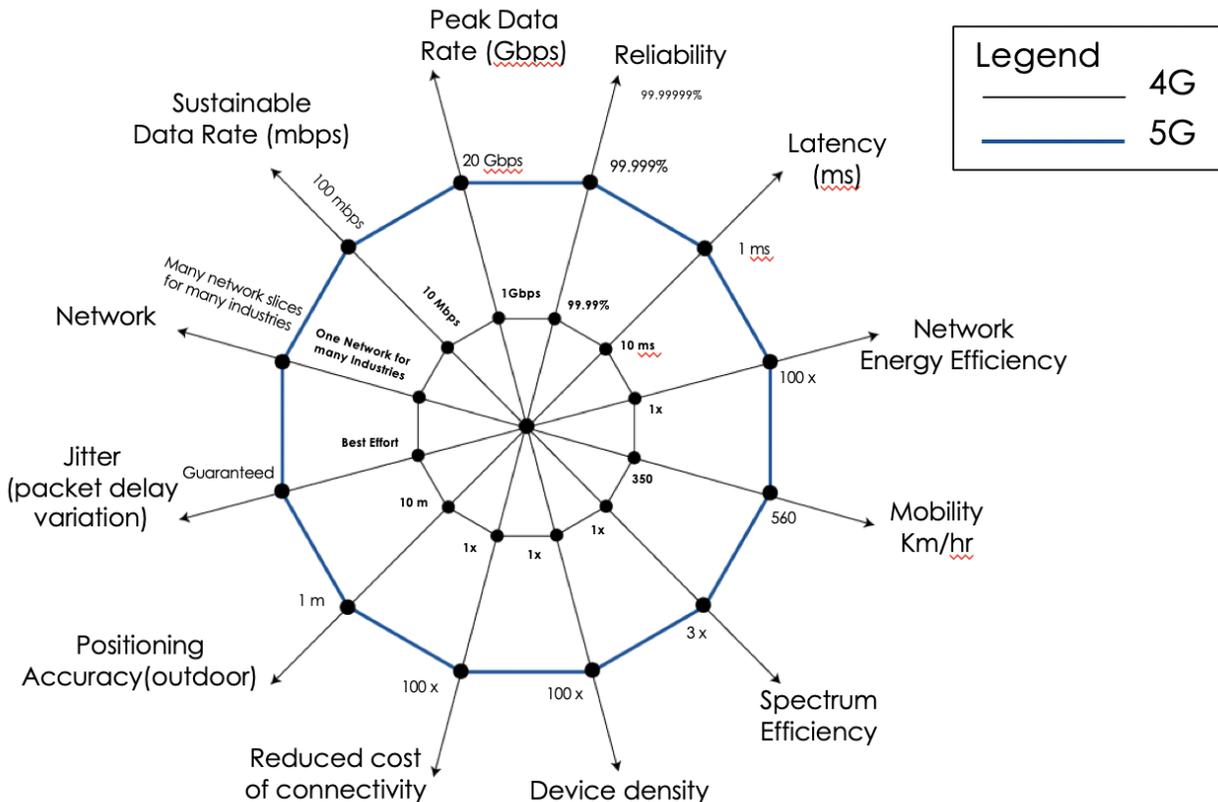


Overview of 5G

As the fifth and latest generation of cellular mobile technology, 5G's presence is rapidly growing and promises to bring with it a technological revolution. It serves as the successor to 4G technology, which was first introduced in 2010. 5G will act as an expansion upon the network and device connection capabilities currently provided by 4G through the introduction of greater data speeds, lower latency, increased connection capabilities, lower costs, and less power consumption.



Source: Medium¹

While the technology has not yet been fully established, it remains in development and several companies, both in the US and China, have launched preliminary 5G services. 5G remains a major focus in terms of investment from both companies and governments for the next decade, and the network is expected to reach advanced development by the mid-2020s.

Applications of 5G

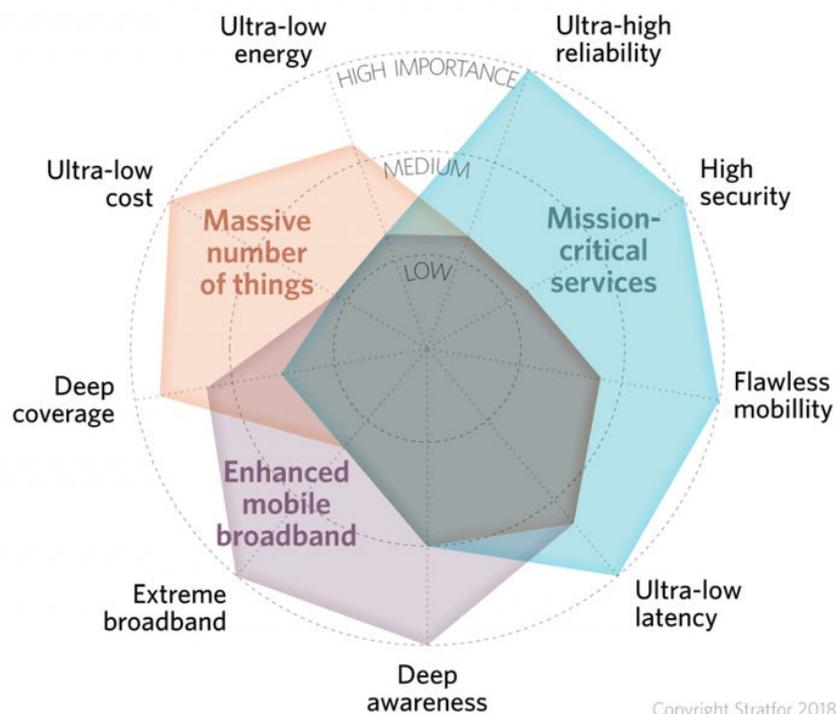
5G's combination of higher bandwidth, lower latency, and greater speeds enables a much greater range of applications than its predecessor. According to a report from PCMag, the bodies responsible for setting the standards for 5G are aiming for speeds of 20 Gbps (20 times superior than 4G) and latency of 1 ms (1/10 the time of 4G), each of which are far better than the respective capabilities offered by 4G.² These features will contribute to a greater integration of technology into all existing industries, while also introducing a number of new industries powered by the 5G network.

¹ <https://medium.com/datadriveninvestor/is-5g-friend-or-foe-for-autonomous-vehicle-72ee70800031>

² <https://www.pcmag.com/article/345387/what-is-5g>

Qualities of 5G

5G will improve upon LTE's performance on multiple fronts. Different qualities will be of varying importance, depending on the end user or application.



Source: Forbes³

Autonomous Vehicles

Key to the advancement of the growing autonomous vehicle industry are low latency and high-performance connection capabilities, which is where 5G wireless technology comes into play. The 4G network that the industry is currently developing on, while useful enough for preliminary testing, experimentation, and data collection, is not suited for the high demands of wireless communication that would have prevented incidents such as the death of a pedestrian in Arizona in March 2018, caused by a collision with a self-driving Uber vehicle.⁴ Since autonomous vehicles will be expected to interact and communicate with other vehicles and the external environment to improve traffic management and passenger and pedestrian safety, the low latencies provided by 5G capability will be imperative for the industry's advancement. As such, autonomous vehicles will likely not achieve mainstream acceptance until 5G data networks are fully established.

Industrial Applications

The expansion of 5G is expected to have a broad impact on the industrial and manufacturing sectors, as automation increasingly becomes the norm. Industrial environments such as warehouses, manufacturing plants, factories, and seaports will become more automated as companies seek to increase productivity and efficiency while reducing costs. Specific functions within the industrial field that will be enhanced through automation include equipment operation, maintenance, data analysis, and energy management, and these processes will be improved through the superior connectivity and data speeds that 5G provides.

Smart Devices

The increased connection capabilities that 5G offers will enable the acceptance of smart devices and increase the viability of smart homes. The 4G networks that devices currently operate on are more expensive and demand more data, resulting in challenges for connectivity and maintenance of these products as well as for the growth of the

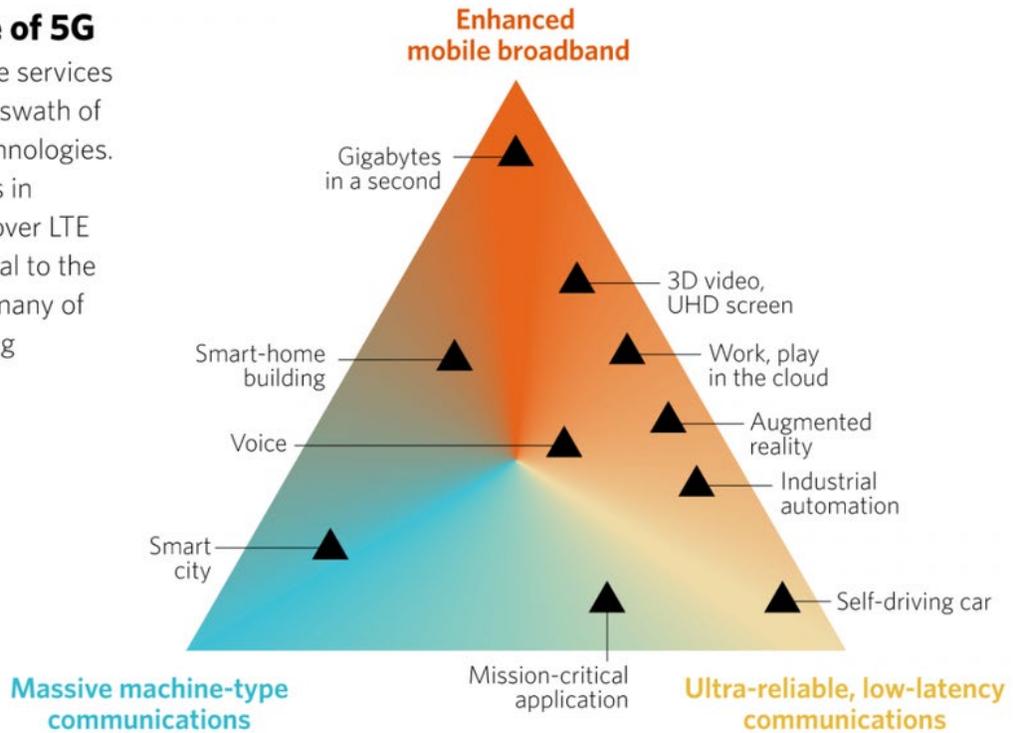
³ <https://www.forbes.com/sites/stratfor/2018/04/03/the-u-s-china-and-others-race-to-develop-5g-mobile-networks/#767d47515875>

⁴ <https://www.nbcnews.com/tech/innovation/self-driving-uber-car-involved-fatal-accident-arizona-n857941>

overall industry. As this new and more technologically advanced network expands its presence, smart home devices and appliances will be able to utilize 5G's broader connectivity, lower latency periods, and better power management.

Future Use of 5G

5G will provide services across a wide swath of disruptive technologies. Improvements in performance over LTE will be essential to the future use of many of these emerging applications.



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Source: Forbes⁵

⁵ <https://www.forbes.com/sites/stratfor/2018/04/03/the-u-s-china-and-others-race-to-develop-5g-mobile-networks/#376db68f5875>

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³ <https://www.forbes.com/sites/stratfor/2018/04/03/the-u-s-china-and-others-race-to-develop-5g-mobile-networks/#767d47515875>

⁴ <https://www.nbcnews.com/tech/innovation/self-driving-uber-car-involved-fatal-accident-arizona-n857941>

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⁵ <https://www.forbes.com/sites/stratfor/2018/04/03/the-u-s-china-and-others-race-to-develop-5g-mobile-networks/#376db68f5875>