



I pay for Gigabit Internet speed. *Why doesn't my phone have a Gigabit Wi-Fi connection?*



The Problem

There is a common misconception that wireless devices such as most phones, tablets, or laptops have the ability to achieve an actual Gigabit connection to a Wi-Fi access point. We know through a combination of math, physics and properly engineered Wi-Fi standards-based safeguards that the achievable connection for most mobile devices in real-world situations is typically 30-40% of the negotiated connection rate. So how do we explain this in easily understood terminology?

Definitions

- Wi-Fi** A wireless networking technology that allows computers and other devices to communicate over a wireless signal. It describes network components that are based on one of the 802.11 standards developed by the IEEE and adopted by the Wi-Fi Alliance.
- Wi-Fi 5** 802.11ac IEEE standard based on current technology mainly focused on performance enhancements in the 5Ghz Wi-Fi spectrum.
- Wi-Fi 6** 802.11ax IEEE standard based on the newest technology focused on stabilizing multiple simultaneous Wi-Fi connections and increasing overall density.
- Mbps** Short for Megabits per second, a measure of data transfer speed.
- Gigabit** One Gigabit (abbreviated "Gb") is equal to 1,000 Megabits.



The Technology

Most mobile devices have a 2x2 radio, two antennas transmit, and two antennas receive at any given time. Devices are able to negotiate different connection rates based on location to the Wi-Fi antenna, Wi-Fi standard being used (Wi-Fi 4,5,6), and interference present in the environment. The maximum negotiated connection rate of an iPhone 11, for example, will be 866Mbps on Wi-Fi 5 and 1201Mbps on Wi-Fi 6 assuming some industry standard configuration settings. This is merely the negotiated connection rate and not the real-world throughput. Basically, both devices have agreed to talk and have agreed on what the max rate could hypothetically be. Tech tip: This information is viewable on a Mac computer by holding down the option key and clicking on the Wi-Fi symbol in the upper left corner of the screen. Look for "Tx Rate:" in the list.



The Reality

When environmental interference is introduced and device proximity is added to the equation, we know that the realistic connection speed will be between 300-500Mbps. This speed range is dependent on the Wi-Fi standard in use and the distance between the device and the Wi-Fi radio. As a device moves throughout the home it is constantly renegotiating this connection rate and therefore performance may change depending on a handful of factors in the environment. As mentioned earlier, distance and RF interference are the two main limiting factors to achieving high connection rates.



The Application

In larger homes the best way to achieve the highest connection rate is to have multiple Wi-Fi radios spread throughout the home to create a blanket of coverage. This will guarantee a level of connectivity to make sure mobile devices can always perform their required tasks however, it does not guarantee the greatest speed because of the aforementioned limiting factors. Devices have complete control of which Wi-Fi antenna they are connected to and therefore your device may be directly under an antenna but still be connected to one further away. The device understands that its current connection is still sufficient to perform the requested tasks and is solely in charge of where it connects. Even something as demanding as a 4K video stream is around 25Mbps download speed and does not require ultra-high Wi-Fi throughput.



The Big Picture

Download and upload speeds are only one part of a performance-based Wi-Fi system and play a small part in the ecosystem being created within your home for your Wi-Fi devices to perform optimally. Additional technologies like roaming assist, airtime fairness, interference mitigation, configuration capabilities, serviceability, and troubleshooting tools are all as important if not more so.