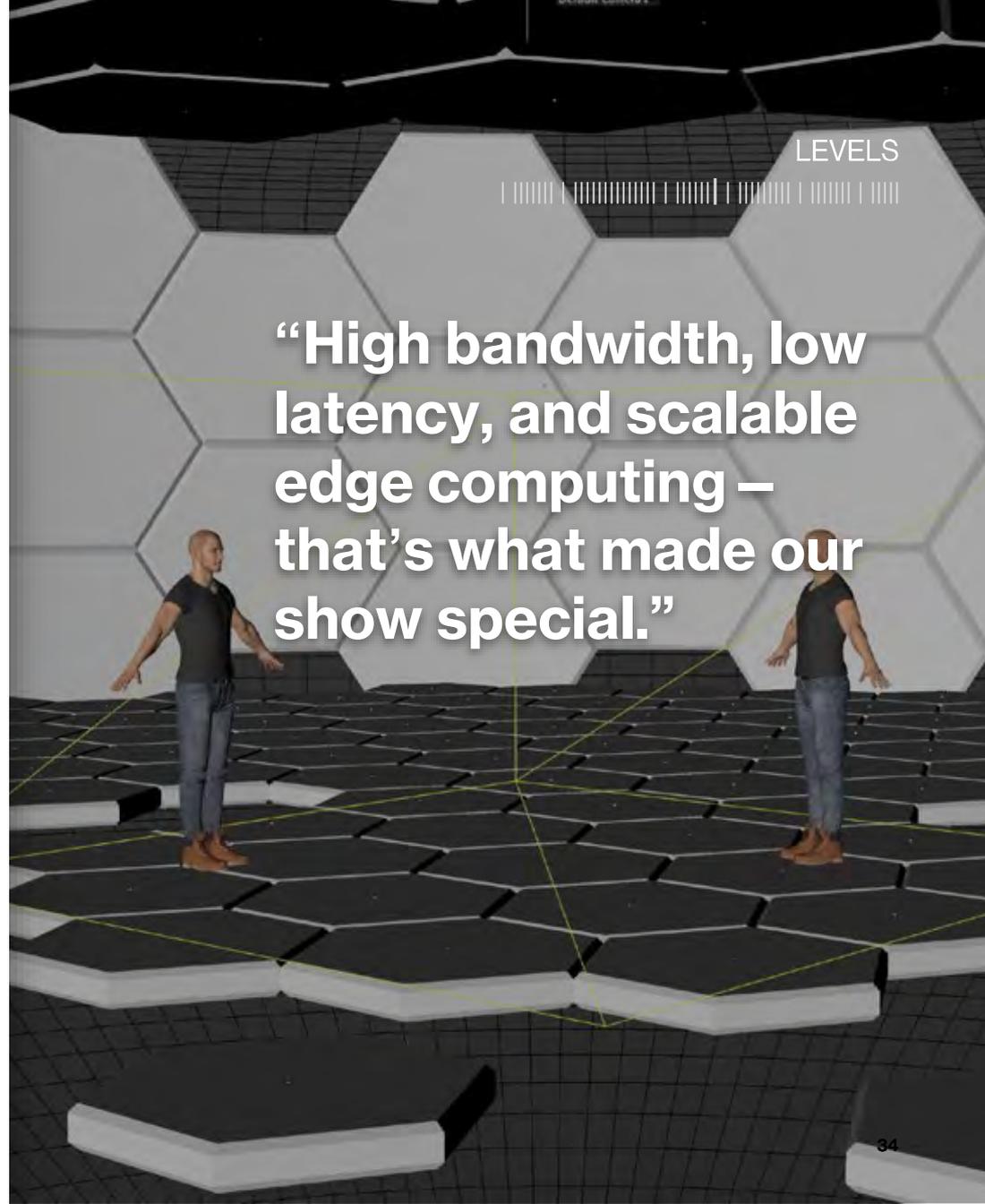


## LEVELS: A brand new live experience to drive tech validation

While the in-studio stage is a greenscreen, the virtual stage comes alive through Aaron's vision of hexagon tiles. "That turned into a way to transform the entire set from one level to the next," he says. What looks like a solid wall will flip tile by tile to transport the artist and audience between the levels.

The tiles are also the medium for people to call into the show, or for audience members to be highlighted. If they're in a Wavelength zone, anyone's phone can become a B-camera broadcast to the main screen in real time. This visual style opens up the world for future possibilities.

The possibilities made available by the foundation of 5G Edge brought together a team you might not normally find on a production crew. This behind-the-scenes team made the impossible possible. "We've made quite a complex show that gets at the heart of Verizon and AWS's tech," says Evan.



**“High bandwidth, low latency, and scalable edge computing – that’s what made our show special.”**

verizon<sup>✓</sup>

aws

# Behind the Scenes: The tech that powered LEVELS



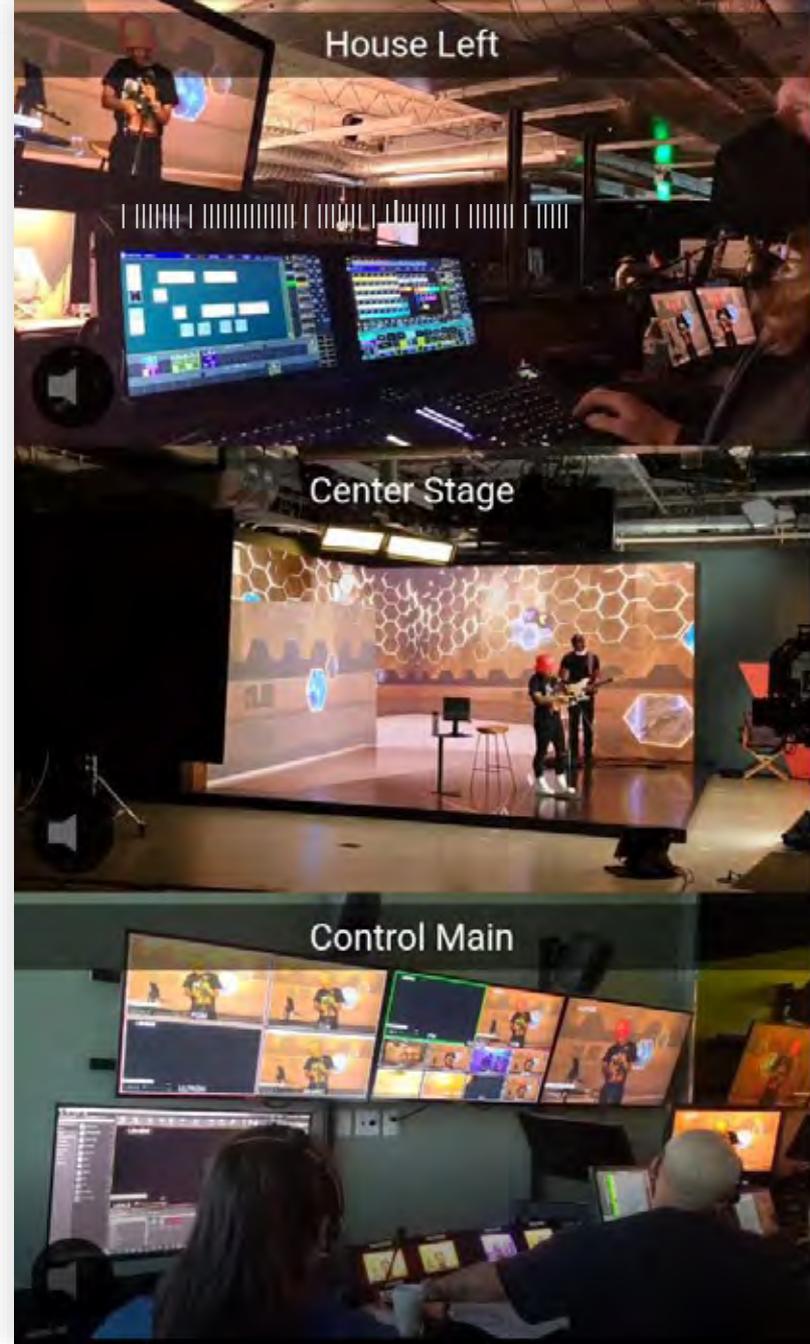
verizon

aws

1.0x

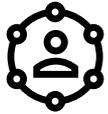
# The production workflow

What makes the show unique is the blending of traditional broadcast techniques with advanced tech 3D workflows. The entire show was live streamed through the gaming service Twitch, and rendered on Unreal Engine, a real time creation tool for immersive experiences. The 3D simulator Disguise D3 served as the show's media server and the hub of the show's activity, handling the calibration, the communication between the director, the rendering engine, the cameras – everything.



# This system necessitated a slightly different production team makeup

behind the scenes



**Director**



**Technical Director**



**Lab Innovators**



**XR Architect**



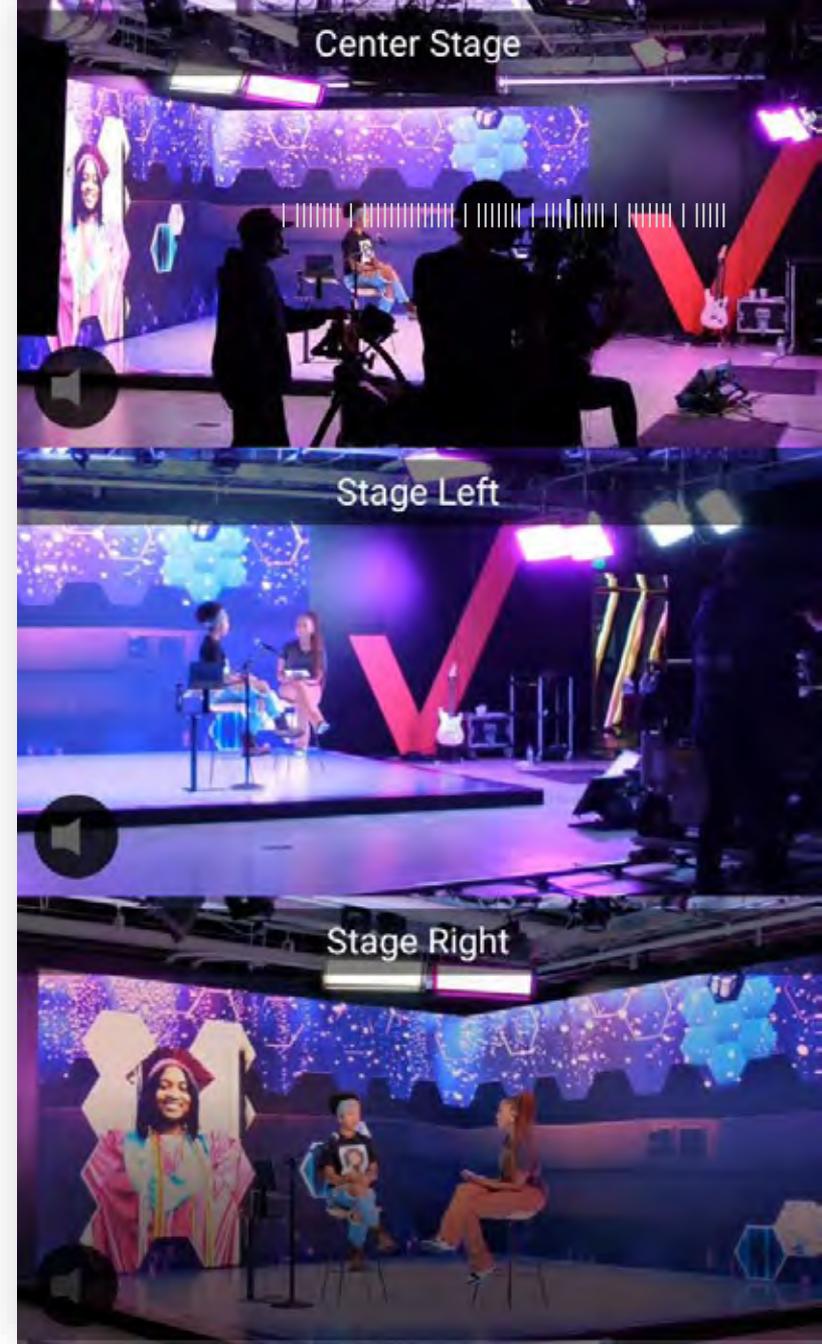
**Content Producers**

Because the space is both physical and virtual, the team needed to think more abstractly about how to capture the content. For example, the technical director didn't work on a traditional switcher to change camera angles, but instead told the Disguise server and Unreal to do the switching. The whole production is a handshake between local hardware, Unreal, and the other software providers who partnered with Verizon.

# A Perfect Partnership

The entire system is set up to be dynamic, as required by a live experience. As voting progresses, the threshold of what constitutes a completed level will change – this can't be anticipated in advance because it depends entirely on the live audience's reaction. So, as people spam on Twitch in order to vote between the levels, triggers are sent to Disguise which tells Unreal Engine to tweak a variable, resulting in a more engaged, organic experience between viewer and producer. This allows the team to adapt their strategy on the fly and dynamically alter the threshold.

**Because this production contained elements not normally seen in live events, Verizon invited a series of partners to collaborate with the Lab to create this unforgettable experience.**





# THE PARTNERS

In order to bring LEVELS to life, each piece of the puzzle came together from different partners who provided integral, sometimes first-of-its-kind technology. Each technical aspect relied on the low latency and speed that Verizon 5G Edge and AWS Wavelength provided to make LEVELS a truly engaging, immersive, real time experience.



# Multicasting.io

the partners



Multicasting.io is a platform for enhanced, real-time video experiences that aims to make events more interactive. “The main premise behind it is that everyone is walking around with a phone, so everyone is truly a broadcaster these days,” says founder and CIO Nem Kashanian. “Multicasting provides the capability to see things in real time at multiple angles which you wouldn’t have access to in normal circumstances.”

Multicasting.io leans heavily on 5G and MEC in order to do what they do. “We wouldn’t be in business without 5G,” says Nem. “We tried eight years ago over WiFi and it wasn’t capable.”

The lowest possible latency is the key to success here. When combined with AWS Wavelength, Multicasting’s tech clocks in at 250ms of latency – “you can’t get any more real time. It’s the blink of an eye at this point.”

Nem understands the importance of low latency in an entertainment experience like LEVELS. “You don’t want what you’re seeing with your eyes to be different than what you’re seeing on screen,” he says. “You want those interactions to be real. When someone’s reacting to something the crowd should all be reacting together.” With Verizon’s 5G and AWS Wavelength, all of that is possible and instantaneous.

Amazingly, Multicasting’s role in LEVELS – the ability to context switch to different views in real time – constituted the first iteration of anyone pushing web RTC into Unreal Engine, essentially bringing real time, two-way communication into a virtual environment.



# Ant Media

the partners



Ant Media creates servers used to power streaming-related projects and has users in 120 countries all over the world. Using 5G MEC they are able to scale for hundreds of thousands of users to watch a stream. That's why Ant Media is used by Multicasting.io. If Multicasting is the front end application, Ant Media is the server that powers it.

For Ant Media low latency is critical. Their servers power everything from broadcasts to autonomous vehicles, all of which require real time reaction. "When we open a web page if it takes longer than one second we start to get bored and it kills interactivity," says Yalim Eristiren, CRO at Ant Media. "Latency is a very critical part in this era because everything is very interactive, and it's increasing. The latency should be as low as possible – with 5G and on Wavelength, Ant Media's latency can decrease to 150ms."

Scalability is another concern, and another benefit to architecting in AWS. "We can scale the Ant Media server in Wavelength very easily. You can just deploy the scalable solution in about five minutes," he says. "It's a perfect match to run a very high quality and scalable streaming service."



# Summit Tech

the partners



Summit Tech develops applications for communication platforms, as well as streams 360 video. Before architecting on Wavelength, reliability of connectivity was a major concern for Summit Tech. “Even if there’s a fiber connection, we didn’t know where it was going to be routed,” says President and CEO Alido Di Giovanni. “It was always a guessing game.” So when carriers with 5G announced edge computing, Summit Tech knew it would be a game changer. “To be able to get closer to the customer at the mobile edge – this is priceless for us.”

For LEVELS, Summit Tech provided a plug-in for Unreal Engine based on their communications platform that enabled scalable network video calling. The show runner could queue up calls over the course of the show, have people on standby, and transfer calls to the virtual wall for the artist to interact with in real time. “It’s a truly interactive experience,” says Alido. Because it’s created with AWS, the backbone of the architecture is scalable so 10 or 200 people can call in at once.

When it comes to comms, buffer time can be a major disruption. “With too much jitter it becomes hard to have two-way communication,” says Alido. “Imagine having 100 people displayed on the wall and it becomes exponentially more challenging.” Here, the combination of 5G’s ultra low latency and the MEC’s ability to quickly and reliably aggregate the functionality means callers and live guests aren’t stepping on each other’s words.

All of this leads to a better audience experience. “For livestreaming with built-in comms, it’s important not to create disruptions because it becomes a negative user experience,” says Alido.





The key to all of these technological pieces coming together is the solid backbone of 5G MEC. The importance of 5G to LEVELS was the ability it provided to connect with the outside world with low latency and high bandwidth.

**“Sure, the show can live in its own bubble and be a cool experience, but without 5G there would be no way to broaden the audience,”** says Evan.

As much as the project was a success it was also a living experiment. As we enter a new era of production, we’re uncovering the types of production techniques that could leverage 5G – most of which haven’t even been conceived of yet simply because there’s never been a time where low latency and high bandwidth coexisted at this level of quality. The question of what this will do for future productions remains.

“The great thing about this team and a project like LEVELS is that it’s uncovering and deliberately developing and discovering those answers,” says Aaron

# The Evolution of Entertainment: What the future of production looks like (and what it means for business)



**If we look at LEVELS as a jumping off point, it begs the questions – how did we get here, what else is possible, and what could come next?**

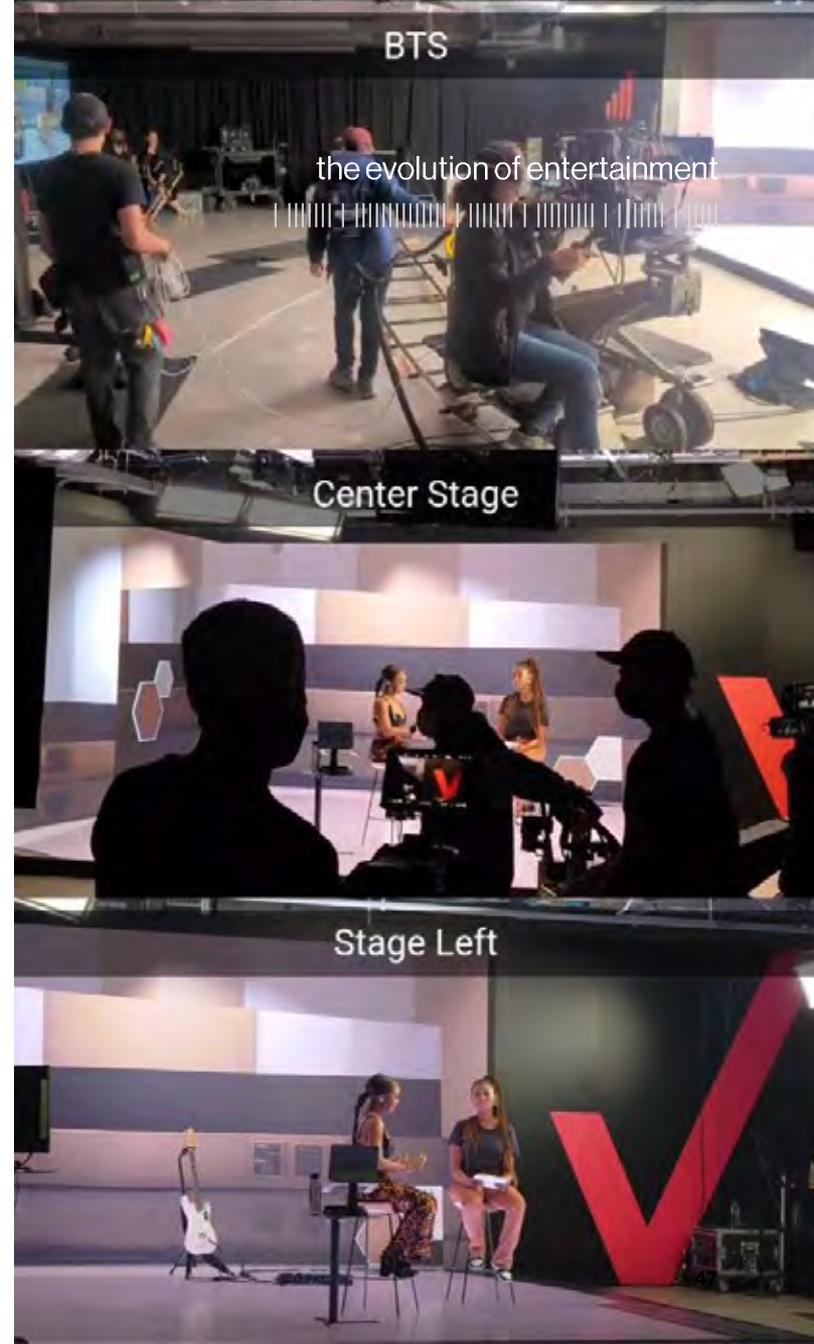


# Verizon 5G Lab: A sandbox for innovation

The Verizon 5G Lab, an incubator focused on the intersection of technology and entertainment, played a major role in this project coming to life. It serves as an innovation sandbox for creatives and developers alike. Spaces that enable playing, failing, and trying again are integral to coming up with the the next great idea.

“It’s extremely rare – telecom companies are not known for working on new ideas but this Lab is,” says Nem Kashanian. “You can’t wait two years to deploy something. If you have 5G speed, you need 5G thought processes. That’s what you get from the Lab, that’s what the Lab’s for.”

As technology evolves, creators need room to push the boundaries of what is possible – to envision experiences that have never been done before. “Bringing projects through the Lab you get to say ‘I know this sounds crazy but I want to do this,’ and they always say yes,” says LEVELS producer Evan Pesses. “It’s somewhat fearless,” agrees LEVELS creative director Aaron Kaminar.





# THE BUSINESS CASE

**When spaces of innovation enable creators to stretch their wings, they create new pathways for businesses to bring tech solutions to their consumers. Using LEVELS as a proof point, the business implications of this event alone are myriad.**





## Reduction of production Costs and technical staff

The way production is evolving, gear becomes more accessible, and the crews needed to bring high-quality content to life shrink. Increased bandwidth and 5G speeds at the edge of the network mean investments in the traditional centralized studio space isn't the necessity it once was.

“We did a trial with 5G MEC and not one ethernet cable, just a phone we were connecting to on a hot spot,” says Alido Di Giovanni. “We were doing Hollywood-quality production value, no IT specialist in the room, all the application servers on the edge, on demand as we needed it.”

This future is not far off. “I'm seeing a future where you can go into the field and do an XR shoot with limited crew and gear, and virtually limitless real time rendering power,” says Aaron Kaminar. If all you need is a camera and a 5G antenna, just a few people can create cinema-quality content from unique locations. This is decentralization and democratization at work.

## Boundless creativity, reaching engaged audiences

Enabling artists to be their most creative means providing robust tools that give them the time and space they need to break down walls and make something entirely new. A reliable, top-performing technical foundation is the canvas – it's up to the creators what they paint. “What was normally not possible before is not only possible, it's already happened,” says Nem Kashanian. This is how storytelling evolves.

“Verizon wants to create the roads for people to drive on,” says Evan Pesses. “They're letting creatives run with this tech.” Engagement is everything, so a future where entertainment is not passively but actively enjoyed is good for business. With this level of technology, that engagement can show up where the consumer is experiencing the content, how consumers are driving interaction with the content, and how businesses can monetize based on it.

# THE FUTURE OF ENTERTAINMENT

Much like the potential for human creativity, the future potential for this technology is limitless and will continue to evolve as access democratizes.

Take a professional sporting event as an example: there are fans in the stadium, fans in the parking lot, and fans watching from their couches at home. Each one is taking in the same event from very different vantage points, and each has different needs. The fan in the stadium might want access to different angles of gameplay they can't see from their row. The fan at home might want to absorb some of the energy of the crowd to feel more connected to the collective experience.

Not only can the combination of 5G and MEC turn every phone into a low-latency, real time broadcasting device, but the content captured by those phones and by the professional cameras can be distributed in different ways to provide customized experiences based on location. Suddenly content isn't merely optimized per device, but optimized per unique need of the consumer.



the evolution of entertainment





**Imagine the connection you  
can make to your consumer  
with this kind of knowledge  
and access.**



# Conclusion





**Levels is just the beginning of  
the endless potential  
provided by Verizon 5G Edge  
and AWS Wavelength**



# Conclusion



Imagine all the equipment, personnel, time, and money that goes into a live show or event – there are truckloads of items and rooms full of people required to make them work. What this innovative technology does is reduce everything down to its very foundation so everything serves the performance.

“Wavelength in this case acts as an online media production studio where all the involved parties can work in unison in order to pull this production together,” says Georgia Elissaios, director of product management for Edge Computing at AWS. “Now companies can work completely online, not only during the production of the event but also ahead of time in order to test and set everything up for gametime.”

Reducing costs, time, and equipment needs does more than save companies money – it democratizes production entirely. Simply being able to log onto your AWS console, with direct access to 5G Edge computing and various cloud services gets you access to everything you’d need to make something amazing come to life.

“That degree of democratization is important because it allows anyone to start pulling together productions, and creating completely new and innovative experiences,” says Elissaios. “It doesn’t close the circle to a select few.”

Aside from easing the needs for productions of any scale, this tech creates perhaps the most important aspect of all – a real sense of immersion for artists and audience. “In order to achieve this very human experience you need very low latencies. Wavelength allows for those low latencies because it is embedded within the 5G network so the traffic never has to leave the Verizon network,” says Elissaios. “With Wavelength what we achieve is to dramatically shorten the traffic path into just a few milliseconds so that these human interactive experiences can feel much more real.”



# Conclusion



Reducing costs, time, and equipment needs does more than save companies money – it democratizes production entirely. Simply being able to log onto your AWS console, with direct access to 5G Edge computing and various cloud services gets you access to everything you’d need to make something amazing come to life. “That degree of democratization is important because it allows anyone to start pulling together productions, and creating completely new and innovative experiences,” says Elissaio. “It doesn’t close the circle to a select few.”

Aside from easing the needs for productions of any scale, this tech creates perhaps the most important aspect of all – a real sense of immersion for artists and audience. “In order to achieve this very human experience you need very low latencies. Wavelength allows for those low latencies because it is embedded within the 5G network so the traffic never has to leave the Verizon network,” says Elissaio. “With Wavelength what we achieve is to dramatically shorten the traffic path into just a few milliseconds so that these human interactive experiences can feel much more real.”

And entertainment – art, music, storytelling, sports – relies on that connection in order to feel true. With Verizon 5G Edge and AWS Wavelength, we’ve started on a pathway to a more exciting, meaningful form of production. One that will pave the way for imaginations to run wild.

“ This is the future. This is how storytelling is going to evolve,” says Verizon’s Global head of business development of media and entertainment, Josh Arensberg.

“We don’t know what the picture is going to look like, but we want to build a canvas as robust and strong as possible so the most creative people can use it to do things we never thought were possible.”



## **Andrew Zarick**

Head of Partnership Activations - 5G Lab, Verizon  
andrew.zarick@verizon.com

## **Joshua Arensberg**

Global Head of Business Development, Media & Entertainment, Verizon  
josh.arenberg@verizon.com

## **Zarn Kucel**

Strategic Alliance Manager, 5G Edge & Hybrid Cloud, AWS  
zarnkucel@amazon.com





# LEVELS

**A 5G interactive experience**