**5G explained: How it works, who it will impact, and when we'll have it**

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What you need to know about 5G

The future is wireless, and it's really fast. [5G](https://www.cnet.com/5g/) data networks promise to usher in a new era of digital transformation powered by lightning-quick phones, enhanced virtual and augmented reality, the [Internet of Things](https://www.cbsnews.com/news/internet-of-things-iot-next-industrial-revolution-davos-2019-world-economic-forum/), and countless more technological wonders.

At least, that's what mobile carriers and device manufacturers would like us to believe. 5G represents the fifth generation of wireless data networks, and while some phones released this year might boast of being "5G enabled," [devices with true 5G won't ship any time soon](https://www.cnet.com/news/no-your-at-t-phone-doesnt-have-5g-yet/). Right now the nomenclature used for the technology is mostly marketing fuzz, and all four major mobile carriers in the U.S. are squabbling about the definition of "[real](https://www.cnet.com/news/verizon-and-t-mobile-bash-at-t-over-fake-5g/)" 5G.

In preparation for broad deployment, every major data carrier in the U.S. is actively marketing 5G. Verizon launched a campaign called [5G Home](https://www.verizonwireless.com/5g/home/), an internet service that runs on Verizon's network. AT&T recently rolled out a campaign touting a data network the carrier calls "[5G Evolution](https://about.att.com/newsroom/2018/5g_evolution_market_update.html)," a [rebranding of LTE technology](https://www.cnet.com/news/at-t-brings-5g-evolution-not-real-5g-to-117-more-markets/). [Sprint promptly sued AT&T](https://www.zdnet.com/article/sprint-files-lawsuit-against-at-t-over-5g-claims/) and claimed the carrier was misleading customers about what qualifies as 5G. T-Mobile enlisted physicist Michio Kaku to help the company promote their ["5G for everyone"](https://www.t-mobile.com/5g) marketing campaign. (Kaku is also a CBS News contributor; he was not involved in this story.)

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The economic potential of 5G is so significant President Trump [tweeted](https://twitter.com/realDonaldTrump/status/1098581869233344512), "I want 5G, and even 6G, technology in the United States as soon as possible. It is far more powerful, faster, and smarter than the current standard. American companies must step up their efforts, or get left behind."

5G could be a truly revolutionary technology, said [Future Today Institute](https://futuretodayinstitute.com/amy-webb/) founder and quantitative futurist Amy Webb. In the near future the tech will enable "city-scale networks and city-scale spatial computing. Not just the [Internet of Things](https://www.cbsnews.com/news/internet-of-things-iot-next-industrial-revolution-davos-2019-world-economic-forum/) (IoT) as it relates to your office or home environment but a city where devices and sensors and all sorts of things are connected."

**What is 5G?**

The name "5G" is a broadcast transmission protocol devised by the 3rd Generation Partnership Project (3GPP), a global consortium of telecom groups; it refers to a spectrum of radio frequencies that carriers like Verizon and AT&T will use to transmit data. The radio signal transmits information at an extremely high frequency (EHF), or "millimeter wave," which allows for connections significantly better than current 4G networks.

The technology promises to transmit a high volume of data to mobile and IoT devices, like connected traffic lights. By [some estimates](https://www.techrepublic.com/article/5g-mobile-networks-a-cheat-sheet/), 5G wireless networks could deliver data at nearly 10 gigabits per second, several orders of magnitude faster than current 4G networks which peak at about 100 megabits per second.

"4G was a faster way to connect to the internet on the go," said Sanyogita Shamsunder, vice president of 5G Labs and Innovation at Verizon. "5G is not only higher throughputs and higher speeds but it fundamentally is a different way to construct the network to provide fast response times from the internet to the mobile end point, whatever it may be: a phone, a robot, an IoT device."

But with great speed comes great complexity. Because the millimeter wave used by 5G transfers information at [short distances](https://www.techrepublic.com/article/does-the-world-really-need-5g/), more transmitters and base stations, signal repeaters, are required. This could result in prolonged deployment times and spotty coverage, or no coverage in rural areas. 5G waves are also more susceptible to atmospheric interference and weather conditions like rain.

Modern cell towers transmit 4G LTE signals over distances up to several miles, but 5G requires a dense concentration of smaller transmitters to cover the same relative area. Transmitters can be hidden in plain sight on utility poles, street lamps, and rooftops in urban areas. In [rural areas](https://www.cnet.com/news/why-5gs-out-of-reach-for-more-people-than-you-think/) there are fewer opportunities to distribute transmitters.

"Opportunities we see in rural markets are around using 5G, perhaps less for just raw speed, and more for these different IoT use cases, so being able to connect farms and farming equipment and sensors in these agriculture locations, so that you know farmers can get much more insight into how crops are doing and get much better yields out," said Samsung's Alok Shah, VP of Networks Strategy, Business Development & Marketing.

There are also security challenges associated with 5G. [Chinese tech giant Huawei](https://www.cbsnews.com/news/what-is-chinas-huawei-and-whats-behind-the-battle-with-the-u-s/) is one of the world's [largest makers of 5G](https://www.cbsnews.com/news/huawei-president-ren-zhengfei-says-he-would-defy-chinese-law-on-intelligence-gathering/) base stations and transmitters in the world, but its products are currently unavailable to American consumers because of sanctions placed on the company by the U.S. government. Huawei has long faced suspicions of espionage, which its [founder and president, Ren Zhengfei, denied](https://www.cbsnews.com/news/huawei-president-ren-zhengfei-says-he-would-defy-chinese-law-on-intelligence-gathering/) this week in an exclusive interview with "CBS This Morning" co-host Bianna Golodryga.

Huawei founder: "5G is not an atomic bomb"

Suspicions about the company turned to actual charges in January, when the company, its CFO and a subsidiary were [indicted on 23 counts](https://www.cbsnews.com/news/huawei-indictment-charges-fraud-selling-trade-secrets-today-us-justice-department-china-company-t-mobile-2018-01-28-updated/) ranging from money laundering and obstruction of justice to stealing trade secrets.

**Virtual reality, augmented reality, and more**

In spite of the challenges associated with the technology, there are plenty of reasons to be excited about 5G, said Verizon's Shamsunder. "When we built the 4G networks, we didn't know what was possible. We had video as one of the major use cases but very quickly we enabled industries, the ride hailing industry probably wouldn't exist if we didn't have cellphones today," she said.

[Augmented reality](https://www.cnet.com/news/microsoft-wins-480m-contract-to-supply-us-army-with-hololens/) and [virtual reality](https://www.cnet.com/tags/virtual-reality/) are likely to gain traction quickly, said Shamsunder. Most contemporary [headsets](https://www.cnet.com/videos/3-ways-to-wrangle-your-vr-headsets-cord/) must be directly connected to a PC using USB 3.0 cables. If those headsets were connected to a 5G mobile network instead, the hardware could potentially be untethered, letting the consumer use VR and AR technology in their home, car or on a flight.

Several startup companies are experimenting with AR and VR technologies at the [Verizon 5G Lab Alley](https://en.wikipedia.org/wiki/Alley_(company)), a coworking space in lower Manhattan. [Evercoast](http://www.evercoast.com/) is a [volumetric capture](https://www.cnet.com/news/sundance-vr-ar-harness-a-different-tech-for-their-art-your-body/) software to build personalized holographic content. The system uses 16 high-definition cameras that capture images from 180 degrees to record real-time 3D scans. The captured images are then transferred to the cloud and a hologram is rendered almost instantly. After capturing the image, users can look at a glass display or through virtual reality goggles to see themselves in different outfits or settings. It's a truly futuristic use of 5G tech.

In the next five years, said Shamsunder, 5G could transform a broad spectrum of industries, including "shopping and education, first responders, public safety, perhaps even nurses and physical therapists."

What excites her most, though, are the innovations that have not yet been invented. "I don't know precisely what is coming," said Shamsunder, "but I know it's going to be wireless and it's going to be exciting."

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