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What's the difference between WiFi 6 and WiFi 6E

By HQ Editorial Group 11-04-2020

You may just start to get familiar with WiFi 6 and consider replacing your old phone with the latest wifi 6 one. The WiFi Alliance announced a new WiFi standard, the WiFi 6E in 2020. Going by the terminology, WiFi 6E appears to be an incremental update to WiFi 6, but you are probably left wondering how WiFi 6 and WiFi 6E differ from each other.

WiFi 6 Technology

WiFi 6 is the next-generation standard in WiFi technology built in response to the growing number of devices in the world. If you own a VR device, multiple smart home devices, or simply have a large number of devices in your household, then a WiFi 6 router might be the best choice for you.

WiFi 6 uses both 1024-QAM to provide a signal packed with more data and a 160 MHz Channel to provide a wider channel to make your WiFi faster. This means you could enjoy a stutter-free VR or stunningly vivid 4K and even 8K streaming. More importantly, technologies like MU-MIMO and OFDMA generated from WiFi 6 provide up to 4x larger capacity and to handle more devices. With WiFi 6, you could easily throw house parties with a network built to handle all your guests and their devices.

What is WiFi 6E and how does it differ from WiFi 6E?

In fact, WiFi 6E is identical to WiFi 6 with an addition of "E", which stands for "Extended" — as in an extended number of the usable wireless band, the 6 GHz band. So simply put, WiFi 6E means WiFi 6 extended to the 6 GHz band.

6 GHz is the new frequency band ranging from 5.925 GHz to 7.125 GHz, allowing up to 1,200 MHz of additional spectrum. Unlike the existing bands on which channels are currently crammed into the limited spectrum, the 6 GHz band exists without overlap or interference. Access to the 6 GHz frequency brings more bandwidth, faster speeds, and lower latency, opening up resources for future innovations like AR/VR, 8K streaming, and more.

How does WiFi 6E make a difference?

Unlike the crowded 2.4 GHz and 5 GHz bands, the wide-open 6 GHz spectrum is occupied only by efficient WiFi 6 connections, removing frustrations currently caused by overcrowding on many WiFi networks. Channels on the newly opened 6 GHz band also wouldn't overlap with each other, greatly reducing network congestion.

WiFi 6E allows for 7 additional 160 MHz channels that double bandwidth and throughput, enabling many more simultaneous transmissions at the highest possible speeds. This translates to you enjoying 8K movies, AR/VR gaming, and large file downloads—all without buffering.

WiFi 6E offers up to 1,200 MHz of additional spectrum for 6 GHz WiFi, fulfilling the needs of ever-increasing WiFi usage. The 1.2 GHz of the contiguous spectrum more than doubles the number of pathways currently available for sending and receiving data, dramatically increasing network capacity while reducing congestion.

WiFi 6E: Unlock the Full Potential of WiFi 6

Opening the 6 GHz band will change the game for WiFi 6. WiFi 6 brings about upgraded performance in network efficiency and capacity. Whereas the advantages of WiFi 6 are not fully realized while competing with transmission WiFi 5 (or other radios). The 6 GHz band is available only for WiFi 6 traffic, allowing WiFi 6 to meet its intended potential.

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Wi-Fi 6E: What is it, and how is it different from Wi-Fi 6?

Mar 4, 2020 | Blog

WiFi 6E? Didn't I just hear about WiFi 6 and then WiFi 7? What is this?

Yes, you are right. You've now heard of all of these new variations of WiFi. You are not crazy. But you can be better informed. To find out more about what WiFi 7 is all about, check out this article all about it.

As far as WiFi 6E and how it's different than WiFi 6, keep reading. Here's what you need to know about these new WiFi standards and what's going on.

What is WiFi 6E?

Simply put, WiFi 6E is an extension of WiFi 6. WiFi 6E works with the same standard as WiFi 6 (802.11ax), however it works on an extended spectrum.

The WiFi Alliance announced 6E as new branding for WiFi 6 equipment (which is not yet released). This new equipment will have a label stating that it is WiFi 6E. So, how exactly does WiFi 6E and WiFi 6 difference other than one letter difference in the name? There are a few ways.

WiFi 6 is the next generation of wireless (WiFi) router protocol and is also known as 802.11ax. WiFi 6 will address congestion issues caused by multiple

standard and internet or things (IoT) devices trying to connect to a network at once.

WiFi 6E is an extension of everything with WiFi 6 but signifies that it supports an all-new 6GHz frequency. Access to the 6GHz frequency will add more spectrum, higher throughputs and lower latency. (Which is great for gaming.)

Where will we see WiFi 6E?

Right now? Nowhere. But once it's released and the Federal Communications Commission (FCC) opens up the 6GHz band for use (which they've already agreed to do), we should see it anywhere that we experience WiFi 6.

- WiFi 6E is promised to shine through congested areas (just like with WiFi 6).
- We should see routers that can work with wider channels (just like with WiFi 6).
- We should see more product innovations like next-generation smartphones, AR/VR devices, wearables and more (just like with WiFi 6).

Okay…so then what is the difference here?

To sum it up, WiFi 6 and WiFi 6E do not differ much other than the naming convention to distinguish the two and to signify extending into the 6GHz frequency.

Breaking into 6GHz is a big deal, though. This radio spectrum is underutilized and gives the opportunity for wider use and more efficient use. **WiFi 6E in the 6 GHz band is expected to bring even better WiFi performance** for current devices and device innovations to come. We've been promised a lot with WiFi 6 and there's already more for us to look forward to.

What you need to know

Not all WiFi 6-compatible devices will be able to support using the 6GHz band. At this point, what you need to know is that if you are still in the process of upgrading to new devices or have recently upgraded to new devices, you will want to check to see if they are distinguished as WiFi 6E devices.

If you haven't tapped into these devices yet, consider waiting until the FCC makes the 6GHz band available.

If being able to tap into the 6GHz band is important to you, definitely wait until the band is available to upgrade or invest in new devices.

There isn't a set date for opening the 6GHz band.

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How-To Geek

Wi-Fi 6E: What Is It, and How Is It Different From Wi-Fi 6?

CHRIS HOFFMAN @chrisbhoffman
UPDATED APR 24, 2020, 11:45 AM EDT | 4 MIN READ

Vasin Lee/Shutterstock.com

Wi-Fi 6 hardware is finally arriving on the market, and you'll be seeing more and more of it released throughout 2020. But people are already talking about something new: Wi-Fi 6E, which promises to reduce Wi-Fi congestion further.

Update: We originally wrote this article in January 2020. On April 23, 2020, the Federal Communications Commission voted to open up the 6 GHz band for unlicensed use later this year, clearing the way for Wi-Fi 6E in the USA. Other countries haven't yet made the same decision, so Wi-Fi 6E still faces regulatory barriers in much of the world.

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What Is Wi-Fi 6E?

Wi-Fi 6 and previous generations of Wi-Fi use the 2.4 GHz and 5 GHz radio bands. A "Wi-Fi 6E" device is one that is capable of operating on the 6 GHz band, too.

The 6 GHz spectrum should work similarly to WiFi 6 over 5 GHz but offers additional non-overlapping channels. As the Wi-Fi Alliance puts it, Wi-Fi 6E allows for "14 additional 80 MHz channels and 7 additional 160 MHz channels." These channels wouldn't overlap with each other, which will help reduce congestion, particularly in areas where lots of networks are operating.

All the devices communicating on the 6 GHz spectrum would also be Wi-Fi 6 devices. There wouldn't be any older devices using standards like Wi-Fi 5 (802.11ac). All devices on the 6 GHz channels will be speaking the same language and can use Wi-Fi 6's new congestion-busting features.

In other words, Wi-Fi 6E is Wi-Fi 6 (also known as 802.11ax) over 6 GHz.

RELATED: ***Wi-Fi 6: What's Different, and Why it Matters***

Wi-Fi 6E Is Waiting on Regulatory Agencies Outside the USA

If 6 GHz is so useful, why didn't existing Wi-Fi standards already use it? Well, they couldn't. Regulatory agencies didn't allow Wi-Fi to use the 6 GHz band, instead reserving it for other purposes.

Back in October 2018, the US Federal Communications Commission proposed offering the 6 GHz spectrum for Wi-Fi and other "unlicensed" uses. That didn't happen immediately, and Wi-Fi 6E began to take shape prior to its regulatory approval. On April 23, 2020, the FCC voted to open the 6 GHz band to Wi-Fi 6E and other uses later this year, so Wi-Fi 6E devices are cleared to launch in the US.

The Wi-Fi Alliance's pre-CES 2020 announcement of Wi-Fi 6E acknowledges this, referring to 6 GHz as "an important portion of unlicensed spectrum that may soon be made available by regulators around the world." Note the word "may" rather than the word "will"—it's up to government regulators, not the industry.

When Will Wi-Fi 6E Hardware Be Available?

Mark Van Scyoc/Shutterstock.com

The Wi-Fi Alliance also says that "Wi-Fi 6E devices are expected to become available quickly following 6 GHz regulatory approvals." With the FCC's vote, we're about to see more products announced and scheduled for release.

The industry already seemed eager for regulators to allow Wi-Fi 6. During CES 2020, Broadcom announced several system-on-a-chip products that router manufacturers can purchase to create Wi-Fi 6E-enabled access points.

Intel announced that it will have WI-Fi 6E chips available in January 2021, so it seems likely that Wi-Fi 6E will start appearing in 2021 and become more common heading into 2022—at least in the USA.

However, despite all the excitement and interest, there's still no official timeline for when regulators around the world will make the spectrum available for unlicensed use. Wi-Fi 6E has no definitive release date in most countries.

Wi-Fi Over 6 GHz Requires New Devices

Wi-Fi 6E devices will be backward compatible with Wi-Fi 6 and previous Wi-Fi standards. But, to take advantage of those new 6 GHz channels in Wi-Fi 6E, you'll need to be using devices that support it. In other words, you'll only be using Wi-Fi 6E once you pair a Wi-Fi 6E-enabled client device (like a laptop or smartphone) and a WI-Fi 6E-enabled access point.

For example, even if you have a bunch of Wi-Fi 6 devices and a Wi-Fi 6E-enabled router, none of your devices will communicate over Wi-FI 6E. They'll all be using Wi-Fi 6 on the typical 5 GHz or 2.4 GHz channels.

RELATED: ***5 GHz Wi-Fi Isn't Always Better Than 2.4 GHz Wi-Fi***

Don't Wait For Wi-Fi 6E...

In technology, there's always something new on the horizon. For Wi-Fi right now, that's Wi-Fi 6E.

Some Wi-Fi 6 devices, like routers, laptops, smartphones, are already for sale. Many more will be released throughout 2020. Wi-Fi 6 isn't an extreme upgrade in terms of speed, but it will lead to faster Wi-Fi

along with less wireless congestion and perhaps even extended battery life for your devices.

Meanwhile, Wi-Fi 6E isn't here at all yet. There's no definite deadline for when regulations will be changed in most countries and manufacturers haven't announced when products with Wi-Fi 6E will be available. Even after you can buy Wi-Fi 6E-enabled devices, the main benefit will be reduced congestion through additional wireless channels. That's a great long-term goal, but we don't think it's worth holding out for if you're thinking about upgrading to Wi-Fi 6 gear.

...But Don't Rush to Buy Wi-Fi 6, Either

Of course, you don't necessarily need to run out and buy a new Wi-Fi 6-enabled router today. Most of the devices you have likely don't support Wi-Fi 6 yet.

For example, Apple's iPhone 11 models do support Wi-Fi 6, but older iPhone models don't. Even Apple's new MacBook Pro models released at the end of 2019 don't include Wi-Fi 6 support. New high-end Samsung phones like the Galaxy S10 have Wi-Fi 6 hardware, but most Android phones don't. Only a handful of PC laptops support Wi-Fi 6. It's very early days for Wi-Fi 6.

There's a good chance that, over the next few years, new devices you purchase will increasingly have Wi-Fi 6. But you probably won't get Wi-Fi 6E on those devices—just Wi-Fi 6. That's fine. Wi-Fi 6E sounds nice, but it's not here yet.

Note that the 6 GHz band for Wi-Fi 6E is different from the 60 GHz band, which WiGig will take advantage of. Wi-Fi 6E's 6 GHz will work similarly to Wi-Fi's 5 GHz, while WiGig is ideal for faster data transfer rates over shorter distances.

RELATED: ***What is WiGig, and How Is It Different From Wi-Fi 6?***

CHRIS HOFFMAN

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technology for over a decade and was a PCWorld columnist for two years. Chris has written for The New York Times, been interviewed as a technology expert on TV stations like Miami's NBC 6, and had his work covered by news outlets like the BBC. Since 2011, Chris has written over 2,000 articles that have been read nearly one billion times---and that's just here at How-To Geek. **READ FULL BIO »**

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Wi-Fi 6 is the fastest standard yet. Wi-Fi 6E will be even better

Wi-Fi is expanding into the 6GHz band, giving new Wi-Fi 6E devices an exclusive multilane expressway for faster internet traffic. Here are the details.

Ry Crist Sept. 11, 2020 9:15 p.m. PT

LISTEN - 07:26

Wi-Fi 6 is barely a toddler -- now, Wi-Fi 6E is set to give the speedy standard an exclusive and massive swath of bandwidth.

Stephen Shankland/CNET

Speed is key with Wi-Fi, and the category has certainly been moving fast as of late. First came Wi-Fi 6, a brand-new, faster version of Wi-Fi that started hitting the market in 2019. Now, after a unanimous vote in April, the Federal Communications Commission is opening up an entire new band of spectrum to accommodate next-gen devices designed to tap into it. Devices like those are already on their way by the end of this year.

Watch this: Wi-Fi 6 vs. Wi-FI 6E: Here's the difference in three... 2:57

The Wi-Fi Alliance, an industry group that manages Wi-Fi nomenclature, branded this new spectrum and the devices that can take advantage of it under a new name: Wi-Fi 6E. One industry-funded report claims that, along with providing faster speeds and new room for growing internet traffic, the move will generate more than $180 billion in US revenue over the next five years.

The rest of the world might be preparing to follow suit. First up is the UK, where regulators at Ofcom laid out the country's own plan to expand Wi-Fi into the 6GHz band.

In other words, it's been a busy couple of years for Wi-Fi -- and the arrival of Wi-Fi 6E might be the most significant development yet. Here's some context to help you wrap your head around it.

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Let's talk 6GHz

Last year, I wrote a post about Wi-Fi 6 that explains the new capabilities it brings to next-gen routers. In a nutshell, it's a faster, more efficient version of Wi-Fi that allows wireless access points like routers to better manage networks crowded with lots of users and client devices. My convoluted metaphor for all of that was to imagine your router as a bartender, and the devices on your network as the people trying to order drinks. A Wi-Fi 6 router is like a four-armed bartender capable of efficiently serving drinks to several patrons at once.

Enter Wi-Fi 6E. It isn't a new version of Wi-Fi like Wi-Fi 6, but rather a term that identifies Wi-Fi 6 devices that are equipped with the chips and radios needed to operate in that new mass of spectrum the FCC just opened up. If a Wi-Fi 6 router is a better bartender, then a Wi-Fi 6E router is a better bartender with a brand-new bar, one with an exclusive client list and lots of room to work.

That new spectrum sits in the 6GHz band, a band that wasn't previously allocated for unlicensed Wi-Fi use like the 2.4 and 5GHz bands already were. So what's so great about 6GHz?

All about bandwidth

Time for another metaphor!

Let's say that you've got a gallon of milk sitting on your kitchen counter representing the entire spectrum of radio frequencies. You take a needle, jab it into the side of the carton, and then pull it out. A very thin stream of milk begins to jet out several feet. Then, you take something a little thicker, like a nail, and poke another hole into the side of the container. More milk shoots out this time because the hole is wider -- but it doesn't go as far.

You can think of those two holes as the 2.4 and 5GHz bands. With a frequency range of just 70MHz, the 2.4GHz band is the narrower of the two. Like the needle-poked hole shooting milk across your kitchen, it can send data at a reasonable distance, but with such a small opening, there's a limit to how much it can send. With 500MHz of bandwidth, the 5GHz band represents a bigger hole in the milk carton. It can pass more data at once -- but it can't send it quite as far.

That brings us to Wi-Fi 6E's 6GHz band and its 1,200MHz of additional bandwidth. It's like you've punched a hole in the milk carton the size of a quarter. Tons of milk comes gushing out, but it gushes downward and doesn't travel very far at all.

The takeaway is that the 6GHz band will be best suited for close-range connections, ideally between devices that are in the same room as one another. In situations like that, the two devices should be able to pass huge amounts of data back and forth with the full efficiency of Wi-Fi 6. We'll look forward to testing connections like those (and their range limitations) at the end of this year, when Wi-Fi 6E-compatible routers start to arrive.

> "With Wi-Fi 6E, you not only get more bandwidth but cleaner bandwidth -- meaning it is able to wirelessly provide the higher data rates required along with true mobility."
>
> *Perry Correll, Extreme Networks*

Extreme Networks' Perry Correll, who sits on both the IEEE 11ax and Wi-Fi Alliance Wi-Fi 6 task groups, suggests that the short range of the 6GHz band and its greater number of channels is actually "a tremendous advantage" in dense, challenging environments like transportation hubs, apartment units, sports arenas and business complexes.

"If you're sitting in a packed stadium with 70,000 other people, the arrival of Wi-Fi 6E means you're not going to be competing for bandwidth in the same way you used to," Correll says. "It will be significantly easier to stream the event to friends, order concessions via app, or even to find out which bathroom has the shortest lines."

Wi-Fi's VIP section

"AR/VR and gaming is another great use case for the 6GHz band," Correll says. "Many don't realize the high-end VR sets that require the

most bandwidth are actually tethered with cables. With Wi-Fi 6E, you not only get more bandwidth but cleaner bandwidth -- meaning it is able to wirelessly provide the higher data rates required along with true mobility."

Wi-Fi 6 is really the key to that cleaner bandwidth, because there won't be any earlier-gen Wi-Fi devices that are capable of tapping into the 6GHz band. That means that Wi-Fi 6E networks won't have any older-generation devices acting as weak links in the chain.

Let's go back to that analogy I sketched out earlier. Like I said, if Wi-Fi 6 makes your router into a better bartender that can effectively serve lots of patrons at once, then Wi-Fi 6E is the bar itself -- and it's an exclusive, members-only kind of joint. The only patrons ordering cocktails are Wi-Fi 6E patrons that are capable of being there, and all of them support Wi-Fi 6.

In other words, nobody's casting any weird, confused looks at the four-armed bartender as he hands out drinks, because they've all got four arms, too. It isn't as crowded or as noisy as other bars, and everyone's equipped to take full advantage of the bartender's capabilities. It's the fastest, most efficient nightlife in town.

asus-zenwifi-ax-1

The Asus ROG Rapture GT-AXE11000 is the first router we've seen that supports Wi-Fi 6E, and it's scheduled to hit stores this December.
Tyler Lizenby/CNET

So, I'll need (another) new router?

There's the rub. Like that metaphorical bar's exclusivity might suggest, you'll need to be a member in order to enter. Specifically, you'll need Wi-Fi 6E devices equipped with new chipsets built to send signals in the 6GHz band. Regular Wi-Fi 6 devices already on the market today don't have those chipsets.

Translation? Yes, you'll need a new router -- and new client devices like phones and laptops -- in order to enjoy the benefits of Wi-Fi 6E.

"We're expecting the first set of devices to come to market in the second half of this year," said Vijay Nagarajan, vice president of marketing for Broadcom's wireless communications and connectivity division. "You'll see a whole slew of devices, both on the infrastructure side and on the client side, and much more in a much more accelerated manner in 2021."

We've already seen one new router -- the Asus ROG Rapture GT-AXE11000 gaming router -- that boasts support for Wi-Fi 6E. That one hits stores in December.

Watch this: Wi-Fi 6: What the heck is it? ▶ 6:57

That's probably frustrating for anyone who jumped in early and bought a new Wi-Fi 6 router in the last year, but don't be too hard on yourself. It's still very early for Wi-Fi 6E, and the rollout will take some time. Wi-Fi 6 only recently penetrated the mainstream with public deployments and support from high-profile devices like the iPhone SE and the Samsung Galaxy S10. Devices like those that support Wi-Fi 6E are only just starting to pop up on the radar. For instance, new gaming phones coming later this year from Asus and Lenovo will use Qualcomm's Snapdragon 865 Plus processor, which supports Wi-Fi 6E. They'll be among the first Wi-Fi 6E devices on the market, but most won't arrive until 2021.

In other words, that Wi-Fi 6 router that you bought on Black Friday will continue to be a top-of-the line access point for another year or so, and it will continue to be a very good router after that, thanks to everything that Wi-Fi 6 brings to the table. In fact, waiting to upgrade until Wi-Fi 6E is more widely implemented and polished might be the best approach. At that point, we'll have a better sense of the sort of users who stand to benefit the most from the upgrade, and they'll have an easier time finding a good deal, too.

More good news: Your older-gen Wi-Fi gadgets will still work with routers that support Wi-Fi 6E, because Wi-Fi 6 is fully backward-compatible with earlier versions of Wi-Fi. They just won't be able to operate in that exclusive 6GHz band.

Meet the Wi-Fi 6 routers that support 802.11ax

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WIRELESS INFRASTRUCTURE (/TOPIC/WIRELESS-INFRASTRUCTURE)

Comparing Wi-Fi 6E to Wi-Fi 6

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Those planning to upgrade their Wi-Fi 4 and 5 networks in the next six to 18 months, may want to consider holding off until 6E hardware becomes widely available.

By **Andrew Froehlich (/author/andrew-froehlich)**

MARCH 24, 2020

(Image: Pixabay)

The Wi-Fi Alliance recently did a great service by rebranding the oft-confusing IEEE technical nomenclature of Wi-Fi standards to ones that are far easier to understand. Now instead of figuring out which specification is the latest and greatest between IEEE 802.11n, 802.11ac, and 802.11ax – we have **Wi-Fi 4, Wi-Fi 5, and Wi-Fi 6 (https://www.wi-fi.org/news-events/newsroom/wi-fi-alliance-introduces-wi-fi-6)**. That's great news, yet it seems as if the simplicity was short-lived. With the recent announcement of Wi-Fi 6E, many enterprise IT leaders are left wondering how Wi-Fi 6 and Wi-Fi 6E differ – and if those differences are relevant to their current wireless LAN roadmap.

Because Wi-Fi 6 has only been around for a short while, it was a surprise to some that Wi-Fi 6E was announced. However, once you realize that Wi-Fi 6E uses the **same IEEE specifications as Wi-Fi 6 (https://www.networkcomputing.com/wireless-infrastructure/what-enterprises-need-know-about-wi-fi-6%E2%80%99s-top-features-and-role-ai)** – only with additional spectrum capabilities, things become clearer. In fact, Wi-Fi 6E is identical to Wi-Fi 6, with the exception that wireless hardware can tap into new unlicensed wireless blocks in the 6 GHz range. Specifically, the Alliance is targeting 14 80 MHz wide channels and 7 160 MHz channels for those of us in the US. Other governments around the globe are also looking to free up similar spectrum and channel sizes.

Thus the "E" in Wi-Fi 6E stands for "Extended" – as in extended number of usable wireless bands. That said, Wi-Fi 6E assumes that the FCC will open the 6 GHz spectrum for unlicensed Wi-Fi use. At this point, the Wi-Fi 6E cart is ahead of the horse because the 6 GHz bands are not yet available for unlicensed use. However, if you listen to the rhetoric from FCC Chairman, Ajit Pai, it seems as though this issue is a top priority. In

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one **statement (https://docs.fcc.gov/public/attachments/FCC-18-147A2.pdf)** released last year, Pai said: "We look forward to compiling a robust record and then acting quickly to make more 6 GHz spectrum available for unlicensed uses." Thus, it's no wonder that the Wi-Fi Alliance has leapt into action to notify the public of the eventual existence of the extension to Wi-Fi 6.

From a technical perspective, the additional spectrum in the 6 GHz range offers several potential benefits compared to 2.4 and 5 GHz bands already in use. For one, adding new channels will increase wireless capacity in areas where device density is high. Second, the addition of the 160 MHz-wide channels will serve as an excellent way to provide throughput for high-bandwidth applications such as the streaming of ultra-high-definition video. In fact, the use of the 6 GHz spectrum across the board will provide faster speeds with lower latency – albeit at the potential cost of slightly less range compared to 2.4 and 5 GHz bands. Lastly, the 6 GHz range will not (at least, initially) suffer from interference coming from other non-Wi-Fi devices that operate in the 2.4 and 5 GHz spectrum ranges. Thus, for areas that have high amounts of wireless interference that negatively impacts Wi-Fi 4, 5, and 6 deployments, Wi-Fi 6E will be highly appealing.

For most organizations that have already deployed Wi-Fi 6, the benefits of Wi-Fi 6E will not be enough to justify an upgrade. However, if issues such as device density, latency/throughput or interference are an issue – or if there is an expected IoT project which adds hundreds or thousands of wireless IoT devices that are also 6E capable, network architects may opt to upgrade portions of their WLAN with Wi-Fi 6E capable access points. Alternatively, those that are planning to upgrade their Wi-Fi 4 and 5 networks in the next six to 18 months, they may want to consider holding off until 6E hardware becomes widely available on the market.

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The international 6G standards are still in development. But one thing is clear: 6G will leave its predecessors far behind.

5G is Here: A Call for Shared Responsibility with Cybersecurity (/wireless-infrastructure/5g-here-call-shared-responsibility-cybersecurity)

Theresa Lanowitz
APRIL 05, 2021
The key factor for the organizations that thrive amidst the 5G revolution will be those that understand and take a shared responsibility towards protecting the assets on the network.

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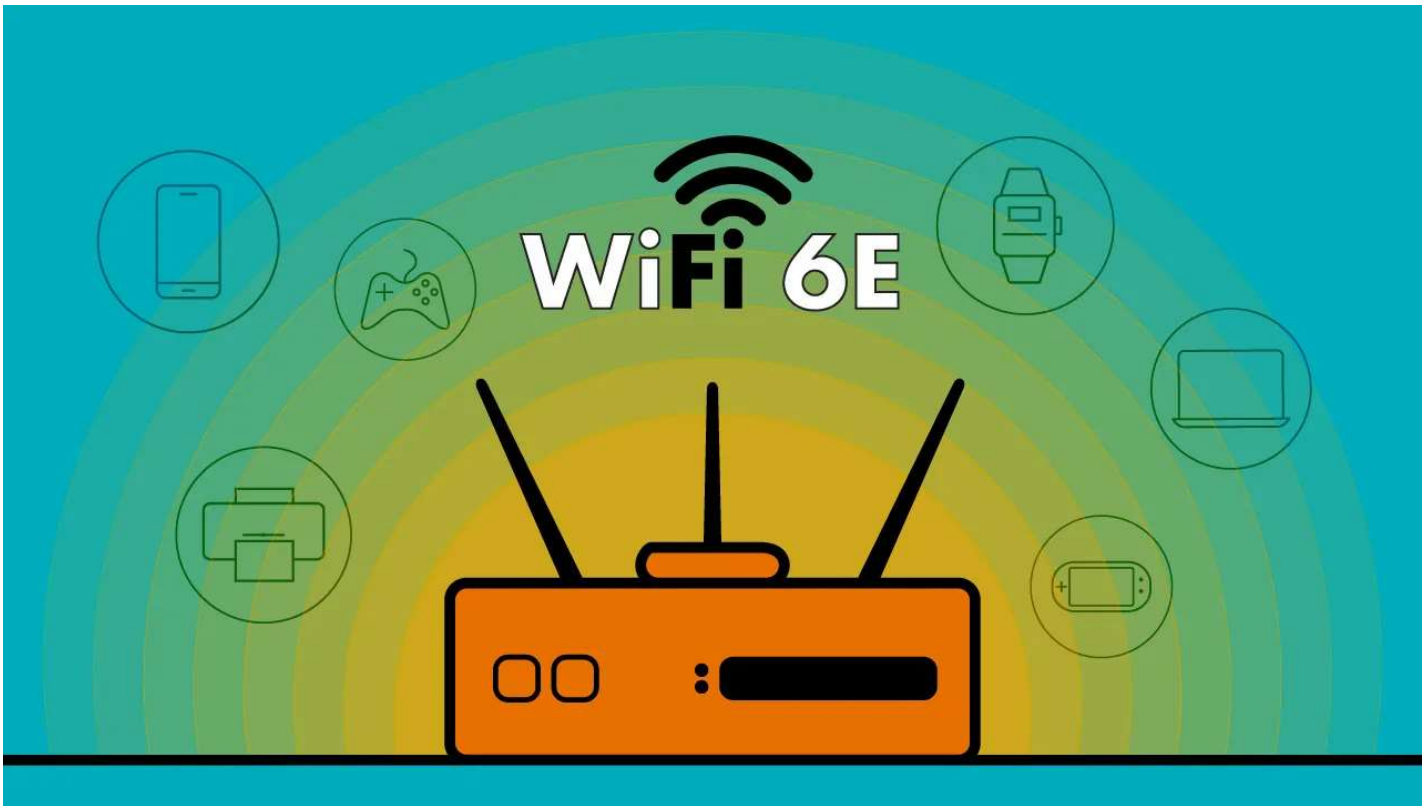
What Is Wi-Fi 6E?

Wi-Fi 6E adds support for 6GHz wireless spectrum, for faster wireless speeds and lower latencies than previous generations, but you'll need a new router and Wi-Fi 6E-compatible devices to take advantage of those new airwaves. Should you upgrade now?

By Jerry Jackson

April 21, 2021, 10:56 p.m.



If you're in the market for a new router or any device that uses Wi-Fi, you should first understand

the new Wi-Fi 6E standard and what it means for the future of wireless networks at home and in offices around the US.

The Wi-Fi Alliance, a group of Wi-Fi platform vendors that work with the FCC and electronics manufacturers to set standards for Wi-Fi technology, announced the Wi-Fi 6E designation in 2020 for any IEEE 802.11ax (Wi-Fi 6) products that support 6GHz wireless spectrum. Essentially, this means Wi-Fi 6E enables faster speeds and lower latencies than Wi-Fi 6 and earlier iterations.

Photo by Wi-Fi Alliance

Wi-Fi 6 vs. Wi-Fi 6E

When the IEEE 802.11ax (Wi-Fi 6) standard was first announced, it was limited by law to a wireless spectrum that only covered the 2.4GHz and 5GHz bands. Now, in a 2.4GHz band, you really have only three non-overlapping channels—and that bandwidth is shared by you, your family members, and your neighbors.

Photo by Wi-Fi Alliance

If you've ever had problems staying connected to a Zoom call or had the latest episode of *The Mandalorian* pause for buffering, spectrum congestion was probably the cause. If too many devices compete for bandwidth on the same wireless channel, then some of those signals will be dropped.

This isn't just a matter of how many family members are connected to your home's Wi-Fi network. Any other Wi-Fi network in range (such as the one beaming from your neighbor's wireless router) is competing for bandwidth on the same limited number of channels.

Photo by Wi-Fi Alliance

In April of 2020, the Federal Communications Commission voted unanimously to open up the 6GHz band for unlicensed use. With that policy change, significantly more airwaves are open that routers can use to broadcast Wi-Fi signals—and that's a big deal.

The opening of the 6GHz band is the biggest spectrum addition to Wi-Fi since 1989. The jump from 5GHz to 6GHz might not sound like much, but it essentially quadruples the amount of airwaves (14 additional 80MHz channels, and seven additional 160MHz channels) available for routers and smart devices. That means less signal interference.

Bottom line: Early-adopter devices using Wi-Fi 6 (such as the first batch of Wi-Fi 6 routers) are limited to the 2.4GHz and 5GHz spectrum, while Wi-Fi 6E-compliant devices will have access to all those juicy 6GHz airwaves.

Photo by Wi-Fi Alliance

What Are the Benefits of Wi-Fi 6E?

The simplest reason that you'll want Wi-Fi 6E? The 6GHz band allows for internet speeds of greater than 1Gbps. Not only that, but the increased spectrum means lower latency (less than one millisecond) for online games, video calls, or virtual computing sessions in which you need instantaneous response to keyboard commands, voices, or mouse clicks.

See How We Test Wireless Routers See How We Test Wireless Routers

Even with faster connectivity, you'll probably only notice the advantages of Wi-Fi 6E when it comes to home network capacity—which is to say, in the form of less spectrum congestion. Whole-home gigabit coverage and multi-gigabit Wi-Fi capacity means normal homeowners can finally have the kind of next-generation computing experiences we've only seen at venues like vendor demos or at trade shows. Imagine virtual reality gaming anywhere in your house, or participating in augmented reality business presentations, all without any bandwidth drop due to other family members streaming Netflix or neighbors watching YouTube.

What's the Catch?

There is usually a hidden "gotcha" with any new technology that sounds too good to be true. If Wi-Fi 6E has an Achilles' heel, it's that the 6GHz wireless spectrum uses shorter wavelengths. Short

wavelengths are great for fast data transfers, but have a harder time traveling long distances, and they suffer greater interference from physical obstructions like dense walls or floors in a building.

Photo by Wi-Fi Alliance

Any real-world Wi-Fi 6E network will likely use both the 6GHz and 5GHz bands to deliver fast, reliable connections throughout a home or office building. It's also entirely possible that future Wi-Fi 6E networks will use a combination of a main Wi-Fi 6E router and one or more Wi-Fi 6E repeaters to create a wireless mesh network that delivers the promised performance of Wi-Fi 6E even in large homes or office buildings with multiple obstructions.

Another potential issue for Wi-Fi 6E: The 6GHz spectrum in the US still has some existing licensed users, and Wi-Fi 6E networks will have to take steps to avoid interference outdoors. This won't be a problem inside your home or office, but if you want to stay connected to your Wi-Fi network while you're in the backyard, a Wi-Fi 6E router will use automated frequency control to prevent interference with other 6GHz band users.

In other words, your Wi-Fi performance will likely scale back to the 2.4GHz or 5GHz bands when you're outside.

How to Get Wi-Fi 6E

Now that you know Wi-Fi 6E is a must-have technology for the future, let's talk about how you can get your hands on it now. Countries like the US, Brazil, and Korea have already opened up the 6GHz

band, but many other countries have been slow to open their wireless spectrum for commercial use. As a result, most of the Wi-Fi 6E devices you'll see today through the end of the year will be hardware marketed for US customers.

Wi-Fi 6E devices will be backward compatible with Wi-Fi 6 and earlier Wi-Fi standards, but in order to use the new 6GHz channels, you'll need a Wi-Fi 6E router and a Wi-Fi 6E client device (meaning computers, phones, smart home devices, and other gadgets that support Wi-Fi 6E). That means even if you have a relatively new Wi-Fi 6 router, you'll still need to upgrade to a Wi-Fi 6E model.

Netgear Nighthawk RAXE500

Routers like the Netgear Nighthawk RAXE500—the first Wi-Fi 6E model we've tested—make a good foundation for a home Wi-Fi 6E network, but you won't be able to use that cutting-edge speed without the next generation of devices that support Wi-Fi 6E. We tested it using a Samsung Galaxy S21 Ultra. Apple's iPhone 13 lineup is rumored to support the standard, but we'll have to wait and see. Any new phone using Qualcomm's FastConnect 6700 and FastConnect 6900 will be able to use the 6GHz band as well.

We starting to see a few Intel-based laptops equipped with the Intel Wi-Fi 6E AX210 (Gig+) adapter, but the vast majority of new models still only support the Wi-Fi 6 standard.

Should You Upgrade to Wi-Fi 6E?

The easy answer to this question for most people right now is no. Wi-Fi 6E routers are just starting to hit the market, and as with most new technologies, they carry a high early adopter fee. By this time next year, prices will likely come down considerably, and there will be a lot more Wi-Fi 6E-compatible devices you can connect to your router.

Additionally, Wi-Fi 6E won't help you all that much outdoors, so if you're looking to expand your work-from-home capabilities to your backyard, you'll likely be better served by a mesh network than a Wi-Fi 6E router.

That said, if you're in the market for a new router, you want something future-proof, and you don't mind paying a premium, then by all means, consider a Wi-Fi 6E model. Everyone else can wait at least until next year before thinking about upgrading.

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Wi-Fi is getting its biggest upgrade in 20 years

6GHz Wi-Fi is coming soon

By Jacob Kastrenakes | @jake_k | Apr 23, 2020, 11:08am EDT

Illustration by Alex Castro / The Verge

In a few months, there's going to be a lot more Wi-Fi to go around. The Federal Communications Commission voted today to open up a plot of spectrum in the 6GHz band for unlicensed use — the same regulatory go-ahead that lets your router broadcast over the 2.4GHz and 5GHz bands. That means there are now more open airwaves — *a lot more* — that routers can use to broadcast Wi-Fi signals. Once the new spectrum is

officially opened for business later this year, that should translate to faster, more reliable connections from the next generation of devices.

This is the biggest spectrum addition since the FCC cleared the way for Wi-Fi in 1989, so it's a huge deal. The new spectrum basically quadruples the amount of space available for routers and other devices, so it will mean a lot more bandwidth and a lot less interference for any device that can take advantage of it.

"This is the most monumental decision around Wi-Fi spectrum in its history, in the 20 years we've been around," Kevin Robinson, marketing leader for the Wi-Fi Alliance, an industry-backed group that oversees the implementation of Wi-Fi, said ahead of the vote.

Devices are expected to start supporting 6GHz Wi-Fi by the end of 2020, so its implementation isn't far away. When it arrives, expect to see it branded under the name "Wi-Fi 6E."

Here's what we know so far about what to expect.

HOW WILL THIS FIX MY BAD WI-FI?

If you've ever had trouble connecting to your Wi-Fi network, there's a good chance spectrum congestion was the problem. Whenever you have too many devices trying to connect over the same band of frequencies, some devices will start to get dropped. So if you see a long list of nearby Wi-Fi networks in your area, that may be why your connection is getting slower and less reliable. There are simply too many competing signals for your computer to get through.

THE HOPE IS 6GHZ PERFORMANCE GAINS WILL LAST, EVEN AS THEY'RE MORE WIDELY USED

6GHz Wi-Fi can go a long way toward solving that problem. It offers not just a new swath of airwaves for routers to use, but a spacious swath that doesn't require overlapping signals like on some current Wi-Fi channels. The new spectrum has enough room for up to seven maximum-capacity Wi-Fi streams to all be broadcast simultaneously and not interfere with each other — all without using any of the previously available spectrum.

To get a little more specific, the FCC is opening up 1,200MHz of spectrum in the 6GHz band. For the past two decades, Wi-Fi has been operating with roughly 400MHz of

spectrum, and all available channels had to be split up within that limited space. Channels on the 6GHz band are expected to be 160MHz each in size. Only two channels at that size could fit inside the currently available airspace.

WHAT IS 6GHZ WI-FI?

Wi-Fi works by broadcasting over airwaves that are open for anyone to use. Today, it's working over two bands: 2.4GHz and 5GHz. Now, we're adding a third band, 6GHz.

QUADRUPLING THE SPACE AVAILABLE TO TRADITIONAL WI-FI

The numbers make a difference (2.4GHz travels farther, but 6GHz delivers data faster), but what really matters isn't the specific frequencies being used, but how large a swath of airwaves is available. And that's why 6GHz is particularly exciting: this new band quadruples the total space available to traditional Wi-Fi.

On an immediate level, it means that if you're the first person in your apartment building to get a 6GHz router, you're going to be living large as far as connectivity goes because no one will be competing with you. But even once 6GHz routers become more common several years from now, the hope is that the more spacious spectrum will allow for signals to remain faster and stronger than the ones we use today. "We will not be in the same position we are today five years from now," Robinson said.

WILL THIS MAKE WI-FI FASTER? SORT OF

Technically, 6GHz Wi-Fi has the same theoretical top speed as 5GHz Wi-Fi: 9.6 Gbps, the maximum offered under the Wi-Fi 6 standard, the current version of Wi-Fi.

You're still not going to get that speed in real life, but the new airwaves should help bump your speed up. That's because the limited spectrum available at 5GHz means Wi-Fi signals are often not as large as they could be. At 6GHz, it's assumed that routers will broadcast at the current maximum allowable channel size, meaning a faster connection.

Wi-Fi connections to smartphones could hit 1–2 Gbps over these new networks, Robinson said. Those are the kinds of speeds expected from millimeter-wave 5G, which so far has very limited availability. Of course, your speeds will still be limited by what your home internet provider offers, but it's a huge potential leap.

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Wi-Fi 6: is it really that much faster?

WHEN CAN I EXPECT WI-FI 6 DEVICES IN STORES?

The first wave of devices using 6GHz Wi-Fi is expected in the final quarter of 2020, according to Robinson. But deployment should really kick off in early 2021 when the Wi-Fi Alliance begins offering a certifications program for Wi-Fi 6E devices.

Manufacturers have been preparing for this moment. Already, the chipmaker Broadcom has announced a Wi-Fi 6E mobile chip. Qualcomm has said that it's ready to support 6GHz Wi-Fi in next-gen wireless products. And Intel said it'll have chips ready for January 2021.

Two major router companies, Linksys and Netgear, have signaled that they're on board. And Apple previously said the FCC's approval "sets the course for the next generation of Wi-Fi networks."

Smartphones are likely to be the first consumer devices to adopt Wi-Fi 6E, Phil Solis, a wireless analyst with IDC, told *The Verge*. Solis predicts 316 million devices will ship with Wi-Fi 6E support in 2021. After smartphones, he expects tablets to follow, with adoption in TVs likely in 2022.

"Wi-Fi's a very important part of the phone, so higher-end phones have higher quality Wi-Fi chips in them," Solis said. "Smartphones are a key product that makes sense for 6E because people use their phones for pretty much everything."

HOW WILL I KNOW IF A DEVICE SUPPORTS WI-FI 6E?

Right now, when you go to buy a new phone or laptop, you might see the label "Wi-Fi 6" on the box. That's great for now since it means your device supports the latest Wi-Fi standard, which offers more efficient wireless performance.

But "Wi-Fi 6" means your device is still operating on the same old spectrum, so starting later this year, you'll want to start looking for the label "Wi-Fi 6E." That stands for "Wi-Fi 6 extended into the 6GHz band." It's the (relatively) consumer-friendly name you'll see on phones, laptops, routers, and other gadgets that support 6GHz Wi-Fi.

All Wi-Fi 6E devices should be compatible with one another and backward compatible with whatever router you already have at home. The important thing to know, though, is that you won't see the 6GHz benefits until you buy a Wi-Fi 6E router. Chances are, those will be some of the first products to hit the market.

WHAT'S THE CATCH?

There are a bunch!

The big one is... companies actually have to follow through! All of the signs suggest they will, but the Wi-Fi Alliance has tried to point companies toward other forms of Wi-Fi before — like speedy WiGig or low-power HaLow — that haven't panned out, pretty much at all. (Robinson said that's not what's happening this time. "6GHz will become an integral part of Wi-Fi 6 and future generations of Wi-Fi," he said.)

OTHER COUNTRIES STILL HAVE TO APPROVE UNLICENSED 6GHZ USE

And assuming this all does work out, you'll still have to replace your devices to get the benefit. Current gadgets aren't set up to use 6GHz networks (it's largely been illegal to broadcast, after all), so you won't see the benefits until you buy a new router and a new phone, laptop, or other Wi-Fi-enabled device that can connect to it.

Wi-Fi 6E devices will still be backward compatible with all old Wi-Fi devices, but those gadgets largely won't get the benefit of the upgrade. They'll still be stuck using whatever version of Wi-Fi they shipped on. At least under the Wi-Fi Alliance's certification program, the 6GHz network will be reserved for more efficient Wi-Fi 6 devices.

Also, airwaves are overseen country by country. The FCC is opening up 6GHz in the US, but people in Europe still have to wait on individual countries and the European Commission to do the same for them. It could happen later this year, but there's no promise of that. That means regulatory issues could delay availability of this tech in some countries. Many gadgets are shipped globally, too, so it could also slow down overall adoption if major markets fall behind.

The 6GHz spectrum also has some existing licensed users, and Wi-Fi will have to work around them. Indoors, that's not expected to present an issue, since your walls should prevent interference. But outdoors, routers will need to make use of something called an

"automated frequency control" system to ensure they don't interfere with existing 6GHz users. That means less space to broadcast, which could degrade overall performance.

WHAT DOES THIS HAVE TO DO WITH 5G?

Nothing. But also — okay, it kind of seems like everything has something to do with 5G right now, doesn't it?

Here's the deal: technically, the FCC didn't open up new "Wi-Fi spectrum." It opened up new "unlicensed" spectrum, which is roughly what it sounds like. It means that you don't need a license to use it, so anyone can use it as long as they do so responsibly.

That means other devices and technologies could make use of the 6GHz band, potentially taking up space Wi-Fi wants to use. And yes, 5G is one of those things.

Cell carriers have in the past used unlicensed spectrum to augment the licensed spectrum that makes up the core of their wireless networks. They did this with LTE as one of many technologies meant to speed up connections. From the looks of things, it's possible they'll do that again by letting 5G overlap on the newly cleared spectrum with Wi-Fi 6.

Will this lead to interference issues? Will 5G come to dominate all global connectivity and totally replace Wi-Fi? Probably not, but it's too early to say. The two standards aren't necessarily in contention, though, so it's not like one has to be the winner or loser here.

"There's so much spectrum in the 6GHz band that there should be room for both," Solis said. Cellular use of 6GHz would be similar to Wi-Fi use, in factories or small cell sites, he said. "You're not gonna see macrocells using 6GHz."

For now, the tech industry seems to be rallying around 6GHz Wi-Fi, which seems like a good sign that Wi-Fi will be the main beneficiary — at least for the immediate future — of the 6GHz spectrum opening up.

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Wi-Fi 6 vs. Wi-Fi 6E: Spectrum, not hype, is key difference

The extended spectrum of Wi-Fi 6E sounds promising. But, when assessing Wi-Fi 6 vs. Wi-Fi 6E, organizations should pay close attention to radio frequency characteristics.

Lee Badman

Wi-Fi 6E is rightly garnering all sorts of interest and excitement right now, but as with all wireless standard advancements, be mindful of the inevitable hype.

First and foremost, from the perspective of feature sets and radio frequency (RF) capabilities written into the IEEE standard, Wi-Fi 6E is still 802.11ax -- and just like Wi-Fi 6 (no E).

Where Wi-Fi 6E gets exciting -- and perhaps a bit overblown -- is in its new frequency availability. For decades now, Wi-Fi has operated in the unlicensed 2.4 GHz industrial, scientific and medical band and in the 5 GHz unlicensed national information infrastructure (UNII) bands. Both slices of spectrum are feeling the pinch of Wi-Fi's ever-increasing popularity. This is why many people say Wi-Fi 6E will play a significant role in changing the overall Wi-Fi paradigm.

Wi-Fi 6 vs. Wi-Fi 6E: Higher frequency, more room to operate

In the 2.4 GHz band, Wi-Fi in the United States has well under 100 MHz in which to operate, and it only allows three noninterfering 20 MHz channels. 5 GHz permits the potential for 25 channels, again at 20 MHz wide.

But this is also where the Wi-Fi Alliance and marketing departments get a bit loopy: In 5 GHz, the wireless standards allow those channels to be bonded to form wider channels at 40, 80 or 160 MHz, which theoretically leads to the higher throughputs promised in 802.11n and 802.11ac.

Those wider channels require conditions that usually can't be achieved in the real world unless you are talking about small, isolated networks.

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5 benefits of Wi-Fi 6 for enterp networks

There is no free lunch, however. Those wider channels require conditions that usually can't be achieved in the real world unless you are talking about small, isolated networks. Alas, such is the state of Wi-Fi: lots of mixed messages about huge numbers that can't be achieved in most cases.

With Wi-Fi 6E, we gain a whopping 1,200 MHz of new spectrum, spanning 5.925 GHz to 7.125 GHz, in the UNII-5, -6, -7 and -8 bands. This translates to 59 new channels at 20 MHz wide and presents an impressive potential for various wider channels.

Unlike previous standards, at least some of those wide channels will be reliably achievable by Wi-Fi 6E client devices engineered to support the power and radio requirements of those bonded channels -- PCs, for example. It is doubtful that many mobile clients will ever get beyond 40 MHz channels due to resource constraints. Nonetheless, that capacity boost will be one of the main marketing drumbeats of Wi-Fi 6 vs. Wi-Fi 6E.

Cleaner air, with caveats

Remember, Wi-Fi 6 and 6E share all the same features as written in the 802.11ax standard. We've learned that the 6 GHz spectrum, where 6E operates, is impressively generous in size. This space is also largely free of the interference found down in the 5 GHz and 2.4 GHz unlicensed bands.

It's important to realize, though, that, as you go higher in frequency, the range at the same power decreases, as does the technology's ability to penetrate walls and other obstacles. This means wireless LAN (WLAN) designers must consider the differences between 2.4, 5 and 6 GHz when networks are created or refreshed; otherwise, holes in coverage are likely to exist.

Wi-Fi 6E faces another complication when you take it outside. The 6 GHz space is peppered with incumbent users, including licensed point-to-point microwave links and mobile TV broadcast uplinks. This means Wi-Fi 6E access points will require frequency control mechanisms that will prevent them from stepping on local licensees where they are authorized to operate.

A qualified bonanza

To be clear, Wi-Fi 6E represents a huge opportunity for the WLAN industry and its customers. Assuming the required conditions are achieved, both Wi-Fi 6 and 6E can deliver increased capacity, lower latency and accelerated data rates.

At the same time, not all devices will be able to take advantage of the headline-grabbing widest-channel capabilities of 6E. Perhaps most importantly, designers must understand the particular RF characteristics that underpin Wi-Fi 6E -- failure to do so could botch WLAN design.

This was last published in April 2021

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In a perfect world, Wi-Fi 6 would introduce benefits to business networks. But real-wo could curb the wireless technology's true

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Wi-Fi 6E expands Wi-Fi® into 6 GHz

Spectrum allocation extends Wi-Fi® capability

Countries and regulatory bodies—including Brazil, Chile, the European Union, Japan, Mexico, South Korea, Taiwan, United Arab Emirates, the U.K., and the U.S.—are delivering 6 GHz unlicensed spectrum to their citizens. These announcements herald a milestone in the Wi-Fi era. Unlicensed spectrum, where Wi-Fi operates, is one of society's most valuable resources. Wi-Fi industry innovation, promotion, and good stewardship of unlicensed spectrum has delivered significant benefits to users, and driven immense economic value worldwide – generating more than $3 trillion USD to the global economy in 2021. Availability of 6 GHz unlocks more value from Wi-Fi and brings even greater economic contributions.

Wi-Fi is foundational to consumer and enterprise networks, as well as the Internet of Things (IoT). It is recognized as an essential part of delivering 5G cellular service, an important tool that brings connectivity to underserved areas, and a strong contributor to global economies.

While demands on Wi-Fi networks have grown steadily for the past 20 years, the amount of available unlicensed spectrum has remained static—until now. The addition of the 6 GHz band for Wi-Fi use creates new opportunities for tremendous innovation and the continued success and economic growth enabled by Wi-Fi.

Wi-Fi 6E brings Wi-Fi to 6 GHz

Wi-Fi 6E is the industry name that identifies Wi-Fi devices that operate in 6 GHz. Wi-Fi 6E offers the features and capabilities of Wi-Fi 6—including higher performance, lower latency, and faster data rates—extended into the 6 GHz band. The additional spectrum capacity used by Wi-Fi 6E devices enables more Wi-Fi innovation and delivers valuable contributions to consumers, businesses, and economies.[1] Wi-Fi Alliance® members are preparing devices to enter the market where the 6 GHz spectrum is available, and are expected to ship over 300 million devices in 2021.[2]

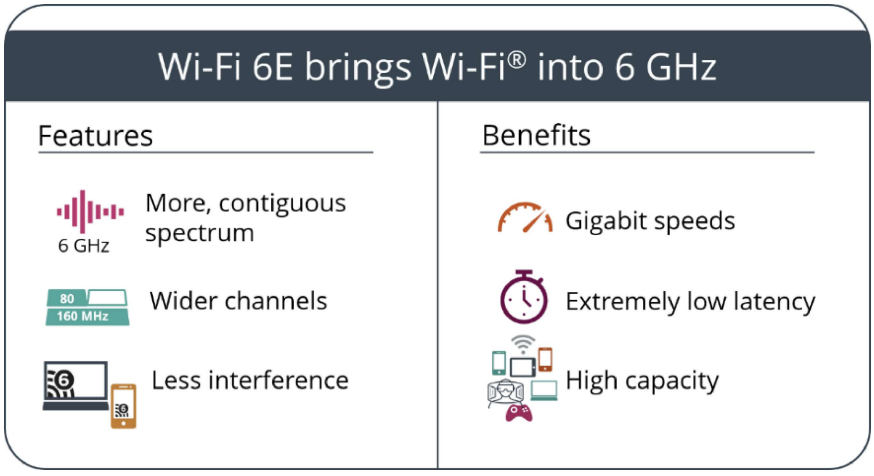
6 GHz brings additional spectrum capacity through contiguous spectrum blocks, which accommodate 14 additional 80 MHz channels or seven additional 160 MHz wide channels. Wi-Fi 6E utilizes the less congested 6 GHz band to enable high-bandwidth applications that require faster data throughput, as well as lower latency connectivity that is specifically well suited for next generation uses, such as unified communications, cloud computing, augmented and virtual reality, and telepresence.

[1] *A study by WifiForward estimates Wi-Fi use in the 6 GHz band could add more than $154 billion USD to the U.S. economy by 2025*
[2] *IDC, October 2020*

Wi-Fi CERTIFIED 6™ introduces Wi-Fi 6E for optimal performance

The Wi-Fi CERTIFIED 6™ certification program from Wi-Fi Alliance has added a certification option for Wi-Fi 6E devices, which extends Wi-Fi into 6 GHz. Devices certified for Wi-Fi 6E provide the advanced features of Wi-Fi CERTIFIED 6 and Wi-Fi CERTIFIED WPA3™ security, offering substantial gains in overall Wi-Fi network performance in challenging environments that are characterized by many connected devices such as stadiums, airports, and industrial parks. As 6 GHz becomes available in many markets around the globe, Wi-Fi Alliance certification enables worldwide interoperabililty of Wi-Fi 6E devices. Wi-Fi 6E delivers these advanced capabilities of Wi-Fi CERTIFIED 6:

- **Multi-user multiple input multiple output (MU-MIMO):** allows more downlink data to be transferred at once and enables an access point to transmit data to a larger number of devices concurrently
- **160 MHz channels:** increases bandwidth to deliver greater performance with low latency
- **Target wake time (TWT):** significantly improves battery life in Wi-Fi devices, such as Internet of Things (IoT) devices
- **1024 quadrature amplitude modulation mode (1024-QAM):** increases throughput in Wi-Fi devices by encoding more data in the same amount of spectrum
- **Transmit beamforming:** enables higher data rates at a given range resulting in greater network capacity
- **Orthogonal frequency division multiple access (OFDMA):** effectively shares channels to increase network efficiency and lower latency for both uplink and downlink traffic in high demand environments



Wi-Fi CERTIFIED™: Technology to trust

Since 2000, Wi-Fi Alliance has been driving the adoption and evolution of Wi-Fi through the Wi-Fi CERTIFIED program. The Wi-Fi CERTIFIED logo designates products with proven interoperability, backward compatibility, and the highest industry-standard security protections in place. Wi-Fi CERTIFIED devices can communicate with previous and future generations of Wi-Fi technologies, enabling a seamless, interoperable experience with a multitude of other Wi-Fi devices for years to come.

Learn more: www.wi-fi.org/discover-wi-fi/wi-fi-certified-6

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What is Wi-Fi 6?

By Tyler Lacoma
March 30, 2021

If your current Wi-Fi connection isn't strong enough to support your growing number of devices, you might be on the lookout for a better solution. Perhaps you're experiencing frequent connection errors, slowdowns, and other technical difficulties. Wi-Fi 6 can offer a faster, more reliable connection.

RECOMMENDED CONTENT

We'll talk more about this next-generation standard in Wi-Fi technology, tell you what it has to offer, and give tips on determining what devices are compatible with Wi-Fi 6.

The dawn of generational Wi-Fi labels

The Wi-Fi Alliance is the organization in charge of deciding, developing, and designating Wi-Fi standards. As devices become more complex and internet connections evolve, the process of delivering wireless connections also changes. That means that Wi-Fi standards — the technical specifications that manufacturers use to create Wi-Fi — need to be periodically updated so that new technology can flourish and everything can remain compatible. So far, so good.

But the awkward naming of Wi-Fi standards has become a real annoyance for the average person who tried to figure

out what those little letters at the end mean. The Wi-Fi Alliance is aware of this, which is why they announced a new way to label Wi-Fi standards by referring to the number of the generation. This will apply to the upcoming Wi-Fi 6/6E and be retroactive, applying to older standards. For example:

- **802.11n (2009) = Wi-Fi 4**
- **802.11ac (2014) = Wi-Fi 5**
- **802.11ax (newly released) = Wi-Fi 6/6E**

Easier, isn't it? This will cause a period of confusion where some products are labeled with the old code, and some are just called Wi-Fi 4 or Wi-Fi 5 when it means the same thing. This should be resolved in time as older product labeling is phased out, and everyone gets used to the new, friendly names when doing research.

What the Wi-Fi 6/6E standards bring

Now that we've covered the naming issue, you're probably wondering just what Wi-Fi 6/6e brings to the table. Why was another update required? There are

a lot of new Wi-Fi technologies on the rise, and Wi-Fi 6 helps standardize them. Here are the important new pieces and what exactly they mean for your wireless network.

Intel

First off is lower latency. Reduced latency means there are shorter or no delay times as data is sent (very similar to ping rate and other such measurements). Everyone wants low latency connections because it improves load times and helps avoid disconnects and other issues. Wi-Fi 6 lowers latency compared to older Wi-Fi standards, using more advanced technology like OFDMA (orthogonal frequency division multiple access). Basically, it's better at packing data into a signal.

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Of course, Wi-Fi 6 will also be faster. By offering full support for technologies like MU-MIMO, connection quality will vastly improve for compatible mobile devices, which should also speed up content delivery. Even if you don't upgrade your internet speed, such improvements can improve your Wi-Fi data speed anyway, so you get more information faster. How much faster? Digital Trends tested a Wi-Fi 6 laptop and router in late December and found a more than 60% increase in speed.

Believe it or not, Wi-Fi 6E promises to be even faster than Wi-Fi 6! While Wi-Fi 6 devices make use of the brand new 6GHz radio band, 6E devices offer "14 additional 80 MHz channels and 7 additional 160 MHz channels", according to the Wi-Fi Alliance. More impressively, these channels are designed to not overlap in order to reduce latency and improve congestion issues when using a device around multiple networks.

It also means fewer dead zones, thanks to some expanded beamforming capabilities. Beamforming is the trick your router uses to focus signals on a particular device, especially if it looks like

that device is having trouble with a connection. The new standard expands the range of beamforming and improves its capabilities, making dead zones in your house even less likely.

Lastly, Wi-Fi 6 means better battery life. There's a term called "TWT" or target wake time, a new technology that Wi-fi 6 embraces. This helps connected devices customize when and how they "wake up" to receive Wi-Fi data signals. It makes it much easier for devices to "sleep" while waiting for the next necessary Wi-Fi transmission (this does not mean your device is turned off, just the parts used for Wi-Fi). In turn, this can save a

significant amount of battery life for devices, which should make everyone happy.

Watch for the Wi-Fi 6/6E label

So, how do you know if a router, phone, or other device works with the new 802.11ax standard? First, look for the phrase "Wi-Fi 6/6E" on the packaging, advertisements, labels, and so on. However, the Wi-Fi Alliance has also suggested using icons to show the Wi-Fi generation. These icons look like Wi-Fi signals with a circled number within the signal. Watch for these icons as well when picking out the right device.

Buying a Wi-Fi 6/6E device

If you go shopping for a new router, you'll probably notice that Wi-Fi 6 routers are already available. These routers use an early version of Wi-Fi 6 for those who want to adopt the technology as soon as possible.

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These routers can exist before Wi-Fi 6 is officially finalized in late 2019 because all the important information about Wi-Fi 6 protocol already exists. Competition is fierce and manufacturers are in an arms race to see who can get their technology on the market before anyone else, so most of them have already begun to produce these routers using only the protocol outline for Wi-Fi 6. They are

betting that any other final changes to Wi-Fi 6 will be minor and easily addressed, probably through a firmware update — and they're probably right. The devices available now are using a prototype version of the new standard and received updates in late 2020.

Router manufacturers may have jumped the gun on offering Wi-Fi 6 routers before there were any devices available to actually support their features. One of the very few is the Galaxy S10. Wi-Fi 6 computers are also slowly coming to market: Intel's 10th-gen processors include Wi-Fi 6 compatibility, which means compatible laptops and other

mobile devices will soon be on their way. The Wi-Fi Alliance launched its Wi-Fi 6E certification program on January 7, 2021, ahead of the hotly anticipated CES 2021 and coinciding with the official release of Wi-Fi 6/6E.

Thankfully, CES 2021 has introduced some impressive-looking Wi-Fi 6/E routers and mesh routers from various well-known manufacturers, including Netgear, TP-Link, Arris, and Linksys, as well as a USB adapter from D-Link to add Wi-Fi 6 directly to your laptop. Many brands are anticipating Wi-Fi 6 to take over the industry and have thus come out with products like Lenovo's ThinkPad X1

and the ASUS ROG Zephyrus that have built-in Wi-Fi 6 support.

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What is Wi-Fi 6E?

Introduced by Wi-Fi Alliance, Wi-Fi 6E is the upcoming standard for an extension of Wi-Fi 6 (also known as 802.11ax), enabling the operation of features in the unlicensed 6 GHz band, in addition to the currently supported 2.4 GHz and 5 GHz bands.

With an additional 1200 MHz of spectrum available for use in the 6 GHz band for Wi-Fi applications, Wi-Fi 6E devices will operate in 14 additional 80 MHz channels and 7 additional 160 MHz channels. This broader spectrum simplifies network design and deliver ultimate Wi-Fi performance with higher throughput and wider channels, while eliminating the need to support legacy devices, resulting in less network congestion.

Making use of this extended spectrum capacity in 6 GHz brings the promising outlook of continued innovation across Wi-Fi user experience and connected devices. The Wi-Fi 6E standard further improves the 802.11ax network user experience with faster and more reliable Wi-Fi networks that are designed for soaring device densities and high-bandwidth applications such as video streaming, videoconferencing, and voice calls.

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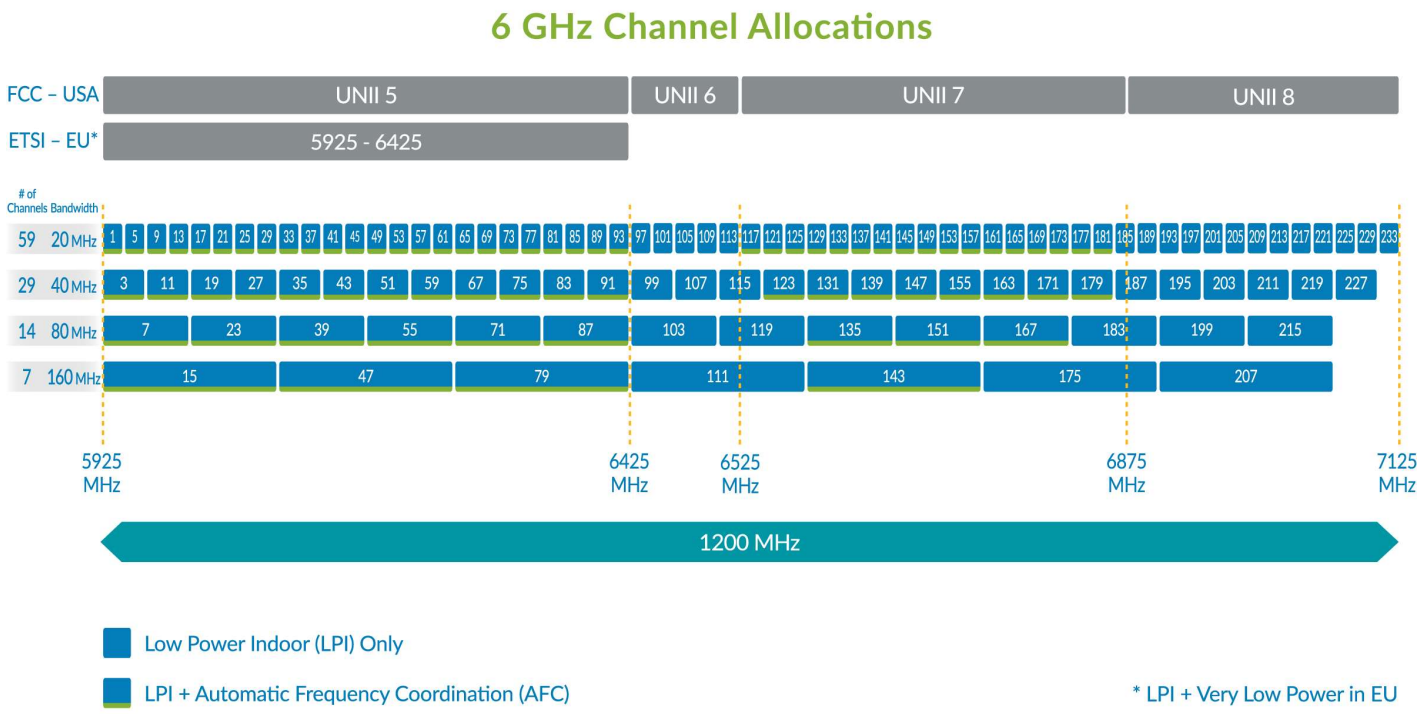

Improving User Experience with Wi-Fi 6E

With the growing demand to connect more devices to the network, Wi-Fi 6E will enable enterprises and service providers to support new and emerging applications and keep each connected device performing at an optimum level.

The introduction of Wi-Fi 6E addresses Wi-Fi spectrum shortage issues by providing additional and contiguous channel bandwidth, supporting an ever-growing number of devices at unprecedented speeds. The added 1200 MHz in the 6 GHz band will enable enterprises to deliver faster, more reliable enterprise Wi-Fi networks. These networks will be highly scalable and resilient, with simplified architectures, improving their ability to support more users at multigigabit speeds—even in very congested environments with many mobile and IoT devices.

Wi-Fi 6E further increases the network capacity and efficiency for demanding and mission-critical applications that require higher throughput, such as enterprise video streaming and video conference. The initial generation of Wi-Fi 6E chipsets is now available for vendors to start the development of both access points and mobile devices. Wi-Fi 6E products will be available in the next two years. As client devices (which often lag chipset development) become more widely available, organizations whose requirements go beyond the reach of 802.11ax are likely to initiate migration projects.

How Does Wi-Fi 6E Work?

Wi-Fi 6E provides all the features and capabilities of 802.11ax, but it does so by operating in the 6 GHz band. 802.11ax goes beyond boosting network speed and combines innovative technologie

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network performance when connecting a large number of devices running high-bandwidth, low-latency applications.

Wi-Fi 6E networks will provide increased capacity by operating on the 6 GHz band with 14 additional 80 MHz channels and 7 additional 160 MHz channels, while leveraging these existing 802.11ax features:

- 8x8 uplink/downlink MU-MIMO, OFDMA, and BSS Color to provide up to four times more capacity to handle more devices.
- Target wake time (TWT) to improve network efficiency and device battery life, including that of IoT devices.
- 1024 quadrature amplitude modulation mode (1024-QAM) to increase throughput for emerging, bandwidth-intensive uses by transmitting more data in the same amount of spectrum.

Realizing the Benefits of Multigigabit Ethernet

Juniper is committed to delivering innovative and high-performance products that will allow enterprises and service providers to realize the full potential of Wi-Fi 6E innovations.

With the support of an additional 1.2 GHz of spectrum in the 6 GHz band, Wi-Fi 6E will drive up the access point uplink requirements and require multigigabit Ethernet (802.3bz) connectivity to the access layer switching infrastructure.

Juniper Networks EX Series Ethernet Switches, a family of high-performance access switches that support 802.3bz (multigigabit Ethernet), can address these soaring bandwidth needs. To help enterprises deliver great end-to-end user and IoT experiences, these switches also work with the complementary Mist Wired Assurance service, which uses AI and data science for actionable insights and self-driving network capabilities.

As enterprise companies prepare to roll out Wi-Fi 6 access points today or plan future upgrades to Wi-Fi 6E for their access switching, they should make sure that their solution has the capability to support 802.3bz connections at 2.5GBASE-T or 5GBASE-T speeds.

Resources

- AFC and 6 GHz Incumbents
- Power Spectral Density
- Wi-Fi 6E Will Demand Multigigabit Ethernet
- Wi-Fi 6E Summary: Top 5 New Things About It
- Wi-Fi 6
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What is Wi-Fi 6E: Routers, devices and how it's better than Wi-Fi 6

By Brian Nadel 4 months ago

Wi-Fi 6e adds support for 6GHz wireless spectrum, supercharging home networks and pushing data to the limit

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(Image credit: Netgear)

Just when you got used to Wi-Fi 6 being the best way to build a home network, Wi-Fi 6e arrives with the power to change the way you think about and use wireless data. By adding a new 6GHz transmission band and opening up a slew of high-performance data channels, Wi-Fi 6e can boost data delivery to new levels but it suffers from limited range.

Based on the Institute of Electrical and Electronics Engineers (IEEE) 802.11ax specification, Wi-Fi 6e opens up 1.2GHz of high frequency spectrum from 5.925- to 7.125GHz for moving huge gobs of data. This makes it the biggest addition to Wi-Fi since the original 802.11b gear came out more than 20 years ago.

(Image credit: Netgear)

"This is a gigantic leap forward for Wi-Fi," says Kevin Robinson, senior vice president for marketing at the Wi-Fi Alliance. "It pushes performance to the limit and can help enable new uses." In addition to all-out online gaming and more easily viewing 8K online videos, Wi-Fi 6e can help keep videoconferencers from staring at frozen faces and opens up new vistas in telemedicine as well as augmented and virtual reality.

Wi-Fi 6 vs. Wi-Fi 6e

A look inside the Wi-Fi 6e spec shows there are several key performance updates. In addition to a low latency design that will make gamers drool, Wi-Fi 6e can tolerate interference better and adds more than 100 new data channels compared to Wi-Fi 6. In fact, it offers seven extra ultra-wide 160MHz channels – up from Wi-Fi 6's single usable 160MHz channel.

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While it matches Wi-Fi 6 with an overall bandwidth of 9.6Gbps, WiFi-6e can help users frustrated with low throughput by spreading the data out over a wider swath of spectrum by using the 2.4-, 5- and now the 6GHz bands. Think of Wi-Fi 6e as a cascade of data: up close to the router, 6GHz's peak performance will dominate, then it will automatically switch over to 5GHz as you go down the hallway and finally rely on 2.4GHz for long range connections.

"Wi-Fi 6e will be most beneficial in areas where high-speed data is most important," adds the Wi-Fi Alliance's Robinson. "It will provide an extra punch of performance."

When is Wi-Fi 6e coming?

The wait for Wi-Fi 6e equipment will likely be much shorter than earlier wireless data specs. That's because some of it is already here. The first Wi-Fi 6e routers have already started selling and we'll begin to see more Wi-Fi 6e routers and mesh systems throughout 2021.

After that, Wi-Fi 7 is on the way. The details are still being worked out, but it will be based on the 802.11be's Extremely High Throughput (EHT) technology. This next-gen spec has promise to further lower latency, while raising available bandwidth and making sure everyone at home has access to all the data they want.

Ad

On the router side of the 6e equation, there are chips available from Intel, Broadcom, Qualcomm and others that will be used to create a new generation of routers. A glance at our list of the routers of CES 2021 shows several Wi-Fi 6e routers on the horizon.

Netgear Nighthawk RAXE500 (Image credit: Netgear)

The first three products are the Asus ROG Rapture GT-AXE11000, the Linksys AXE8400 mesh system and the Netgear Nighthawk RAXE500.

Linksys AXE8400 (Image credit: Belkin)

All are tri-band premium devices that will sell for between $450 for a conventional router and $1,200 for a three-piece mesh networking kit.

Wi-Fi 6e devices

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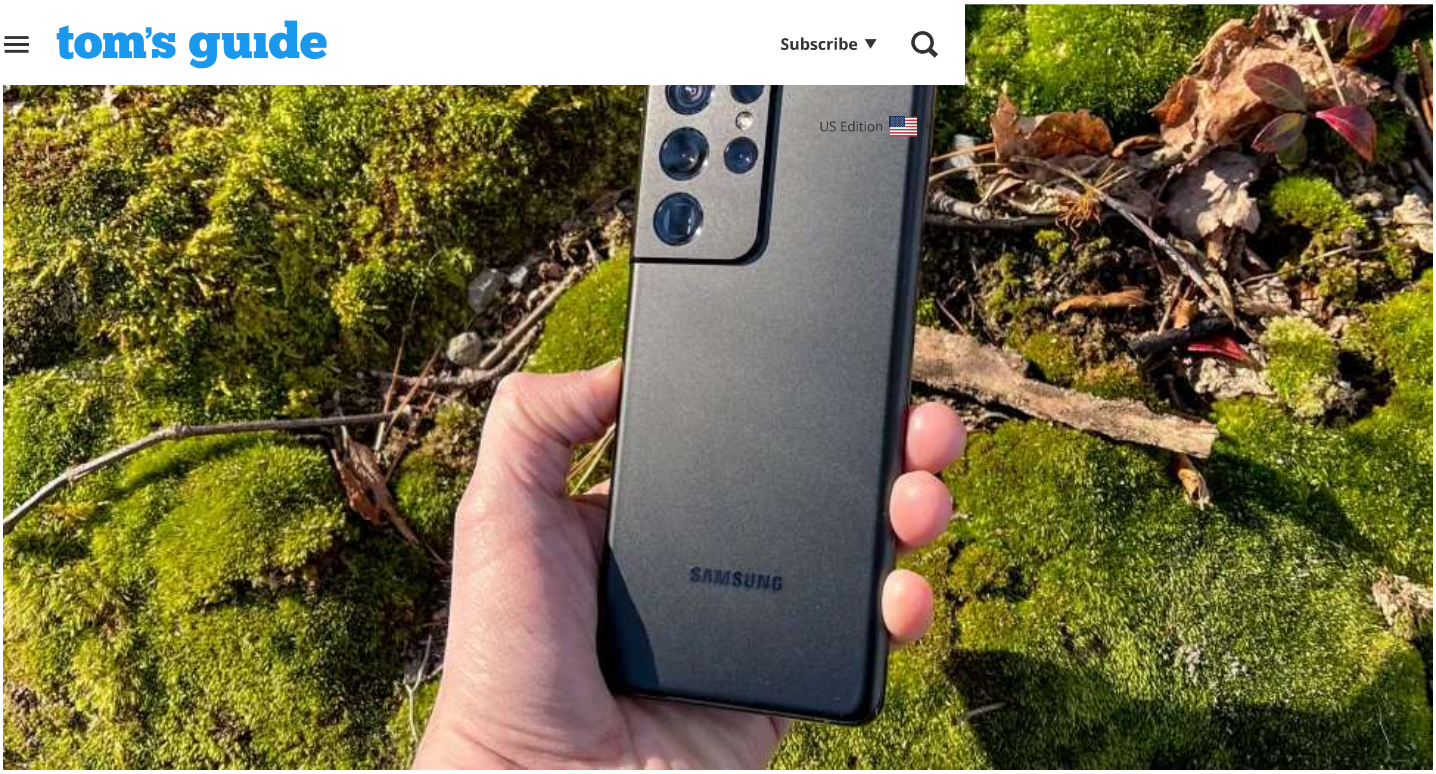

Samsung Galaxy S21 Ultra (Image credit: Future)

The good news is that the Wi-Fi Alliance has started certifying the new Wi-Fi 6e gear that it will not only work with existing systems but a new generation of wireless gear. By summertime, look for hundreds of Wi-Fi 6e products, from routers, laptops and tablets to phones and augmented reality headsets.

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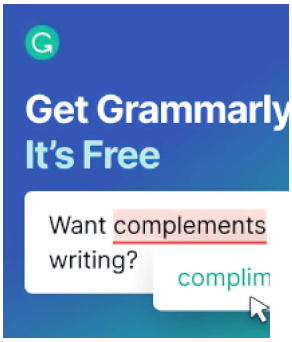

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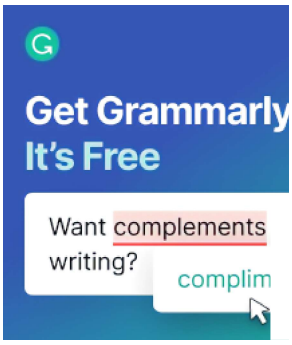

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