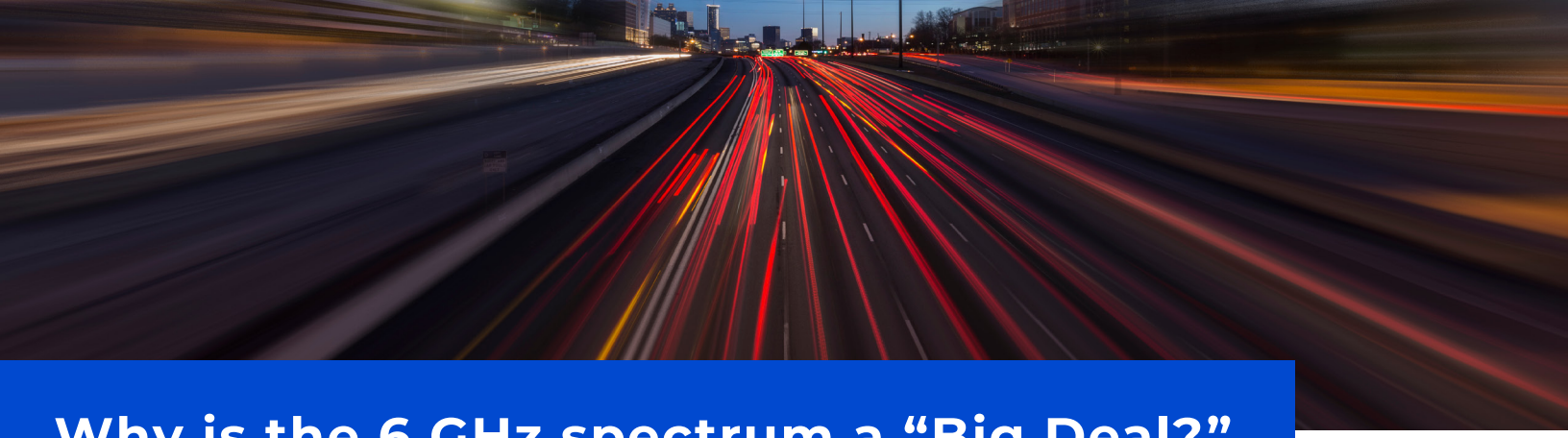
6 GHz Wi-Fi and The Future of Wireless Connectivity

WORLDVUE®

As a technology company with a rich history in the property technology industry, our 48 years in business solidifies WorldVue as a credible source for technological commentary. Below are our predictions for wireless connectivity, emerging applications which will depend upon improved networks, and how this may transform our future...

Our lives benefit from secure, reliable, high-speed wireless connectivity. Technological advancements in wireless networking, user smartphones, wearables, sensors, and connected building systems are growing faster than we've ever experienced, and we expect this trend will continue. New ecosystems like immersive augmented reality, blockchain based asset management, and connected building systems will grow in prevalence, infiltrating all aspects of life and influencing the way we engage socially, relax comfortably, connect professionally, and advance financially.

As our dependence on robust and reliable connectivity grows, Wi-Fi systems need to advance to include high-quality, high-speed internet connections with minimal latency and high reliability. While it is impossible to predict the extent of tomorrow's inventions we can assume that our dependence on internet connectivity will continue to grow. Most buildings are ill-equipped to handle the sheer volume of data and demand for reliable connections future applications will require. We believe that a technological revolution is here today. On April 23, 2020. the FCC "unleashed" 1,200 megahertz in the 6 GHz spectrum band (5.925-7.125 GHz to be exact) for unlicensed use to largely benefit Wi-Fi use cases. This regulation marks the biggest technology leap for Wi-Fi since its invention. The benefits will be realized in the next generation of Wi-Fi standards starting with Wi-Fi 6E and closely followed by Wi-Fi 7. From a consumer standpoint (guest or resident) this advance will finally allow use-cases which, from the consumer standpoint, offer a complete wire replacement, with speeds, latencies, and reliability to provide transformative immersive mobile experiences.



Why is the 6 GHz spectrum a “Big Deal?”

In the world of wireless, we often equate the wireless experience to driving a car on the highway. The wider the highway, the more lanes, the less congestion, the greater the speed, and more enjoyable and secure the ride. While new spectrum offered with 6 GHz provides more lanes on the wireless highway, advances which promise to be delivered with Wi-Fi 7 allow for wider lanes, the ability to magically use more than one lane at a time (or more than one highway at a time) when needed (multi-link operation), and the vehicle itself is also faster and more agile (4096 QAM). All of this results in a transformative experience, which includes a bunch of different possible uses of the highway itself which we can only dream of today.

Despite what the name implies, Wi-Fi 7 is not merely an extension of or addition to our existing connectivity infrastructure. Instead, Wi-Fi 7 will create an entirely different framework upon which we will invent new technologies and advancements. To effectively understand all that Wi-Fi 7 will bring, we need to look beyond our conceived boundaries of connectivity. The structure of Wi-Fi 7 is fundamentally different from preceding connectivity platforms and the physical restructuring of the network will enable faster connections, higher throughput, and extended reliability. Because the components of Wi-Fi 7 are different from what we’ve seen in the past, it will likewise produce a very different experience than what we are used to today. The Wi-Fi 7 platform will be smarter, faster, and able to accommodate significantly more data transfer at quicker speeds with less interference and more throughput, allowing us to support future applications beyond our current comprehension.

Additional Spectrum

Today's Wi-Fi platforms (excluding Wi-Fi 6E) utilize two bands: 2.4 GHz and 5 GHz. The difference between the two bands is extensive but complementary. Dual-band enabled Wi-Fi allows users to connect to the band best suited for a particular application. This process worked well, until the 2.4 GHz and 5 GHz bands became overwhelmed with data. Enter 6GHz.

First implemented in the Wi-Fi 6E advancement in early 2021, the 6 GHz band supports significantly more channels than the 2.4 GHz bands and 5 GHz band applications. Increased channel support means the network can accommodate more data at faster speeds with less interruption and higher rates of throughput. Numerically speaking, the 6 GHz band has more than 20 times the capacity of the 2.4 GHz band (3, 20 MHz channels in the U.S.) and 6.5 times the capacity of the 5 GHz band (9, 20 MHz channels in the U.S.), supporting up to 59 20 MHz channels.

Additional spectrum means data can be transferred at higher speeds with more throughput, greatly reducing latency and lag time typically associated with this quantity of information. Immersive augmented reality experiences require additional bandwidth to operate, and the 6 GHz band advancement will be the foundation of future applications. The additional spectrum is important, but a significant component of Wi-Fi 7 lies in its network intelligence. Wi-Fi 7 uses a more advanced modulation technology called 4096 QAM (vs 1024 QAM used in Wi-Fi 6, or 256 QAM used in Wi-Fi 5). This improvement in modulation technology allows for even greater throughput.

Channel Bonding

Future immersive networking applications are going to restructure and improve the ways in which we interact with one another globally, significantly advancing our connections across financial, social, and metaphysical boundaries. To facilitate this level of global communication and enable people across the world to interact in real time, we'll need the advanced data control systems of Wi-Fi 7. In addition to adding more usable 20 MHz-width channels, Wi-Fi 7 will further capitalize on the process of channel bonding.

Channel bonding is a customary practice today, especially for enterprise-grade Wi-Fi systems. Defined as the automated process of utilizing either 20 MHz, 40 MHz, or 80 MHz of bonded channel widths, channel bonding allows devices to connect to wider channels. For instance, if users are unable to connect to the 20 MHz band (due to traffic, interference, availability, etc.), their internet connectivity platform will automatically bond channels to extend their usability, combining two 20 MHz channels to use 40 MHz of space, two 40 MHz for 80 MHz, etc., up to 160 MHz bonds. Wi-Fi 7 will support even more data with increased channel usability, supporting up to 320 MHz of combined channel width, over twice the bonded channel width currently available to our networks today.

Multi-Link Operations

While Wi-Fi 6E improved connectivity by adding the 6 GHz band, Wi-Fi 6E routers are still limited as users can only connect to one band at one time (either 2.4 GHz, 5 GHz, or 6 GHz). Wi-Fi 7 is further improving connectivity by enabling multi-link operations. Through this process, users can combine channels and connect to multiple bands simultaneously, utilizing all three at once if necessary. The benefits of this process are two-fold, benefiting users by sending one data stream across all bands or sending multiple files of data across the bands simultaneously.

Multi-AP Coordination

Wi-Fi 7 allows bands to not only work simultaneously but communicate amongst each other to provide the best possible internet for connected devices. By enabling band communication, Wi-Fi 7 brings multi-AP coordination and cooperation. Historically, devices selected a band based on the needs of specific applications. Wi-Fi 7, however, will allow the bands to communicate with one another, deciding which access point is better suited to support a particular application based on the current connectivity of each band. The bands can now support one another by deciding how much connectivity each band needs for connected devices and the associated applications. For instance, if one access point has a user nearby, and another is supporting a user who is further away, the first access point may relinquish some power to accommodate the second access point's additional needs.

Joint Transmission

Finally, because the next generation of Wi-Fi will allow access points to communicate better, bands can now overlap their coverage instead of interfering with one another's data stream. For high quantity or quality data transfers, multiple access points can agree to broadcast the same information to one device, eliminating interference and improving transfer speeds. This revolutionary practice will enable faster connections with little to no interference.

Exploring the Possibilities

Each new generation of Wi-Fi solves the preceding solution's inefficiencies and major pain points. Today's Wi-Fi platforms are overwhelmed with data, particularly in high-traffic environments like apartment communities, hotels, and major transportation hubs. Wi-Fi 7 will alleviate most of today's connectivity woes with significantly more bandwidth and advanced capabilities of Wi-Fi 7 will allow data and information to move more intelligently, freeing up room for increased internet consumption. It is essential to develop connectivity solutions that can support future technologies, especially as augmented reality, blockchain enabled high-trust asset management platforms, and the metaverse continue to grow in relevance.

Hotels

Outside of keeping up with brand standards, over the past few years, hotels have had a difficult time justifying the additional investment in recapitalizing their Wi-Fi networks. Densification, however, important and needed, is expensive especially when the Wi-Fi upgrade couldn't accommodate the replacement of wired connections for phones, televisions, and security cameras. Most guests simply didn't need the advancements in networking that Wi-Fi 5 and Wi-Fi 6 offered. They were "nice to have," but not "must have." With the advancements in both spectrum and network intelligence, the newest "yet to be ratified" standard of Wi-Fi 7 will provide the transformation to justify truly changing the way we use Wi-Fi.

Increased bandwidth and channel bonding will significantly improve hotel internet connectivity. With an extra band, the information highway will be double the size of bandwidth we are using today. Wi-Fi 7 will accommodate thousands of devices, more than we can even imagine today. With innovations like smart mirrors and IoT technologies, hotels will need to accommodate a growing number of connected devices. Wi-Fi 7 will give hotels the bandwidth necessary for tomorrow's innovations.

Additionally, because Wi-Fi 7 will be more intelligent than previous generations of Wi-Fi, access points can communicate with one another to accommodate the increased need for a specific time. The access router responsible for supporting their first gate in the example can borrow data from the access point in the second gate as there is a much smaller need for bandwidth connection. The ability to share data and converge networks will revolutionize how we use Wi-Fi. In addition to expanded bandwidth and multi-AP coordination, the ability to link to multiple bands at once will also improve the transfer of data within hotels, regardless of physical proximity to an access point. Reliable internet is increasingly important in hotels, especially during busy travel seasons and times of delays and routine interruptions. Wi-Fi 7 will have the capacity and intelligence to determine how to best deliver fast, reliable internet to guests and staff alike, regardless of their location at the hotels.

Apartments

It wasn't until the past few years that apartment communities even considered providing Wi-Fi to its residents in their homes. Most communities provides Wi-Fi in their clubhouses or by the pool, but the apartments themselves were dominated by old-school technology designed for use in a single family home environment. Cable providers would provide a set-up box, cable modem (sometimes with a built in Wi-Fi router), and try to bundle in an old school landline phone (just like grandma and grandpa used to use). Then Wi-Fi 5 offered a simple, manageable, and reasonably fast and reliable connection which almost every resident used. Bulk Wi-Fi has become a very sensible amenified platform for multifamily owners to offer to their residents.

But Wi-Fi 7 will make community-provided Wi-Fi an industry standard in the multifamily environment. The speed, reliability, and network intelligence that Wi-Fi 7 will provide will prove to be too intriguing for an apartment owner to ignore. Not only will resident satisfaction be optimized, but smart building systems like cameras, sensors, environmental controls, and asset tracking systems will drive apartment owners to view community Wi-Fi systems like they view roofs, common area access control, and driveways and parking lots today. If you don't keep up with the quality of your community network, the quality and capitalized value of your community will suffer.

Student Housing

Today's students use the internet more than ever before, and they rely on fast, accessible connections. Remote learning changed the way classrooms operate, and many students take classes online rather than in person. Many professors live-stream their classes to increase accessibility. To ensure the same quality of education for remote and in-person students, universities need to have superior Wi-Fi coverage in classrooms and throughout the campus. Wi-Fi 7 will be able to accommodate an entire campus worth of computers and devices, ensuring property-wide internet access to keep students connected at all times. Internet connectivity is an essential component of learning in college, and students need to be able to access their assignments anytime and anywhere across campus.

Additionally, students will need access to Wi-Fi enabled computers and scanners to complete assignments. Faculty and staff also need reliable Wi-Fi with increased bandwidth to perform their duties and maintain the status quo wherever they are on campus. Security teams and law enforcement will also need constant connection to surveillance cameras, especially those that utilize artificial intelligence for proactive monitoring. Joint transmission will enhance communication amongst the bands and increase accessibility by utilizing multiple communication channels at once. Joint transmission is especially useful for transferring large files like videos and projects.

Many classrooms have realized the benefits of remote testing, having a student use their camcorder to connect with a qualified, online proctor to watch their eye movements and track progress. If a student's Wi-Fi cuts out during a test, they are immediately given a negative grade and may or may not have another chance to make up the test. Online classes and exams dictate the increased need for reliable internet.

Timing and How To Prepare:

Wi-Fi standards are defined and enforced by the IEEE (Institute of Electrical and Electronics Engineers). Today's current ratified standard is Wi-Fi 6 and 6E (802.11 AX), which was approved on February 9, 2021. Wi-Fi 7 (802.11 be) has been drafted with final approval expected in early 2024. Certain chipset manufacturers have already released their Wi-Fi 7 platforms in anticipation of anticipated standards. At least one Wi-Fi consumer-grade router has been released well ahead of the standard being officially ratified. Look for several Wi-Fi 7 routers and platforms to be announced in Jan 2023 at the Consumer Electronics Show. However, don't expect to deploy an enterprise-grade Wi-Fi 7 platform until 2024.

Until then, property owners have plenty to prepare for. All Wi-Fi platforms will require proper infrastructure (we recommend fiber optics with virtually infinite capacity for bandwidth and less concern for longer cable distances, or Cat6a twisted pair structured wiring). Wi-Fi access points should be placed as close to the guest or resident as possible with densification on a 1:1 (unit or room to access point) if possible. Access points should be powered by house power so individual rooms or units cannot turn power off to any access point. And lastly, access points should be secured to limit physical access from guests or residents.

Conclusion

Today and tomorrow's consumers crave connectivity. Our devices are increasingly dependent on internet access, and we will soon experience more things using the Internet to talk to other things, than there are people communicating with other people. The implications of network advancements will be transformational. We are excited to be part of an industry that has had profound impacts on society which is creating a future of abundance and infinite possibilities.