6 REASONS WHY AUTOMOTIVE OEMs ARE UPGRADING TO WI-FI 6

NXP SEMICONDUCTORS

For decades, when car enthusiasts talked about automotive performance, the conversation mostly centered on raw speed. With each car generation, there were incremental improvements in how quickly a car could go from 0 to 60, or how long it took to complete a quarter mile. Today, those conversations are changing. The electronics that support the car – and enhance the driving experience – have expanded the definition of performance. It's not just about how fast a given car model is, but how much smarter, safer, and more capable it is compared to its peers.

Similarly, with previous Wi-Fi standards, speed has been the predominant and driving improvement for each technology generation. While the latest Wi-Fi 6 standard does offer considerable raw performance improvement, automotive OEMs are quickly adopting Wi-Fi 6 for the many other enhancements it brings to market. These enhancements are essential to deliver a seamless wireless experience for the growing number of use cases both in and outside of the vehicle.

GROWING WI-FI USE CASES

Wi-Fi is a core technology that consumers use to interact and connect with their car today. It is used for streaming music and videos, providing in-car hot-spots for devices, projecting your mobile phone display to your in-dash panel, and downloading over-the-air updates to your infotainment system. Car OEMs are looking to greatly expand these

use models in the future to support a growing number of innovative use-cases, including:

- streaming and recording of multiple cameras feeds inside and outside of the car to promote driver safety,

- uploading of autonomous sensor and camera data so that OEMs can improve their driver assist capabilities,

- uploading of service and diagnostics data so your mechanic knows what is wrong with your car even before you schedule your service appointment.

Even before a car is delivered to the consumer, OEMS are looking to use Wi-Fi for programming of vehicles on the production line or updating car firmware as the car sits in the dealers' parking lot. Wi-Fi technology can even being used to address the requirements to detect children that are accidently forgotten and left alone in a car on a hot day.

With these growing use cases, everyone, from drivers and passengers to the vehicles themselves, is using more data, and this demand will only increase. Infotainment files are getting bigger, with support for high-resolution video, and more people are downloading data to their devices while on the road. The sensors used for autonomous driving generate a significant amount of data projected at upwards to 4TB per day[1], and this data needs to be uploaded for processing and analysis. Firmware updates are also growing in size, with manufacturers downloading larger software images to vehicles in order to keep them updated with the latest security, safety, and operating algorithms. Automotive OEMs need more ways to meet this growing demand for data, and Wi-Fi 6 will play an important role in that effort.

WON'T 5G FILL THE NEED?

Wi-Fi 6 is coming online around the same time as 5G cellular and as such they have been designed to work together and provide very complementary roles in automotive connectivity. For many of the connectivity needs, Wi-Fi offers several key benefits. First, there is an ongoing cost associated with using 5G, since it operates in licensed bands governed by mobile providers who deliver services based on individual and corporate contracts. Second, 5G coverage is likely to be limited in the near term, since the infrastructure is expensive to deploy and mobile operators are being selective about upgrades. Third, Wi-Fi has historically offloaded over 50% of the total mobile traffic from cellular networks in order to improve performance due to saturation or low-coverage. This number is projected to grow close to 60% by 2022 with 5G operators integrating Wi-Fi 6 as part of their deployment plans.[23]

6 BENEFITS FOR WI-FI 6 IN THE CAR

NXP and industry leaders, including the IEEE's 802.11ax working group, have equipped Wi-Fi 6 with a number of important upgrades and added capabilities. Here are six prominent reasons why OEMs are adopting Wi-Fi 6 in their current platform developments.

1. **LESS CONGESTION**
   Use of Wi-Fi has grown dramatically in recent years as it is included in many more vehicles (the majority of cars are projected to include at least one Wi-Fi device by 2022). This has resulted in increased congestion and interference both inside and outside of the car. This congestion will impact wireless performance on the roads, in traffic jams, in parking garages and even dealer lots.

   Wi-Fi 6 increases the total bandwidth available with two features to mitigate congestion, resulting in more than four times the bandwidth and more overall bandwidth per user. OFDMA (Orthogonal Frequency-Division Multiple Access) makes it possible for multiple users, with varying bandwidth needs, to access the channel simultaneously. BSS (Basic Service Set) coloring lets Wi-Fi 6 identify signals on the same channel that are coming from different radios. A device can then recognize and ignore extraneous traffic resulting with an increase in total available bandwidth.

2. **LONGER RANGE**
   When cars are parked in a garage at home, in a dealer lot or parking structure, they are often far away from the nearest access point. This can make it difficult to use Wi-Fi features such as over-the-air firmware updates or uploading of vehicle data.

   Wi-Fi 6 adds several core technologies to greatly improve range. Today, due to its longer wavelengths, the 2.4 GHz band is typically used to maximize communication distance. Wi-Fi 6 further extends this range with the addition of a special range-extension mode. Wi-Fi 6 also adds support for up-to 8 antennas in an Access Point where 8x8 sounding feedback can achieve the fullest download performance at longer range.

3. **LOWER POWER**
   Accessing the Wi-Fi network while the car is off uses precious battery power and will reduce the time your car can sit between use. This limits the usefulness of Wi-Fi while your car is parked. OEMs use a variety of techniques to power-down systems to achieve very low current draw when the car is not being used, and Wi-Fi 6 makes that job easier.

   Wi-Fi 6 uses a power-efficient scheduling mechanism called Target Wake Time (TWT) to let the access point schedule the wake time for each client. The car can go to sleep for a set amount of time and then wake up as needed for Wi-Fi connectivity. On dealer lots, for example, cars can receive necessary updates, and still be ready to start and operate normally, even after sitting for an extended period.

4. **FASTER**
   Along with the enhanced capabilities already described, Wi-Fi 6 does, indeed, deliver higher performance in terms of data rates. The peak data rates for a single client device are up to 40 percent higher even in a highly congested environment. Several enhancements and additions to the basic protocol, including OFDM, MU-MIMO, and 1024-QAM (Quadrature Amplitude Modulation) are leveraged to increase throughput.

5. **UPLOAD PERFORMANCE**

The amount of data generated in-vehicle is growing exponentially as cars become smarter and autonomous driving modes are introduced. Further, more and more cameras are being added to the car to monitor passengers or driver in ride-share and other programs. In the near future, offloading of this data will demand upload performance on-par with download speeds.

Complimenting download multi-user MIMO (MU-MIMO) introduced in Wi-Fi 5, Wi-Fi 6 extends MU-MIMO capabilities to the upload direction. WThis will greatly improve the upload data rates by up-to 80% for networks with multiple users.

6. **CONSUMER SATISFACTION**

The consumer experience isn't, strictly speaking, a feature of Wi-Fi 6, but the presence of Wi-Fi 6 in new vehicle models will help improve the driving experience and meet consumer demand for technology. Wi-Fi 6 is already gaining traction in consumer devices, including smartphones and access points, and will soon be a familiar part of IoT and smart home devices, too. Consumers will want their vehicles to be part of this trend, and will have growing expectations for seamless, reliable connectivity, based on Wi-Fi 6, as the technology becomes more prevalent.

DON'T BE LATE

The time to start designing with Wi-Fi 6 is now. It typically takes two to three years for a technology that's standard on a smartphone to appear in vehicles. Consumers expect their cars to keep pace with these trends especially when a superior experience, performance and quality can be delivered. For this reason, numerous OEMs have already included Wi-Fi 6 into their development plans for next generation vehicles.

THE NXP ADVANTAGE

NXP is an early innovator with Wi-Fi 6 and already offers a portfolio that is purpose-built for use in vehicles. Our products are AEC-Q100 certified, so automotive OEMs can be confident that our solutions will meet the challenging quality and performance demands of carts, trucks, and motorcycles.

CONNECT TO WI-FI 6

Wi-Fi 6 as a pivotal technology for the future of automotive, and we're excited about the promise it holds for innovation, operational efficiency, and the driving experience. To learn more about our portfolio, and how we're addressing the specific needs of Wi-Fi in automotive, visit us at www.nxp.com/wifi6

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[1] IDC forecasts that by 2025, the global data sphere will grow to 163ZB (that is, a trillion gigabytes). That's 10 times the 16.1ZB of data generated in 2016. Inside the vehicles themselves the news is daunting too. Autonomous vehicles' data is growing even faster thanks to autonomous test vehicles, which typically generate between 5TB and 20TB of data per day, per vehicle.

[2] https://www.networkworld.com/article/3341099/wi-fi-6-5g-play-big-in-ciscos-mobile-forecast.html. "As a percentage of total mobile data traffic from all mobile-connected devices, mobile offload increases from 54 percent (13.4 exabytes/month) in 2017 to 59 percent (111.4 exabytes/month) by 2022. Offload volume is determined by smartphone penetration, dual-mode share of handsets, percentage of home-based mobile Internet use, and percentage of dual-mode smartphone owners with Wi-Fi fixed Internet access at home," Cisco said.

[3] https://autotechreview.com/features/flood-of-data-will-get-generated-in-autonomous-cars. According to various industry experts, autonomous cars on an average will churn out 4,000 GB of data per day and mind you, that is just for one hour of driving a day.