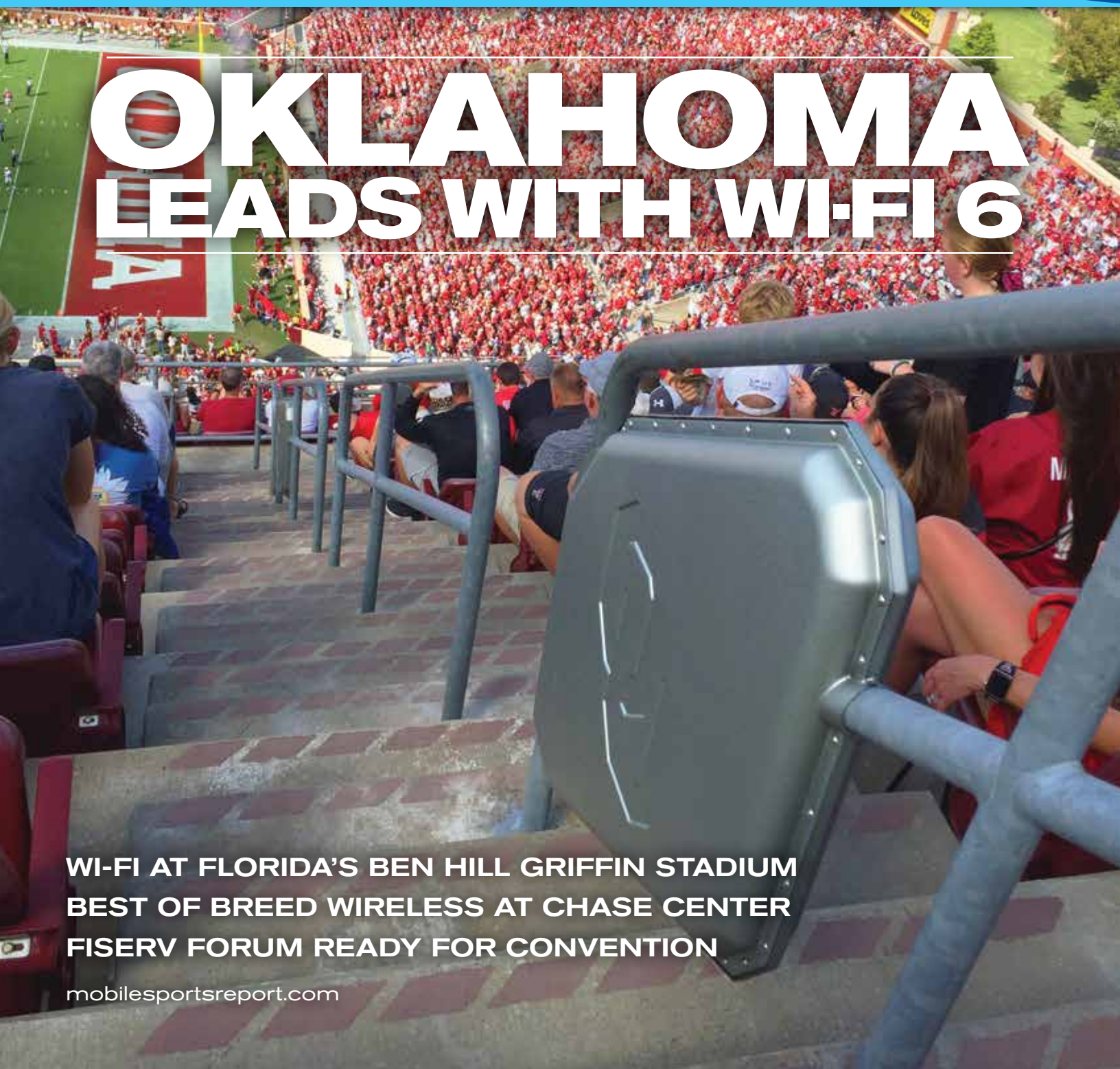
msr/mobile sports report

WINTER 2019/20

STADIUM TECH REPORT™



OKLAHOMA LEADS WITH WI-FI 6

WI-FI AT FLORIDA'S BEN HILL GRIFFIN STADIUM

BEST OF BREED WIRELESS AT CHASE CENTER

FISERV FORUM READY FOR CONVENTION

mobilesportsreport.com

mobilitie®
intelligent infrastructure

FOLLOW US ON

SMALL CELLS Wi-Fi DAS

Keeping Fans Connected.

As a global wireless solutions provider, **Mobilitie** deploys infrastructure that keeps fans connected in the most jam-packed and demanding environments. From stadiums to arenas to amphitheaters, we fund, design, build, and operate next-generation networks that enable rich mobile experiences and robust wireless connectivity. These solutions not only deliver the coverage needed for today's fast-paced world, but also anticipate the needs of tomorrow's increasingly connected fans.

VISIT MOBILITIE.COM TO LEARN MORE

msr/mobile sports report

STADIUM TECH REPORT™

Welcome to the fourth issue of our SIXTH year of STADIUM TECH REPORTS, the Winter 2019/20 issue! These quarterly long-form reports are designed to give stadium and large public venue owners and operators, and digital sports business executives a way to dig deep into the topic of stadium technology, via exclusive research and profiles of successful stadium technology deployments, as well as news and analysis of topics important to this growing market.

Our stories for this issue include an in-person profile of the new Wi-Fi 6 network at the Gaylord Family Oklahoma Memorial Stadium at the University of Oklahoma; we also have an in-person profile of the Wi-Fi and DAS networks at the Golden State Warriors' new Chase Center, plus a look at the new Wi-Fi network installed at "The Swamp," otherwise known as Ben Hill Griffin Stadium at the University of Florida. Capping off this feature-filled issue is a look at the DAS and Wi-Fi deployments at Fiserv Forum, home of the Milwaukee Bucks and the scene of this coming summer's Democratic National Convention.

We'd like to take a quick moment to thank our sponsors, which for this issue include Mobilitie, JMA Wireless, Corning, Boingo, MatSing, Cox Business/Hospitality Network, Oberon, and ExteNet Systems. Their generous sponsorship makes it possible for us to offer this content free of charge to our readers. We'd also like to welcome readers from the Inside Towers community, who may have found their way here via our ongoing partnership with the excellent publication Inside Towers. We'd also like to thank the SEAT community for your continued interest and support.

As always, we are here to hear what you have to say: Send me an email to kaps@mobilesportsreport.com and let us know what you think of our STADIUM TECH REPORT series.

Paul Kapustka, Founder & Editor
Mobile Sports Report

IN THIS ISSUE:

CORNING

Future-Ready Network

For The Way We Play

Can your venue keep up with the connectivity demands of tens of thousands of devices all at once? Whether you are planning a new venue or renovating your existing one, Corning fiber and cellular solutions can help you deliver a connected experience your fans will appreciate. Lay the fiber foundation so your venue can deliver the best today and be ready for years to come.

For a winning connectivity solution, visit us at **corning.com/gameday**

WIRELESS OUTLOOK FOR 2020:

Will the iPhone 11 drive faster Wi-Fi 6 adoption?

BY PAUL KAPUSTKA

You may not immediately think of Apple as a huge driver in the Wi-Fi business, but some initial data points surfacing at early Wi-Fi 6 network deployments may be showing that Apple's decision to include Wi-Fi 6 support in its new iPhone 11 line could end up driving faster adoption of the latest version of Wi-Fi technology.

As always with any such predictions we suggest you order a side grain of salt to go with our year-end crystal-ball outlook for what lies ahead in 2020. But from an active fall season where we traveled a bunch and talked to a lot of smart people, here are some other observations we have for what lies immediately ahead for the wireless technology marketplace for stadiums, arenas and other large public venues.

1. Wi-Fi 6 adoption may happen faster, thanks to Apple

If you were building a new stadium or doing a full Wi-Fi refresh over the past summer, the big budget decision most likely on your plate was whether to go with Wi-Fi 6 gear or to wait and use Wi-Fi 5 equipment for now. While those who went the Wi-Fi 6 route may have paid a higer up-front cost and gone through some of the normal struggles with first-generation products, some of the data we are seeing from stadiums with operational Wi-Fi 6 networks is that Wi-Fi 6 client devices are already showing up, in not-so-small numbers.

And you can largely thank Apple for that.

One unofficial but largely true statement we feel comfortable in making is that at most stadiums, iPhones are still the vast majority of devices in use. We haven't asked for any formal numbers but everywhere we go we keep hearing that stadium network users are typically a majority of Apple devices, sometimes as high as 70 percent of the active devices. (If this sounds like a good topic for future in-depth research, you think the same way we do.)

When the iPhone 11 line came out in September with support for the emerging Wi-Fi 6 standard, it caught many in the industry a little by surprise, since historically Apple has been conservative when it comes to putting new technology into iPhones. Those of us who have been around a bit remember that happening during the shift to 4G, when iPhones were pretty much a year behind the leading Android platforms in supporting LTE.

If you also believe (as I do) that sports fans represent both ends of the device-adoption curve – meaning that a certain percentage of fans will have the latest phones, while others may still have flip phones – it is those forward-leaning fans who most likely got iPhone 11 devices as soon as they were available. According to the Golden State Warriors, they are already seeing iPhone 11 traffic on the Wi-Fi 6 network they have in the bowl seating at Chase Center. And at the University of Oklahoma, the all-Wi-Fi 6 network put in at the football stadium this year saw a growing number of Wi-Fi 6 connections as the season went on, hitting 2,000+ at one game later in the year.

So it's just a drip of data, but enough to be noticed. Certainly something for you (and us) to watch as the year progresses and more Wi-Fi 6 networks come on line.

2. CBRS deployments will take time to arrive

And even though Apple also included support for Citizens Broadband Radio Service (CBRS) spectrum in the iPhone 11 line, we don't expect to see CBRS deployments in venues accelerate anytime soon. Though there was a lot of CBRS talk ahead of the FCC approval for initial commercial deployments (and a lot of whispers about numerous trials at venues), so far there have been only two public announcements of live CBRS networks inside sports stadiums, and both of these involve trial networks with no real deployment goal, and most significantly, no signed contracts.

While we remain big believers in the utility that the new bandwidth and LTE support may eventually bring, it's easy to see why CBRS faces a slow adoption rate in sports venues. The main reason may just be historical inertia, the same conservative approach that has (still!) kept many venues from deploying even basic connectivity on the Wi-Fi or cellular fronts. Second may be the combination of a lack of budget and expertise; because there is no have-to problem that CBRS solves, teams and venues don't need to rush into deployments.

And while we do believe that CBRS will eventually do great things for applications that need more mobility and security, the lack of turnkey-type approaches (like, "here is your CBRS package for parking-lot connectivity") makes it a naturally longer sales cycle.

Throw in the fact that many venues may also be currently facing a Wi-Fi overhaul decision or what to do next on the cellular front as 5G arrives, and you have even more reasons for putting CBRS-type discussions on a back burner. The good news is, by the time CBRS starts getting more real, devices will probably have the dual-SIM issue solved in a more user-friendly fashion. When that happens the ability to use CBRS networks as a sort of Super-DAS should accelerate adoption – but that's not a 2020 thing, at least as far as we can tell.

3. 5G is coming, whether anyone wants it or not

You can't escape the press releases, headlines and other paid-for proclamations that 5G cellular services are now live in many sports stadiums. But given the fact that devices that support 5G are still at a minimum, only a lucky few fans will likely take advantage of the fast, low-latency bandwidth, at least for the time being.

Going back to Apple – which did NOT include support for 5G spectrum in the iPhone 11 – you can guess why stadiums that have 5G services are reluctant to talk about exactly how many users are on the 5G networks. Here's a hint: It's not a lot. The good news for venues is, however, that since the 5G wars are basically a huge marketing battle between the largest cellular carriers, that means that those carriers will basically pay to put those networks into venues, so all you really need to do is provide some space in the rafters and a fiber connection.

At Mobile World Congress in Los Angeles, we did hear from Ericsson and Verizon that early 5G deployments in stadiums are showing some welcome surprises, like "better than expected" ability for signals to roam – meaning that you can actually (maybe) leave your seat or twist your phone and not lose the signal.

So while the loudly hyped promises of 5G applications in venues – virtual reality! fan-provided video! – remain just an idea, more good news is that with little user pressure, network engineers, equipment vendors and service providers all have some time to learn what works and what doesn't in a live environment. But for 2020, 5G in stadiums is more about carrier TV commercials than real commercial uses.

4. 4G LTE and DAS are still needed

One of the more-pertinent questions (and the subject of an upcoming MSR Research report) is what happens to the 4G LTE and DAS world inside venues, as carriers want to focus on 5G. The answer here is not as clear, but what's undeniable is that 4G LTE services are still going to be the balance of cellular traffic for at least the next two years, if not more. That means that venues of all sizes still need to have a DAS or small-cell strategy, which gets tougher as carriers squeeze the margins traditionally charged by neutral third-party hosts.

If you're a big or high-profile venue, you may not have as much to worry about, as for places like that (think Super Bowl, NBA/concerts, or any MLB stadium) it will likely be business as usual with carriers participating in DAS deployments. The biggest wild card on the DAS business side going into 2020 is the still-unresolved question of whether or not T-Mobile and Sprint will actually become one company. In places like Chase Center, that means negotiations over how T-Mobile and/or Sprint will come on to the DAS are on hold. Unfortunately, it's the customers who will suffer the most as DAS participation from T-Mobile and Sprint gets delayed.

Another thing we'll be looking at in the upcoming DAS and 4G report is what deployment methods will take the lead going forward – will the traditional top-down DAS antenna deployment method still work, or will under-seat deployments (like the one at Chase Center, see report in this issue) proliferate? Another trend to keep watching is the use of MatSing ball antennas, which are gaining more acceptance every time we talk to stadium IT teams. Amalie Arena went big with an all-MatSing DAS (using 52 of the big ball antennas) and Fiserv Forum recently put in 10 MatSings (again, see report in this issue). We are also hearing of MatSing deployments happening in football stadiums, so watch for more MSR info on that front this year. –MSR–

Enable the ultimate technology experience.

• Managed WiFi • Wayfinding • Distributed Antenna Systems (DAS)
• App Development • Digital Signage • Small Cell Networks

Find out more at coxhn.com

COX BUSINESS® | HN Hospitality Network

IN THE LONG HISTORY OF COLLEGE FOOTBALL, THE UNIVERISTY OF OKLAHOMA IS A NAME THAT IS ALWAYS SOMEHOW IN THE DISCUSSION WHEN IT COMES TO TOP TEAMS AND HEISMAN-QUALITY TALENT. AND NOW YOU CAN ADD STADIUM WI-FI TO THE LIST OF THINGS OKLAHOMA DOES WELL, AFTER AN OFFSEASON DEPLOYMENT OF A 100 PERCENT WI-FI 6 NETWORK AT GAYLORD FAMILY-OKLAHOMA MEMORIAL STADIUM.

OKLAHOMA LEADS THE WAY WITH WI-FI 6

BY PAUL KAPUSTKA

OKLAHOMA LEADS WITH WI-FI 6

Formerly among the most conspicuous Wi-Fi have-nots among big-school stadiums, the Sooners have now moved to the front of the class with a network of approximately 1,350 access points in their 80,126-seat stadium, all new models that support the emerging Wi-Fi 6 standard, also known as 802.11ax. With a deployment led by AT&T, using gear from Aruba, a Hewlett Packard Enterprise company, and a design and deployment from AmpThink, using mainly handrail-mounted enclosures in the main bowl seating areas, OU fans now have the ability to connect wirelessly at the most advanced levels, with a technology base that will support even better performance as the balance of attendee handsets starts to catch up to the network with support for Wi-Fi 6.

"We're very excited" about the new network, said David Payne, senior technology strategist for athletics at the University of Oklahoma's information technology department. Payne, who has been at Oklahoma since 2003, has spent the last several years shepherding the overall stadium Wi-Fi plan into place, starting first with Wi-Fi coverage for the stadium RV parking lots, then adding initial forays into stadium Wi-Fi deployment when Oklahoma renovated the south part of the stadium three years ago. But this past offseason was the big push to full stadium coverage, a trek that included a switch in equipment vendors that was prompted by Oklahoma's solid commitment to the emerging Wi-Fi 6 standard.

FACING PAGE: THIS STADIUM NOW HAS WI-FI 6 AS WELL AS A TOP FOOTBALL TEAM. THIS PAGE: THE SOUTH STANDS ARE A GREAT PLACE TO CATALOG OKLAHOMA'S GRIDIRON SUCCESS. CREDIT, FIRST PHOTO: UNIVERSITY OF OKLAHOMA. CREDIT, THIS PAGE: PAUL KAPUSTKA, MSR

Committed to Wi-Fi 6 for the future

If there was a tricky time to pull the trigger on Wi-Fi 6, it was this past summer, when not every vendor in the market could ensure it would have enough gear on hand to fully supply a big stadium like Oklahoma's. And even though Wi-Fi 6 gear is new and generally more expensive than previous versions, for Payne and Oklahoma the long-term benefits combined with the periodic ability to refresh something as significant as a football stadium network made committing to Wi-Fi 6 somewhat of a no-brainer.

Payne, like many other big-school IT leaders, has spent years helping administrators and others at budget-deciding levels of leadership at his school try to understand the benefits of stadium-wide Wi-Fi connectivity. For many of those years, it just didn't make sense to try to push through the multi-million-dollar expense of a project "that would only be used six or seven Saturdays a year," Payne said. "There's always a difficulty in telling the story of what value you receive in this since it's different from traditional revenue streams," Payne said. "There isn't a direct dollar seen from Wi-Fi users."

CLOCKWISE FROM TOP LEFT: CABLING HEADS THROUGH A CORE DRILL IN THE UPPER SEATING AREA; FANS LINE UP TO ENTER THE STADIUM; A WI-FI AP COVERS A CONCESSION STAND. CREDIT ALL PHOTOS: PAUL KAPUSTKA, MSR

But with the late-2018 approval of a capital expenditure project to revamp the football stadium's lower-bowl seating with new handrails, wider seats and other ADA-related improvements, Payne and the IT team were able to weave in the extra $3 million (out of a total project cost of $14.9 million) it would cost to bring full Wi-Fi coverage to the entire stadium.

"It's just taking advantage of the timing to get economies of scale," said Payne. Because of the already-planned work on the handrails, Oklahoma was able to add the AmpThink-designed handrail Wi-Fi enclosures (which use the handrail pipes to carry cabling) for a fraction of the cost of having to do that work as a separate project, Payne said. The university had also installed new backbone gear and cabling during the south end zone renovation, so that cost was already paid for.

The decision to commit to Wi-Fi 6, Payne said, was based on standard release projections from manufacturers. "We paid close attention to projected order availability and ship dates," Payne said. "We were felt that if we were able to receive the gear by June, we could complete the project on time."

Though some manufacturers were not sure of being able to fully deliver Wi-Fi 6 gear, Aruba, Payne said, had "high confidence" in meeting the deadlines, and won the deal. According to Payne, all the Aruba gear was shipped in time to begin construction in June.

"It's important for us to get the full life cycle of technology, so that's why we decided to go 100 percent Wi-Fi 6," Payne said.

Attention to detail an AmpThink hallmark

On a visit before and during a home game against Texas Tech in late September, Mobile Sports Report was able to test the live network in all parts of the stadium, with strong performance at even the highest seating levels as well as in sometimes overlooked spots like the long ramps that fans walk up to get in and out of the venue.

The Oklahoma deployment was part of a very busy summer for AmpThink, with similar Wi-Fi design and deployments at Oklahoma, Ohio State and Arkansas. Like those two others, Oklahoma's main bowl AP deployment was in the patented AmpThink handrail enclosures, each stamped with the distinctive "OU" logo.

The handrail deployment system, which typically includes a core drill through the concrete floor to bring wiring into the handrail tubing, is now a standard process for AmpThink, following similar deployments at the Minnesota Vikings' U.S. Bank Stadium and at Notre Dame Stadium, among others. At Oklahoma, AmpThink said it used 10 different handrail enclosure designs to fit all the necessary spaces.

AmpThink president Bill Anderson was present during our visit and took great pride in showing off some of the finer points of an AmpThink deployment, including a method of using a metal sleeve and some clever waterproof paint and sealant to ensure that no moisture finds its way into the holes used for cable delivery.

CLOCKWISE FROM TOP LEFT: ANTENNAS UNDERNEATH THE PRESS BOX OVERHANG; WI-FI COVERS THE STAIR-WELLS; CONCOURSES COVERED FROM THE TOPS OF COLUMNS; AN ANTENNA ABOVE A CONCESSION STAND; TOP-DOWN COVERAGE IN THE SOUTH STANDS. CREDIT ALL PHOTOS: PAUL KAPUSTKA, MSR

SOME OLD STADIUM PHOTOS SHOW HOW VENUES LIKE OKLAHOMA'S CHANGE OVER TIME. CREDIT: PAUL KAPUSTKA, MSR

"We spend a tremendous amount of time [during deployments] making sure there isn't any water leakage under the stands," Anderson said. "Because you never know what is going to be below. This is a big part of what we do. We don't just sell an enclosure."

The same can be said of AmpThink's overall network designs, which it monitors and tests and tweaks as fans use the system. On the game day we visited, no fewer than four AmpThink employees were at the stadium in the network control room, checking AP performance and network usage.

"We're pretty proud of what we can do," Anderson said about the company's track record for network design in large venues. "We have proven formulas which we reliably implement."

Solid speed tests throughout the venue

At 10:20 a.m. local time, just ahead of the early 11 a.m. kickoff, Mobile Sports Report started our testing inside the main-level concourse, where fans were already lining up to purchase cold beer, another first at the stadium this season. In the midst of the entering crowds we got a speedtest of 55.9 Mbps on the download side and 43.7 on the upload side, an inkling of the strong tests we were to see everywhere we walked. In the concourses and near concession stands, a mix of overhead and wall-mounted APs provided coverage.

Up in the stands, we took our first test among the railing-mounted enclosures in section 6, row 51, just about at the 50-yard line. We got a mark of 68.2 Mbps / 58.7 Mbps before the stands were completely full. We then hiked up to row 67, which was underneath the press box overhang and served by overhead APs, not railing enclosures. There we got a speedtest of 27.8 Mbps / 49.5 Mbps, a half hour before kickoff.

One more speedtest in the lower bowl (around the 30-yard line, in row 19) netted a mark of 68.9 Mbps / 61.2 Mbps; then as we walked around to the south end zone, we got a mark of 38.7 Mbps / 64.3 Mbps in the south concourse, busy with fans getting food and drink ahead of the imminent kickoff.

The recently renovated south end of the stadium has a series of loge boxes and other premium seating options, and has an overhang which provides additional real estate for Wi-Fi AP mounting options. Ducking into a loge box (covered by overhead APs) for a quick test we got a mark of 36.8 Mbps / 54.2 Mbps just before kickoff. Moving around to the corner of the south stands for the pregame ceremonies we got a mark of 33.7 Mbps / 63.8 Mbps even as all the phones were out to capture the team run-on and school song rendition. After kickoff, we went into the crowded main east concourse and got a mark of 43.2 Mbps / 46.6 Mbps amidst all the late-arrivers.

Good coverage in the stairwells

If there is one area where stadiums sometimes skimp on wireless coverage it's in the stairwells and pedestrian

AMPTHINK USED 10 DIFFERENT HANDRAIL ENCLOSURE DESIGNS TO FIT ALL PARTS OF THE STADIUM.

ramps, which may not seem like an important place to have connectivity. But at Oklahoma, the multiple switchbacks it takes to climb from ground level to the top seating areas are all well covered with Wi-Fi, as we got a mark of 39.9 Mbps / 29.5 Mbps during a brief rest stop on our hike to the top of the east stands.

At a concession stand on the top-level concourse we got a mark of 61.3 Mbps / 70.5 Mbps, as we admired the neatness of the core drilling we could see that got the cabling to the underside of the seating areas above. In the stands we got a mark of 57.5 Mbps / 69.5 Mbps at one of the highest rows in the stadium, row 24 of section 226, a half hour after the game's start.

Hiccups, headaches and increasing users of Wi-Fi 6

According to Payne our visit coincided with the first live game with the Wi-Fi 6 software fully turned on, part of a sort of rolling start to the network deployment which wasn't fully live at the first game on Aug. 31.

"It wasn't without some hiccups and headaches," said Payne of the overall deployment, which included a small number of temporary black-colored handrail enclosures from AmpThink, which saw its single source of handrail molding material run out of supply late in the summer. According to Payne Oklahoma started the season with 966 radios working on the network, ramping up with more at each home game until reaching full capacity later in the season.

Oklahoma also experienced what other venues deploying Wi-Fi 6 may find – that some of the very oldest devices still in use may have issues in connecting to the Wi-Fi 6 equipment. Payne said one such problem surfaced in the press box (where reporters were using older laptops) but it was solved by creating some virtual APs which were tuned to an older version of the Wi-Fi standard.

OU also didn't widely promote the network early in the season, but by the Oct. 19 home game with West Virginia not only was the school promoting the network on the stadium's big video boards, the IT team also added the ability for students to automatically join the stadium network via their regular WiFi@OU SSID used around campus.

With 82,620 in attendance for the West Virginia game the total number of Wi-Fi users took a big jump from the previous high, with 25,079 unique connections, according to numbers provided by Payne. When Iowa State came to Norman on Nov. 9, the network saw its highest usage with 32,673 unique users, who used approximately 4.2 terabytes of data while in the stadium.

What was also interesting to Payne was the number of devices connected using the Wi-Fi 6 standard, which

CLOCKWISE FROM TOP LEFT: THE HANDRAIL ENCLOSURES ARE PRETTY MUCH EVERYWHERE IN THE SEATING BOWL; A CLOSEUP OF THE WATERPROOF SEAL; CABLING RUNNING UNDER THE UPPER SEATING DECK; AN UPPER-BOWL ENCLOSURE;; FULL HOUSE AT OU ON A SUNNY SEPTEMBER AFTERNOON. CREDIT ALL PHOTOS: PAUL KAPUSTKA, MSR

CLOCKWISE FROM TOP LEFT: WI-FI 'COACHES' GET READY TO ASSIST FANS; OU FAITHFUL DURING THE PREGAME CEREMONIES; THE SCOREBOARD HELPS GET FANS ONLINE. CREDIT, COACHES AND SCOREBOARD PHOTOS: UNIVERSITY OF OKLAHOMA; FAN PICTURE: PAUL KAPUSTKA, MSR

currently is only supported by a small number of phones. Payne noted that the first week OU had the Wi-Fi 6 working in the stadium was the same week Apple started delivery of its new iPhone 11 line, which includes support for the new Wi-Fi 6 standard. After seeing 941 devices connect on Wi-Fi 6 at the Texas Tech game, Payne said Oklahoma saw a steady increase of Wi-Fi 6 devices at each following home game, with 1,471 at the West Virginia game and 2,170 at the Iowa State game.

Is AX coming 'sooner'... rather than later?

Though most consumer handsets being used today do not support the Wi-Fi 6 standards, Apple's decision to include Wi-Fi 6 support in its latest iPhone 11 line as well as Wi-Fi 6 support from other new Android phone models suggests that device support for the standard may be coming sooner, rather than later, to the fans in the stands. When that happens and the Wi-Fi 6 network starts utilizing its new capabilities, Oklahoma's network will be among the first to make use of the new standard's ability to support more clients at higher connection speeds, critical features for big networks in small places like football stadiums.

The non-insignificant number of AX devices already seen by the stadium network, Payne said, felt like good justification of the school's decision to commit to Wi-Fi 6.

Looking ahead to next season, Payne said he will be working with school network officials to see how to more closely tie the stadium network with the overall campus wireless infrastructure, and to see how the school might be able to incorporate a stadium app or web-based sites to increase the ability of the network to improve the fan experience. Currently Oklahoma uses a portal from AmpThink to get email addresses from network guests, which Payne said will be used by marketing and ticketing departments to try to increase engagement.

The good news is, Payne said, is that "we are no longer looking at what it costs to put a network in place" to drive any new digital experience ideas.

For Oklahoma athletics director Joe Castiglione, it was important for the school to deliver an amenity that provided a a consistent fan experience whether a fan was in a suite or in the upper deck, a goal our tests seem to have validated.

"We feel that the Oklahoma tradition is among the strongest in the nation and really want to provide a top-notch fan experience to celebrate that tradition," Castiglione said. "Wi-Fi is just the beginning of enhancing that experience. We hope to be able to use it to engage our fans through in venue activations and experiences that would not be available without the addition of Wi-Fi." –MSR–


MATSING®
LENS TECHNOLOGY ENABLED
It's now a whole new ballgame.
MatSing Lens Antennas
Powering your exceptional cell experience.
Find out more at matsing.com
LENS TECHNOLOGY ENABLED

WI-FI BREATHES NEW LIFE INTO 'THE SWAMP'

CAN WI-FI HELP BRING NEW LIFE TO AN OLD VENUE? IN A WAY, THAT HAPPENED THIS FALL WHEN THE UNIVERSITY OF FLORIDA LIT UP A STADIUM-WIDE WI-FI NETWORK AT BEN HILL GRIFFIN STADIUM, THE 88,548-SEAT VENUE KNOWN BY MOST AS JUST "THE SWAMP."

BY PAUL KAPUSTKA

THE 'GATOR WALK' IS A PHOTO-TAKING TRADITION OUTSIDE THE STADIUM ON GAME DAY. CREDIT ALL PHOTOS: PAUL KAPUSTKA, MSR

Though at Florida, like most SEC stadiums, the fans don't really need any technology to fire them up, the addition of a NFL-caliber Wi-Fi network from Extreme Networks and Verizon was quickly embraced by fans in Gainesville, with one early contest against Auburn cresting the 11-terabyte mark for total data used. If nothing else, with the network in place a whole world outside of the stadium walls gets to see the arm-chomping craziness that makes Ben Hill Griffin Stadium one of the nation's premier college football venues, thanks to social media and other apps that let fans share their game-day experience.

But beyond the obvious benefits for fans, the new network also brought new features to the Gators' back-of-house business operations, including being able to connect a new point-of-sale system for concession stands, while also providing the potential for better digital engagement with the people in the stands. According to Florida athletic director Scott Stricklin, the addition of Wi-Fi has given Ben Hill Griffin Stadium somewhat of a new lease on life, with the ability of the new to augment the old.

"We had a lot of the inherent challenges of putting technology into a 90-year-old venue," said Stricklin, "but it's also interesting how technology allows you to work around those challenges."

By partnering with stadium-application developer VenueNext, which has recently expanded its services to include a back-end POS system, Florida can now offer fans at home games a wide menu of digital-powered services, like the ability to order food and drinks ahead of time for pickup at express windows, and the ability to click on a phone to say "Water Me," to have cold water delivered to the sunny-seat sections of the stadium.

For the business of running the stadium, the new VenueNext POS system allowed Florida to shed its old cash-drawer system to one that can now provide a connected way to manage concession stands.

"The new app and POS technology makes concessions better for everyone, it's faster for those who order ahead of time, and the lines are shorter," Stricklin said. "It's a fascinating idea that technology can extend the useful life of a facility."

Scenes from a retrofit: drilling and conduits

Like many other big-bowl stadiums at the big football schools, Ben Hill Griffin Stadium is a work built over time, with different renovations and additions adding layers of concrete and seating in ways that definitely did not have wireless networking in mind. And like many other schools, Florida had a tough time historically making the case for the capital outlay needed to bring Wi-Fi to a venue that might only see six or seven days of use a year.

CLOCKWISE FROM TOP LEFT: WI-FI APS ARE VISIBLE UNDER BENCHES AND CLUB SEATS; A CONCOURSE DEPLOYMENT; METAL FLASHING AND CONDUITS BRING CABLES TO UNDERSEAT APS; UNDER-SEAT APS VISIBLE AS WHITE DOTS IN THE STANDS; CONDUIT UNDER THE SEATS HEADS UP IN ORDERLY FASHION; A QR CODE OFFERS A QUICK WAY TO DOWNLOAD THE APP; AND CENTER, A TOOTHY WELCOME TO THE CLUB LOUNGE.

WHEN YOUR NETWORK SCORES

FANS WIN

Boingo handles the fan-first experience from end-to-end, so you can focus on your fans, not your wireless network.

Let's Get Started.

Doug Lodder | SVP, Business Development
dlodder@boingo.com | 310-586-4023

boingo

FANS IN THE SUNNY SECTION OF BEN HILL GRIFFIN STADIUM CAN ORDER COLD WATER DELIVERED TO THEIR SEATS BY USING THE MOBILE APP'S 'WATER ME' SERVICE.

At his previous job as athletic director for Mississippi State, Stricklin was part of an SEC advisory board that just five years ago didn't see stadium Wi-Fi as a priority. Fast forward to 2019, and both the world in general and Stricklin have changed their views.

"At one point, Wi-Fi was seen as a luxury item [for stadiums]," said Stricklin. "Now, connectivity is like running water or electricity. You've got to have it."

An RFP process for a full-stadium Wi-Fi network ended up getting Florida to choose a $6.3 million proposal from Verizon and Extreme, which have paired together for similar big-stadium deployments before, mainly at NFL venues like Green Bay's Lambeau Field and Seattle's CenturyLink Field.

"Obviously they're experienced," Stricklin said of the Extreme-Verizon pairing. "The success they've had before played a big role in increasing our comfort level."

Like at those stadiums, at Florida Verizon has its own separate SSID for Verizon customers, who can be automatically connected to the Wi-Fi upon entering the stadium. Other guests can sign in for free via a portal screen.

According to Matt Vincent, Florida's director of infrastructure operations, construction of the network actually started during the 2018 season, with small-section rollouts of the service. Over this past summer, however, the heavy lifting went in, with Extreme finishing the full-stadium design with 1,478 APs, all Wave2 802.11ac. Of that number, approximately 1,200 are in the main seating bowl, with most of those located in under-seat enclosures.

Unlike some other under-seat deployments where a separate core drill was done for each AP location, at Florida Extreme was able to reduce the number of concrete holes needed with some ingenious use of conduit and metal plating. In many areas of the stands, one hole through the concrete supports a number of APs, with conduit and metal plating covering the connections under and behind the seats and benches.

If you know what you are looking for, when you wander the maze of concourses under the seating sections you can spot a new network of conduit pipes that bring the cabling from the network out to the seats. In concourses, clubs and other areas with overhead mounting places, Extreme also used omni-directional antennas and other typical indoor equipment for coverage.

Getting to 11+ TB with fast, consistent coverage

At Florida's biggest home game of the year, an Oct. 5 game against Auburn (a 24-13 Florida victory), Gator fans used 11.82 terabytes of data on the Wi-Fi network, one of

CONDUIT HEADS UPHILL TO UNDER-SEAT CORE DRILLS; AN EXPRESS PICKUP LANE AT A CONCESSION STAND; AND ONE OF FLORIDA'S HEISMAN HEROES.

the top totals ever seen at a college venue. Mobile Sports Report visited the stadium for a Nov. 9 game against Vanderbilt, and found strong performance on the network stadium-wide, including in harder-to-cover areas like concourses and narrow seating areas under overhangs.

Starting our testing in the club-seating lounge area, MSR got a Wi-Fi speedtest of 68.6 Mbps on the download and 65.2 Mbps on the upload, in front of a stuffed alligator with a very toothy grin. Heading down to the main entry gate, we got a mark of 50.2 Mbps / 61.8 Mbps as fans were streaming in just ahead of game time.

In a somewhat enclosed seating area on the lower level behind one end zone, we got a test of 21.9 Mbps / 29.9 Mbps just as the Gator mascots took the field for pregame activity. Moving up into the upper deck of section 43, we got a mark of 47.8 Mbps / 50.9 Mbps just after kickoff. Heading under the upper deck stands to the top concourse we got a mark of 43.6 Mbps / 55.5 Mbps, while drawing puzzled stares from fans wondering why we were taking pictures of the metal tubes running up the back of the seating floor.

Stopping under the other end zone for a Gatorade break, we sat at some loge-type seats and got a mark of 61.2 Mbps / 64.4 Mbps. Then moving back out into the stands we got our up-close picture of the sign welcoming us to "The Swamp," where we got a speedtest of 54.0 Mbps / 53.8 Mbps.

An island of connectivity among the crowds

While Florida's Vincent spends most of his game days working to assure the network keeps running at top performance, he said that stadium staff enjoys the Wi-Fi as well.

"It's been just a night and day difference for everyone since we added the Wi-Fi," Vincent said, noting a tweet from a fan during the Auburn game that said "the only place in town his phone could connect was at the stadium."

While saying the decision to deploy Wi-Fi was still somewhat of a leap of faith, Stricklin gave credit to the Florida staff members who prepared the reports outlining the benefits such a system could bring to the venue, for both the fans as well as for the school.

"It's a little like Indiana Jones when he steps out [over the cliff] and doesn't see the floor below him," Stricklin said. "It's an intense capital outlay [to build a Wi-Fi network] and I don't know that we'll ever see it all returned in terms of numbers. But again, I thank the staff and partners like VenueNext who all had a great vision of what a connected stadium could do. With mobile ticketing, you have the opportunity to learn who's in your stadium. There are concrete ways we can use connectivity to engage, learn about fans, and keep up with them. It's a wise investment." –MSR–

WITH HIGH PERFORMANCE WI-FI IN THE STADIUM, GATOR FANS CAN RECORD AND SHARE EXPERIENCES TO THEIR HEART'S DELIGHT.

POWERFUL CELLULAR CONNECTIVITY AT WISCONSIN'S ENTERTAINMENT HUB

Serving Generations of Milwaukee Bucks' Fans

Fiserv Forum, the new home of the NBA's Milwaukee Bucks basketball team, is more than just an arena. This 714,000 square foot sports and entertainment facility is a central recreation hub in Milwaukee, which will gain even further relevance as the surrounding 30-acres are developed with entertainment, residential and commercial spaces. Fiserv Forum wanted to guarantee a world class fan experience, and to accomplish this goal, it needed to supply the best mobile communications. To ensure powerful wireless connectivity, the solution designer and network operator and owner, ExteNet Systems, selected JMA Wireless, a global leader of wireless communication solutions.

Situation: Complex Sports Venue Brings Complex Challenges

Today's arenas are complex environments that require wireless connectivity for many reasons. It is critical that a wireless network is both reliable and robust enough to handle all these different use cases. And, with the introduction of 5G soon, it must be future-proof to support even more applications and services.

Congested wireless networks often can be a critical issue at large venues. This problem is caused by a high volume of users concentrated across a limited area, all expecting constant wireless connectivity. And, this concern will be further amplified with 5G.

Fiserv Forum's fans/mobile phone users subscribe to a variety of wireless carriers, using various frequency bands and technologies. It is critical that the wireless system support all cellular operators and bands.

Furthermore, dedicated wireless coverage is necessary for public safety. In the event of an emergency, it is critical that not only first responders, but also fans and employees have reliable mobile communications.

Providing reliable cellular coverage for over 17,000 people in a single location is never a routine exercise. At Fiserv Forum, this challenge is further compounded by the tons of steel and concrete used in its construction, which impede cellular signals from the outside.

As the surrounding entertainment district progresses, seamless wireless connectivity from Fiserv Forum to the newly developed area will be expected. However, the network equipment enabling wireless communication must blend into the surrounding landscape to maintain the environment's aesthetics.

Solution: JMA Wireless Offers Unprecedented Innovation

Fear the Deer is the mantra of the Milwaukee Bucks, but its fans have nothing to fear when it comes to powerful wireless connectivity. This fourth utility was a foundational element, which was included in Fiserv Forum's architectural plans from the start.

This plan included multiple solutions from JMA Wireless, such as its industry-leading TEKO® DAS (distributed antenna system), which provides wireless coverage and capacity for five cellular carriers and is future-proof ready for 5G. To support the venue's 34 sectors, a combination of high power remote units (RUs) and software defined remote units (SDRUs) along with 215 antennas were deployed. Finally, the FUZE™ platform was installed to support the forum's heterogeneous network. It includes an integrated IDF mounting and cabling kit for DAS and Wi-Fi delivery. Plus, the platform's Digital Electricity™ can supply power to equipment up to one mile away.

Result: A Wireless Victory

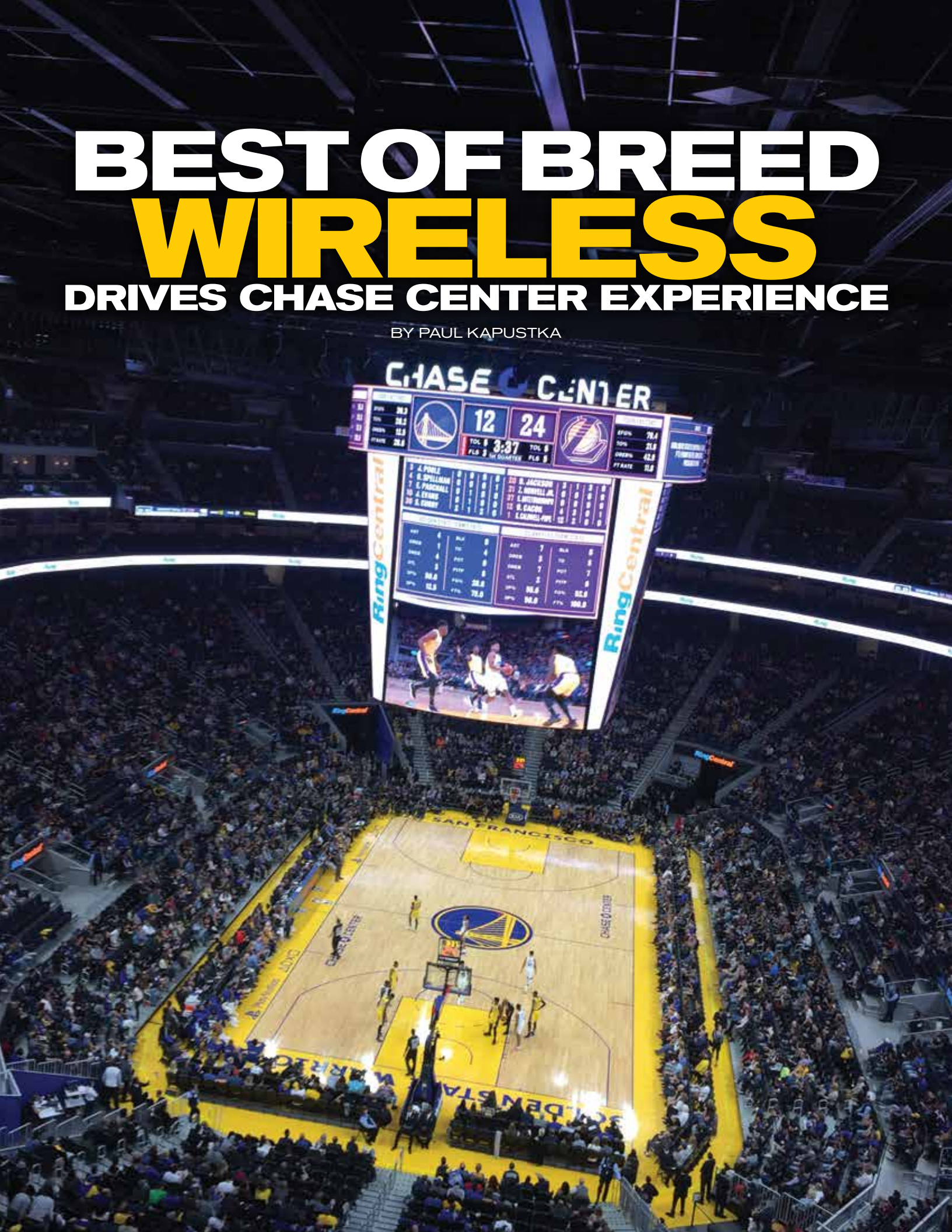
Thanks to JMA Wireless and ExteNet Systems, Fiserv Forum has achieved its goal of providing a world class fan experience. As the surrounding area is developed and 5G enables many new applications and services, the future-proof wireless network will be there to support them.

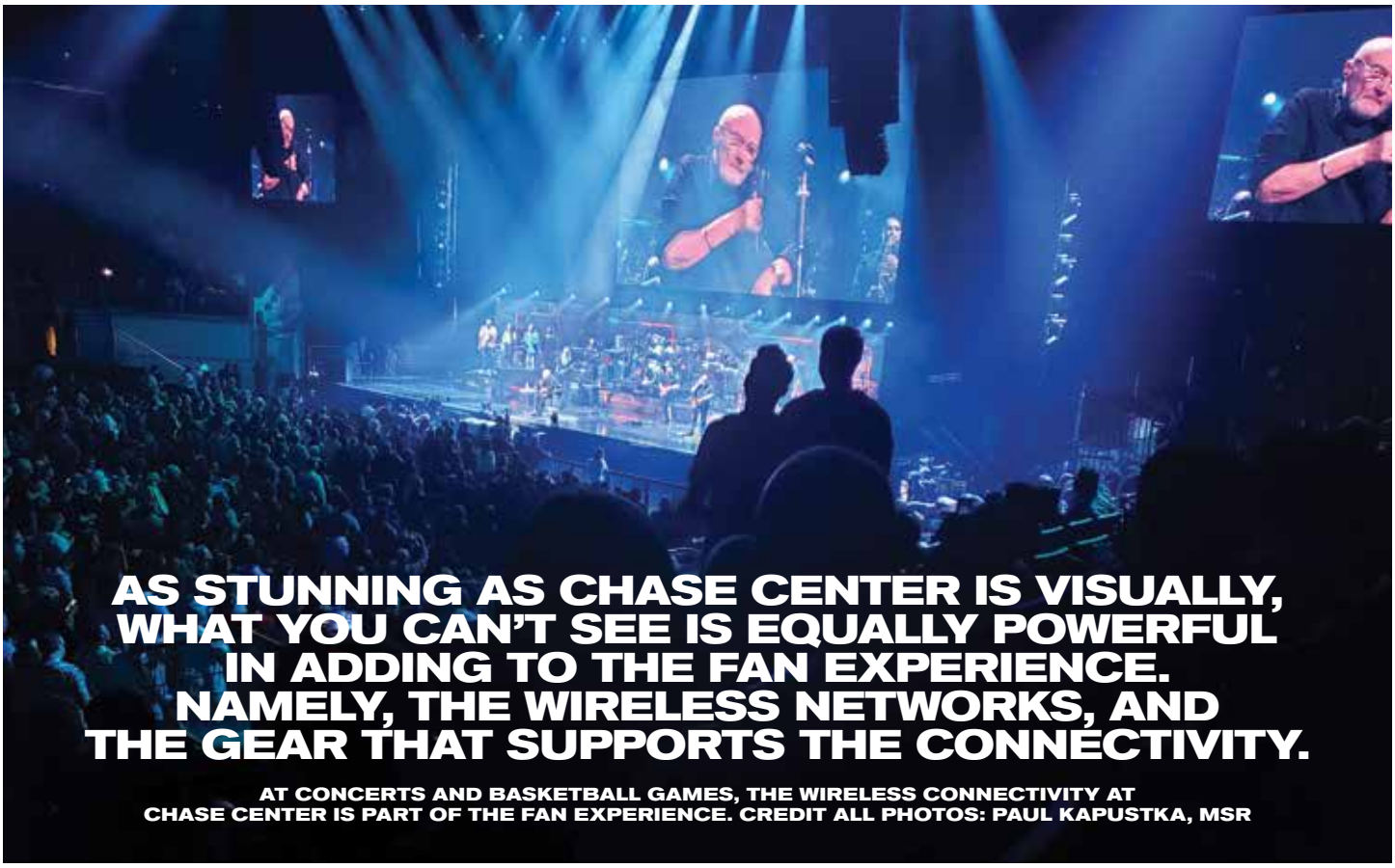
To learn more about the deployment at Fiserv Forum, view the video case study at https://info.jmawireless.com/about/videos.

JMA WIRELESS

BEST OF BREED WIRELESS DRIVES CHASE CENTER EXPERIENCE

BY PAUL KAPUSTKA





AS STUNNING AS CHASE CENTER IS VISUALLY, WHAT YOU CAN'T SEE IS EQUALLY POWERFUL IN ADDING TO THE FAN EXPERIENCE. NAMELY, THE WIRELESS NETWORKS, AND THE GEAR THAT SUPPORTS THE CONNECTIVITY.

AT CONCERTS AND BASKETBALL GAMES, THE WIRELESS CONNECTIVITY AT CHASE CENTER IS PART OF THE FAN EXPERIENCE. CREDIT ALL PHOTOS: PAUL KAPUSTKA, MSR

Inside the shiny new home of the NBA's Golden State Warriors, which sits on the edge of the San Francisco Bay, is a cellular DAS deployment from Verizon using Corning gear that may be the new forward-thinking model for cellular infrastructure for large public venues like stadiums and arenas. The 18,000-seat arena also has a Wi-Fi network using gear from Aruba, a Hewlett Packard Enterprise company, which supports the emerging Wi-Fi 6 standard for communications inside the main seating bowl.

But if you're attending a Warriors game, or one of the many concerts scheduled at Chase Center, you may not ever see the equipment that brings the world-class connectivity to the fans. Both the DAS and the Wi-Fi networks utilize an under-seat antenna deployment method, just part of an aesthetic plan that does its best to minimize the visual impact of antennas and other wireless gear. Even deeper into the building is all the optical fiber supporting the networks, with capacity for future needs already in place.

During a mid-October visit before all the networks were fully tuned, Mobile Sports Report still got strong test results from both Wi-Fi and DAS networks in most areas in and around the arena, clear confirmation that the Warriors' goal of having excellent wireless connectivity at their new home was right on track. And with the Corning ONE system in behind a DAS design built from the ground up with future needs in mind, as well as the expected capacity gains coming from Wi-Fi 6, the Warriors and their partners are confident they've built a wireless system worthy of their world-class venue goals.

"We feel extremely proud" of the venue's wireless systems, said Brian Fulmer, director of information technology for the Golden State Warriors. Though the inevitable construction delays led to some late nights heading up to the arena's Sept. 6 public debut, according to Fulmer all wireless systems were fully online for the opening Metallica concert, where the arena saw 2.58 terabytes of data used on the Wi-Fi network with another 2.69 TB used at another Metallica show a couple days later.

"It was a race to the finish line but we did it, and the performance speaks for itself," said Fulmer.

Searching for 'Best in Breed'

If there was ever a chance to build the best-ever new arena, Chase Center was probably a once-in-a-lifetime opportunity. When you combine the championship run of the team on the court with a devoted fan base centered in one of the hottest economic markets ever, you have the liberty to search for quality instead of bargains on every level.

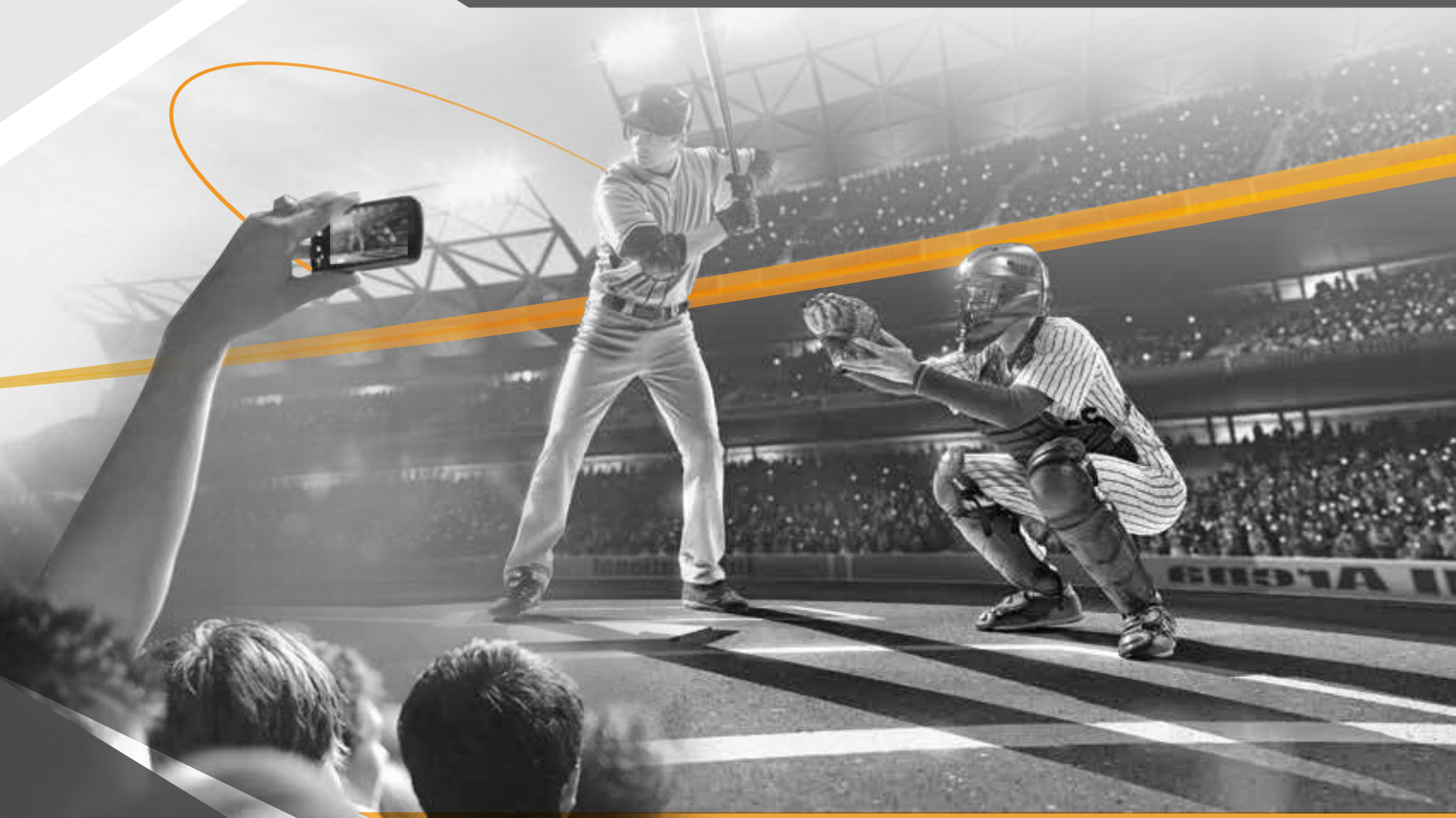
extenet SYSTEMS

DELIVERING TOMORROW'S CONNECTIVITY TODAY

Connecting Stadiums for a Better Fan Experience

World Class Solutions Advancing Connectivity

Serving Carriers, Venues and Teams



www.extenetsystems.com

CLOCKWISE FROM TOP LEFT: WIRELESS EQUIPMENT IN THE RAFTERS POINTING AT THE TOP SEATING AREAS; WARRIORS PRESIDENT RICK WELTS HOLDS COURT IN FRONT OF THE HUGE OUTDOOR DISPLAY; A WI-FI AP ON THE STADIUM'S EXTERIOR; AN UNDER-SEAT WI-FI ENCLOSURE.

(Case in point: The Warriors were able to sell out of their new court-level luxury suites, which have rooms just under the stands that include private wine lockers and can cost up to $2 million per year. Clearly, this is a model that may not work in places that aren't Silicon Valley.)

For the privately financed $1.4 billion building, the Warriors turned to consulting firm Accenture to help determine the "best in breed" technology partners, especially on the wireless front. Several Warriors executives interviewed for this story did all agree on one main point: The team was not trying to install any technology to win imaginary awards for being the best or fastest building out there. Instead, it was all about how technology, especially wireless, could help bring about a world-class experience during every visit.

"Nobody shows up [at an arena] just looking for fast wireless speeds," said Mike Kitts, the Warriors' senior vice president for partnerships. "They want to interact. We wanted to create unforgettable experiences in an engaging environment. With the end in mind of a world-class experience, we knew great technology would absolutely play a role."

Like a team drafting top players, the Warriors ended up choosing Verizon to lead the distributed antenna system (DAS) for cellular wireless, and Aruba for Wi-Fi. To build its neutral-host system, Verizon chose Corning and the Corning ONE platform, with an installation led by Communication Technology Services (CTS).

"We certainly leveraged the expertise of Verizon, as well as AT&T (which is also on the DAS as a client)," said Fulmer. "They've done this countless times, and they have the lessons learned of painful experiences."

Building a DAS that can handle growth

Anyone in the stadium business in Northern California doesn't have to look too far or remember too long ago to recall one such example of the pain that the nonstop growth in cellular demand can cause. After the San Francisco 49ers' brand-new home, Levi's Stadium, opened in 2014, the also brand-new DAS had to be upgraded the very next season to ensure it had enough capacity for the upcoming Super Bowl 50. Verizon, which basically invented under-seat DAS antennas for that deployment, said it had a goal at Chase Center to build a DAS that didn't need upgrading for at least a few years.

Terry Vance, senior manager for Verizon's Pacific market network performance group, said "the plan from day 1 was to build a DAS with capacity for today and

IF THERE WAS EVER A CHANCE TO BUILD THE BEST-EVER NEW ARENA, CHASE CENTER WAS PROBABLY A ONCE-IN-A LIFETIME OPPORTUNITY.

A CALDER MOBILE GREETS FANS INSIDE THE WEST ENTRYWAY.

DURING OUR OCTOBER VISIT, MSR GOT WI-FI SPEEDTESTS OF 27.3 MBPS DOWNLOAD AND 18.2 MBPS UPLOAD WHILE STANDING OUTSIDE THE EAST ENTRY DOORS.

tomorrow. We needed to build this DAS so that for the next 3 to 4 years, we won't have to touch it."

Verizon also had to build the DAS in a way that complied with the Warriors' stringent requirements for clear sight lines, especially in the main bowl seating area. According to the Warriors' Fulmer, the team "looked at handrail [enclosure] designs," but rejected them in favor of an under-seat approach. Though more costly in both equipment and construction, the under-seat approach was Verizon's favored method as well to get more density in the arena.

What Verizon ended up with was a design that currently uses 71 active sectors, with 42 of those in the seating bowl. According to Vance, all the sectors in the bowl area can basically be split into two parts if needed, for a total of 84 potential bowl sectors. Currently, Vance said there are 598 under-seat DAS antennas in use.

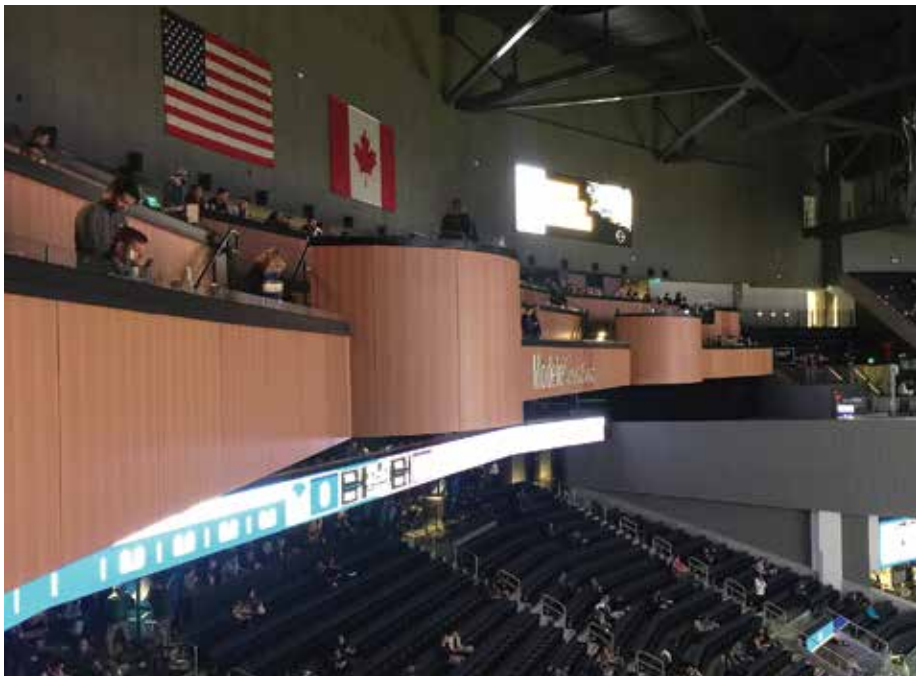
According to Vance the Corning ONE system's extensive use of optical fiber makes it easier to add capacity to the system as needed.

"The fiber to the edge [in the Corning system] is especially useful as you go to 5G," Vance said. Though it's not part of the shared DAS system, Verizon also has full 5G bowl coverage at Chase Center, one of the first arena deployments in California. Verizon also is using a couple of MatSing ball antennas, mounted in the rafters to provide cellular coverage to the floor area for concerts and other non-basketball events. Right now AT&T is the only other carrier on the DAS, with participation from T-Mobile and/or Sprint pending depending upon the outcome of those two companies' potential merger.

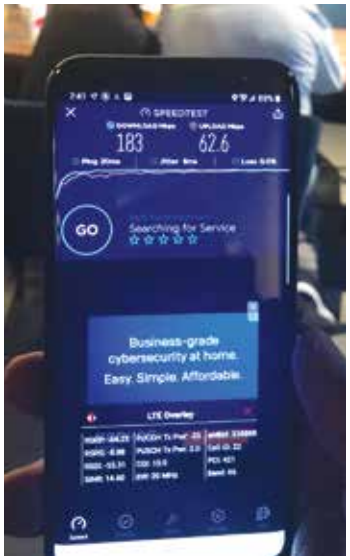
Jessica Koch, sports and entertainment director of business development for Corning optical communications, gave praise to integrator CTS for its deployment know-how, which she said was "critical to the success of this project." Corning, Koch said, knows that for fans in large venues like Chase Center, "reliable connectivity without restriction – all the time, at full speed, on any device, from anywhere – has become the expectation in our connected world."

For Warriors president and COO Rick Welts, the best wireless system is one fans don't see or worry about, but just use without concern.

THE MIRROR BALLS OUTSIDE THE EAST ENTRY ARE 'SELFIE CITY' FOR CHASE CENTER ATTENDEES.



CLOCKWISE FROM TOP LEFT: THE UPPER-DECK CONCOURSE; THE BIG VIDEO BOARD, HIDDEN IN THE CEILING DURING A CONCERT; THE 'THEATER BOX' SEATING AREA IN THE UPPER DECK; UNDER-SEAT DAS AND WI-FI ENCLOSURES; AN OUTDOOR DECK JUTTING OUT ON THE STADIUM'S BAYSIDE EXTERIOR.



LEFT TO RIGHT: STATS RULE ON THE LED SCREENS IN THE UPPER DECK; A 5G SPEEDTEST; A 4G LTE SPEEDTEST. CREDIT FOR SPEEDTEST PICTURES: VERIZON WIRELESS.

"The best thing is if the phone just works, and I don't have to think about it," said Welts, who led a stadium tour during MSR's October visit.

Though Verizon said the system went through some necessary optimization during the hectic early events schedule at Chase Center, Verizon engineers are currently getting DAS speed tests in excess of 100 Mbps for both download links in most locations, according to Philip French, vice president of network engineering for Verizon. Download speeds for 5G connections, he said, are breaking the 1 Gbps mark.

"This DAS is unique since it was the first one we've built with 5G in mind from the ground up," French said. "It's a very robust design, and for us this is the design of the future."

Leading the way with Wi-Fi 6

Like several other stadiums that were being finished this past summer, Chase Center was able to take advantage of the release of Wi-Fi equipment that supports the emerging Wi-Fi 6 standard. Though all the new capabilities won't be fully realized until most end-user devices also support the new version of Wi-Fi, having support for the technology inside the arena was key for the Warriors' plans.

"You can never really be 'future proofed' but we were extremely fortunate with the timing [of Wi-Fi 6 gear arriving]," said the Warriors' Fulmer. "We were right in the sweet spot for an initial deployment."

According to Aruba, Chase Center has approximately 250 Aruba 500 Series APs (which support Wi-Fi 6) deployed in the main seating bowl, mostly in under-seat enclosures. Overall, there are approximately 852 total APs used in the full Chase Center network, which includes coverage inside the building as well as in the connected outdoor plaza areas.

During our October visit, MSR got Wi-Fi speedtests of 27.3 Mbps on the download side and 18.2 Mbps on the upload side while standing outside the east entry doors near the big mirror balls that are selfie central for fans visiting the new arena. Inside the doors, our speedtest in the lobby got a mark of 55.8 Mbps / 68.6 Mbps.

On one upper concourse area, near several concession stands outside portal 57, we got a speedtest of 10.5 Mbps / 11.2 Mbps. In the seats in upper section 220 just before tipoff we got a mark of 46.0 Mbps / 28.0 Mbps, and in a lower-bowl concourse area outside portal 9 we got a test mark of 53.7 Mbps / 71.5 Mbps.

According to Aruba, several events other than the Metallica concerts have passed the 2 TB Wi-Fi data mark so far, with several events seeing more than 8,000 unique clients connected and marks of 6,000+ concurrent connected devices and 2.6 Gbps of throughput.

The Warriors' Fulmer praised not just the Wi-Fi gear but the full "end to end network solutions" available from Aruba as well as from parent Hewlett Packard Enterprise, which is a founding partner at Chase Center.

"We're still only three months in, and there's a lot more that we want to do," Fulmer said. "It was not a small undertaking. But I think we can let the technology speak for itself." –MSR–

> An annual hive mind of sports and entertainment execs.
>
> — *Sports Illustrated*

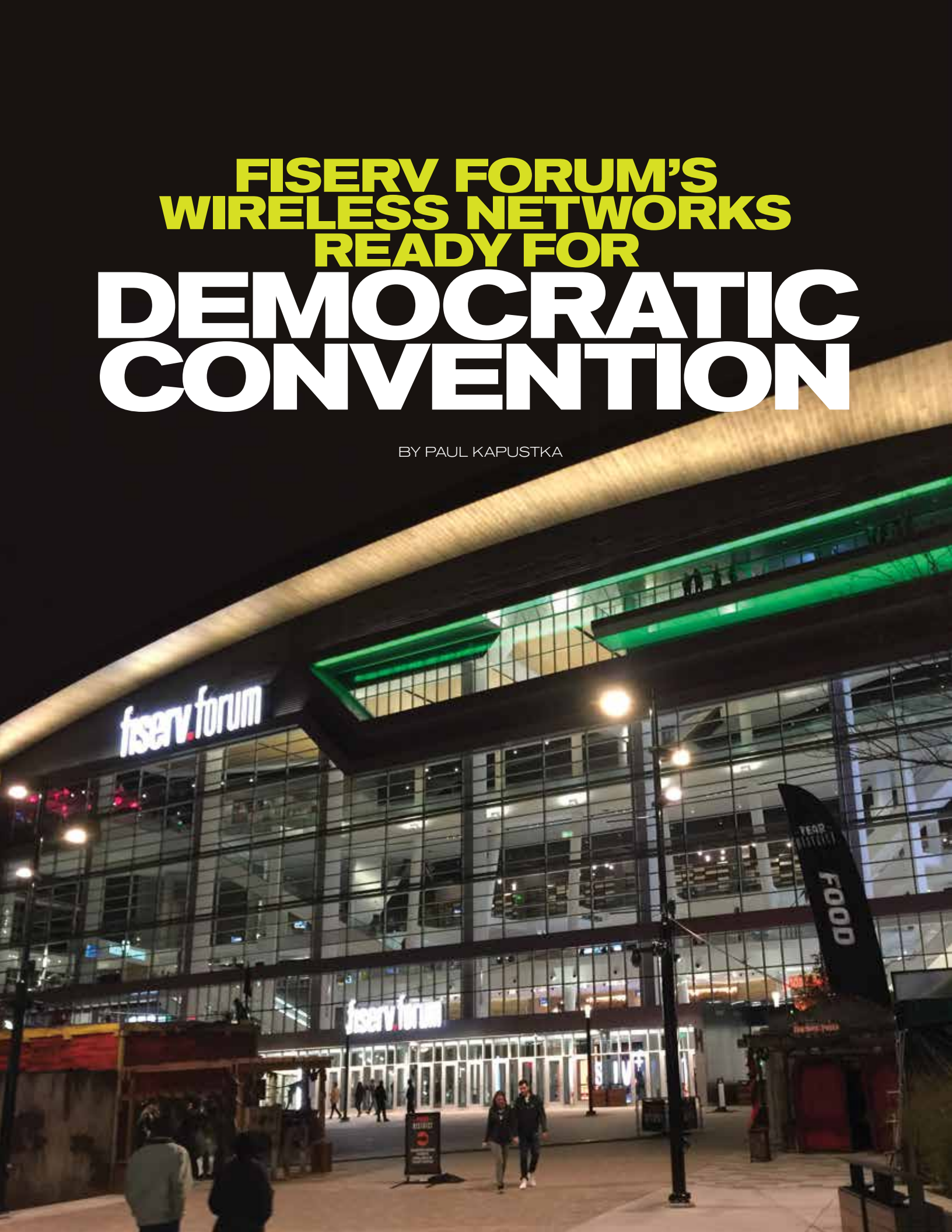
Ask about our new

MEMBERSHIP

seatconference.com

FISERV FORUM'S WIRELESS NETWORKS READY FOR DEMOCRATIC CONVENTION

BY PAUL KAPUSTKA



FACING PAGE: FISERV FORUM'S ENTRYWAY GLOWS AT NIGHT. THIS PAGE: THE BUCKS' ROBERT CORDOVA IN THE DAS HEADEND ROOM. CREDIT ALL PHOTOS: PAUL KAPUSTKA, MSR

With one of the most demanding arena-sized events headed its way this upcoming summer, the wireless networks at Milwaukee's Fiserv Forum appear to be more than ready to handle any audience demand for mobile connectivity.

With a full-featured distributed antenna system (DAS) deployed and operated by ExteNet Systems using gear from JMA Wireless, as well as a Wi-Fi network using Cisco gear, Fiserv Forum shows both the expertise of wireless providers who have a long history of knowing what works, as well as the foresight to add new techniques and technologies to combine high performance with the quality aesthetics that are the hallmark of the new home of the NBA's Milwaukee Bucks.

And while a Mobile Sports Report visit this fall for a Bucks game found all the wireless elements in top working order, the big event for the venue's second year of operation will be the Democratic National Convention in July 2020. While the four-day nomination gathering is a test for any locale, Fiserv Forum's forethought on how to prepare for numerous types of events in and around its uniquely designed structure has it well prepared to handle whatever wireless needs the convention will require.

It all starts with the DAS

Even in these days of predictions of the death of DAS, Fiserv Forum is proof that for high-profile venues, carriers will still participate in a quality deployment. And while many venues have just two or three cellular providers on their DAS, according to ExteNet, the Fiserv Forum DAS has five major carriers participating – AT&T, Verizon, T-Mobile, Sprint and U.S. Cellular.

Unlike some new arenas, where wireless is an afterthought to construction, ExteNet was involved early on, according to Manish Matta, vice president of marketing at Extenet.

"Getting in sooner rather than later is always better," said Matta, who said ExteNet was well involved in the overall construction plans, ensuring that there were no delays associated with wireless deployments holding up construction of other parts of the building.

During a pregame tour in October with a team from ExteNet as well as with Robert Cordova, chief technology and strategy officer for the Bucks, Mobile Sports Report got an up-close look at some of the inside parts of the DAS network design, including the headend room and multiple antenna installations that were hard to find given their well-designed placements and camoflauging.

CLOCKWISE FROM LEFT: A LOWER-BOWL MINI WI-FI ENCLOSURE; A DAS ANTENNA HIDDEN ABOVE A CONCOURSE; A WI-FI ENCLOSURE CAMOUFLAGED IN A CLUB AREA.

In addition to regular enclosures that were painted or otherwise placed in areas out of the main sight lines, ExteNet and JMA also utilized some of the newer circular flat-panel antenna enclosures that fit flush to ceilings, minimizing the exposure.

The 215 DAS antennas are powered by 40 remote units. According to JMA, the remotes are connected to the backbone with optical fiber, and use digital power to bring power to elements up to a mile away. With 16 sectors in the bowl design, the DAS is able to segment coverage to all parts of the arena, including the bowl as well as concourses and other in-house areas.

ExteNet, which owns and operates the DAS as a neutral host, also installed 10 extra MatSing ball antennas in the rafters for additional top-down coverage. Though only AT&T is using the MatSings right now, ExteNet said they are integrated into the DAS design if other carriers should wish to utilize them in the future.

During a short walk-around before the Bucks game started, MSR got a DAS speedtest of 85.8 Mbps on the download and 14.9 Mbps on the upload, even though our older iPhone (on the Verizon network) doesn't support all the latest DAS capabilities. Near the start of the game, as the pregame introductions were at their peak, we got a DAS mark of 18.0 Mbps / 15.7 Mbps in the middle of an upper-deck seating area (Section 227) and then a little bit after the game started, we got a mark of 21.3 Mbps / 12.5 Mbps near a bar area on the upper-level concourse.

Wi-Fi inside and out

On the Wi-Fi side of things, a visitor to Fiserv Forum can connect to the network even before coming in the doors, as part of the 623-AP Cisco installation includes Wi-Fi APs mounted on light poles in the "Deer District," the plaza area on the stadium's east side that connects to an outdoor beer garden and several bars and restaurants that were all part of the planned environment built in sync with the arena's opening. Before we went inside, we got a Wi-Fi speedtest of 40.5 Mbps / 40.2 Mbps in the middle of the Deer District plaza, which was hosting a pop-up haunted house attraction sponsored by Jack Daniels.

Inside the building, we again needed some guidance from the Bucks' Cordova to locate some of the Wi-Fi APs, which are inside triangular enclosures that are either painted to match wall surfaces, or utilized as high-visibility section number signs, hiding the gear in plain sight.

In the seating bowl, Fiserv Forum again shows its commitment to aesthetics with the smallest handrail


Wireless
Home-Field
Advantage
You need complete Wi-Fi coverage in your venue, but how will you deploy it? Oberon enclosures step up to the plate, even in the most challenging environments, to protect and conceal your access points.
OberonInc.com
OBERON
Mounting Solutions for Wi-Fi Access Points

CLOCKWISE FROM TOP LEFT: A WI-FI ENCLOSURE ABOVE THE UPPER SEATING DECK; THE OUTDOOR VIEW FROM THE PANORAMA LOUNGE; MORE WIRELESS EQUIPMENT WITH A DISCREET PRESENCE.

enclosures we've ever seen, a discreet hand-sized enclosure that tucks the antenna components neatly into the top part of a railing, with the AP electronics hidden below the seating areas. Designed by integrator Johnson Controls and its ecosystem partners, Abaxent and AccelTex, the 28 special enclosures are also designed to be easy to detatch and re-attach (with a simple two-click "dart connector") which facilitates keeping the network working when the lower-bowl seating areas need to be reconfigured for different events.

Sitting in a courtside seat near one of the handrail enclosures about 20 minutes before tipoff, we got a Wi-Fi speedtest mark of 15.8 Mbps / 33.2 Mbps. On the main concourse just after the game's start we got a Wi-Fi mark of 28.6 Mbps / 60.4 Mbps, and later on at that same upper-concourse bar we got a mark of 39.9 Mbps / 61.1 Mbps.

Later on during the second quarter of the game, we watched another fan in our lower-bowl seating area spend most of the period keeping one eye on Monday Night Football streaming on his phone. "The Wi-Fi is really good here," he noted.

Looking ahead to CBRS and 5G

As ExteNet and JMA prepare for the onslaught of the convention's needs, in many areas the Bucks are already looking farther ahead, to future communications improvements including 5G millimeter wave deployments, and a possible introduction of CBRS services. Cordova, who is an advocate of the capabilities of private LTE networks over the CBRS spectrum, said the flexibility of provisioning services in a CBRS environment could be extremely useful for temporary needs, like during last year's NBA playoffs when the NBA on TNT crew set up a temporary stage out in the plaza.

While the Bucks have already prepared for connectivity of all sorts out on the plaza space – from the top-level outside Panorama deck at Fiserv Forum that lets fans look out over the city, Cordova pointed out several metal boxes in the plaza that have home-run fiber connections for broadcast TV as well as remote power – there's going to be all sorts of temporary connectivity needs when the convention media tents set up in the empty lot next door where the previous stadium, the Bradley Center, used to stand.

The fact that the Bucks and ExteNet were already well involved with planning for a July event in October the year before is just another sign of a networking operation that is well positioned now and already thinking about what the next necessary steps are. –MSR–

CLOCKWISE FROM TOP LEFT: THE BIG BOARD; EVERYONE KNOWS TO FEAR THE DEER; TWO MATSING ANTENNAS IN THE RAFTERS; THE LOWER-LEVEL CURVED LED BOARD; WI-FI AP ON A LIGHT POLE IN THE PLAZA; A GOOD BLEND OF ARCHITECTURE AND DISPLAYS IN A CONCOURSE.

5G and Fiber and DAS, oh my!

There's a lot happening in the wireless industry, making it more important than ever to stay in-the-know. *Inside Towers* has you covered. We keep our readers, listeners and followers up-to-date with a daily digital newsletter, podcast, website and active social media platforms. All things wireless infrastructure, all the time.

Learn More

Complimentary Newsletter Trial | insidetowers.com/free
The Wireless Influencer | insidetowers.com/advertise
Inside Towers Targets | insidetowers.com/digital

Inside Towers

SPONSORS SHOWCASE

Mobilitie is the largest privately-held wireless infrastructure provider in the United States, helping people stay connected wherever they are. Mobilitie funds, installs, and operates indoor and outdoor neutral host DAS, Small Cell, and Wi-Fi networks, communication tower sites, as well as other infrastructure used by wireless carriers to enable high speed mobile communications. Mobilitie engineers wireless solutions at the largest and most complex venues across all major industries, including sports and entertainment, real estate, hospitality, education, healthcare, government, and transportation. Mobilitie is headquartered in Newport Beach, California with regional offices across the United States. To learn more about our wireless coverage solutions, visit us at www.mobilitie.com.

JMA Wireless is the leading global innovator in mobile wireless connectivity solutions that assure infrastructure reliability, streamline service operations, and maximize wireless performance. Employing powerful, patented innovations their solutions portfolio is proven to lower the cost of operations while ensuring lifetime quality levels in equipment and unrivaled performance for coverage and high-speed mobile data. JMA Wireless solutions cover macro infrastructure, outdoor and indoor distributed antenna systems and small cell solutions. JMA Wireless corporate headquarters are located in Liverpool, NY, with manufacturing, R&D, and sales operations in over 20 locations worldwide. For more information visit jmawireless.com or follow on Twitter at @JMAwireless

Corning is a leading provider of wireless infrastructure solutions, offering flexible architectures in the rapidly growing wireless market. With a portfolio of products ranging from converged cellular and Wi-Fi solutions for enterprises, to distributed antenna systems for wireless operators, Corning offers in-building infrastructure solutions that cover the needs of venues of all types and sizes. www.corning.com

Boingo Wireless (NASDAQ: WIFI) is a leading provider of cellular and Wi-Fi networks at stadiums and arenas, universities, airports, military bases, convention centers and commercial properties. You'll find Boingo connecting people at sports and entertainment venues that include Soldier Field, Vivint Smart Home Arena, Philips Arena, University of Arizona's Arizona Stadium, University of Nebraska's Pinnacle Bank Arena and more. Boingo's industry-leading Distributed Antenna System (DAS) networks leverage state-of-the-art design to deliver comprehensive stadium coverage and maximize carrier participation to ensure more fan access. As a global leader in managed Wi-Fi services, the company maximizes access to networks through global roaming agreements via carrier offload and major brand sponsorships through the Boingo Media Platform. For more information, visit www.boingo.com.

SPONSORS SHOWCASE

MatSing is a pioneer company with several years of experience in bringing high performance RF lens solutions to industries including wireless broadband, satellite, measurement and big venues. MatSing has had a strong focus on meta-material development and design, allowing them to construct the worlds lightest and largest RF lenses. Having developed unique high-performance lens antennas for multiple industries, MatSing is now driven to transform 4G networks to lens technology. Holding several RF MetaLenzTM technology patents, MatSing Inc. has led the development of a new approach to antenna design, focusing on using RF Lenses to outperform traditional phased-array (panel) or dish antennas, providing a needed solution to growing capacity demands. www.matsing.com

Since 1999, Oberon, Inc. has provided WiFi infrastructure solutions to wireless consultants, integrators, installers, and end users. Oberon's wireless access point mounting solutions and enclosures are used where wireless coverage, infrastructure security, environmental robustness, aesthetics, and serviceability are paramount in the network implementation. Oberon offers the widest variety of ceiling, wall, outdoor, and challenging-environment mounting solutions for Wi-Fi access points from all leading wireless vendors. Oberon's installation solutions have helped thousands of wireless professionals in the global healthcare, government, transportation and logistics, education, retail, hospitality, and manufacturing fields achieve optimum mobile network performance. Oberon is a division of Chatsworth Products.

Hospitality Network, an affiliate of Cox Business, is a premier provider of choice for Managed Wi Fi, Location Based Services and In-Room Entertainment to convention centers, arenas, stadiums and hotels across the nation. Our custom tailored, technology solutions are created to meet the specific needs of each of our customers. HN has proven solutions that benefit our customers, their guests and visitors from coast to coast. Visit us at www.coxhn.com to learn more.

ExteNet Systems is a leading provider of converged communications infrastructure and services addressing outdoor and in-building wireless, fiber and other advanced connectivity needs of its customers. Our customers include mobile network operators (MNOs), real estate & venue owners, property managers, wholesale carriers, enterprises, municipalities and rural carriers. In addition to the design and build of converged networks, venue and team ownership increasingly rely on us for consultation and managed services.

SUBSCRIBER LICENSE AGREEMENT

Between

MOBILE SPORTS REPORT and Subscriber

Any Mobile Sports Report ("Report") and the information therein are the property of or licensed to Mobile Sports Report, and permission to use the same is granted to site-wide or single-category Subscribers ("Subscribers") under the terms of this Subscriber License Agreement ("Agreement"), which may be amended from time to time without notice. When requesting a Report, you acknowledge that you are bound by the terms and conditions of this Agreement and any amendments thereto. Mobile Sports Report therefore recommends that you review this page for amendments to this Agreement prior to requesting any additional Reports.

OWNERSHIP RIGHTS

All reports are owned by Mobile Sports Report and protected by federal, state and international copyright, trademark and intellectual property laws, under and by applicable treaties and/or conventions. Subscriber agrees not to export any Report into any country that does not have copyright, trademark and intellectual property laws that will protect Mobile Sports Report's rights therein.

GRANT OF LICENSE RIGHTS

Mobile Sports Report hereby grants Subscriber a non-exclusive, non-refundable, non-transferable license to use the Report for research purposes only pursuant to the terms and conditions of this Agreement. Mobile Sports Report retains exclusive and sole ownership of each Report disseminated under this Agreement. Subscriber agrees not to permit any unauthorized use, reproduction,distribution, publication or electronic transmission of any Report or the information/forecasts therein without the express written permission of Mobile Sports Report.

In case of any distribution of Reports under this Agreement, Subscriber agrees to retain all copyright, trademark and other proprietary notices on the Reports.

DISCLAIMER OF WARRANTY AND LIABILITY

MOBILE SPORTS REPORT, ITS EMPLOYEES, AFFILIATES, AGENTS AND LICENSORS DO NOT WARRANT THE ACCURACY, COMPLETENESS, CURRENTNESS, NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE OF ANY REPORTS COVERED BY THIS AGREEMENT. MOBILE SPORTS REPORT, ITS EMPLOYEES, AFFILIATES, AGENTS AND LICENSORS SHALL NOT BE LIABLE TO SUBSCRIBER OR ANY THIRD PARTY FOR LOSS OR INJURY CAUSED IN WHOLE OR PART BY MOBILE SPORTS REPORT'S NEGLIGENCE OR BY CONTINGENCIES BEYOND MOBILE SPORTS REPORT'S CONTROL IN COMPILING, PREPARING OR DISSEMINATING ANY REPORT, OR FOR ANY DECISION MADE OR ACTION TAKEN BY SUBSCRIBER OR ANY THIRD PARTY IN RELIANCE ON SUCH INFORMATION, OR FOR ANY CONSEQUENTIAL, SPECIAL, INDIRECT OR SIMILAR DAMAGES (INCLUDING LOST PROFITS), EVEN IF MOBILE SPORTS REPORT WAS ADVISED OF THE POSSIBILITY OF THE SAME. SUBSCRIBER AGREES THAT THE LIABILITY OF MOBILE SPORTS REPORT, ITS EMPLOYEES, AFFILIATES, AGENTS AND LICENSORS, IF ANY, ARISING OUT OF ANY KIND OF LEGAL CLAIM (WHETHER IN CONTRACT, TORT OR OTHERWISE) IN CONNECTION WITH ITS GOOD/SERVICES UNDER THIS AGREEMENT SHALL NOT EXCEED THE AMOUNT SUBSCRIBER PAID TO MOBILE SPORTS REPORT FOR USE OF THE REPORT IN QUESTION.

This License will be governed by the laws of the State of California.

msr/mobile sports report

MOBILE SPORTS REPORTS, LLC
1630 30th St., Suite A, #503
Boulder, CO 80301
(720) 668-9842
kaps@mobilesportsreport.com